SPHERICAL FUZZY ANALYTIC HIERARCHY PROCESS (AHP) AND ITS APPLICATION TO INVESTIGATE SUSTAINABLE ENTREPRENEURSHIP INTENTION AMONG FPT UNIVERSITY STUDENTS

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ABBREVIATIONS AND ACRONYMS LIST

Abbreviation	Full explanation
EE	*Entrepreneurship Education*
APS	*Adult Population Survey*
GEM	*Global Emerging Markets*
TEA	*Total Early-Stage Entrepreneurial Activity*
EBO	*Established Business Ownership*
EEA	*Entrepreneurial Employee Activity*
MCDM	*Multi-Criteria Decision Making*
FAHP	*Fuzzy Analytical Hierarchy Process*
PDSE	*Perceived Desirability Of Self- Employment*
PA	*Personal Attitude*
MOT	*Motivation*
ESE	*Entrepreneurial Self-Efficacy*
SN	*Social Norms*
AS	*Achievement Striving*
INNO	*Innovativeness*
LOC	*Locus Of Control*
PRS	*Perceived Relational Support*
PUS	*Perceived University Support*
PGS	*Perceived Government Support*
PES	*Perceived Environmental Support*
RT	*Risk Taking*
PFS	*Pythagorean Fuzzy Sets*
IFS2	*Intuitionistic Type 2 Fuzzy Sets*
IFS	*Intuitionistic Fuzzy Sets*
q-ROFS	*q-Rung Orthopair Fuzzy Sets*
SFSs	*Spherical Fuzzy Sets*
SFDWG	*Spherical Fuzzy Dombi Weighted Geometric*
TOPSIS	*Technique for Order Preference by Similarity to the Ideal Solution*
SF-AHP	*Spherical Fuzzy Analytic Hierarchy Process*
SF-VIKOR	*Spherical Fuzzy VIKOR*
SF-WASPAS	*Spherical Fuzzy WASPAS*
SF-QFD	*Spherical Fuzzy QFD*
LSFS	*Linguistic Spherical Fuzzy Set*
CSFRS	*Spherical Fuzzy Rough Set*
T-SFS	*T-Spherical Fuzzy Set*
T-SFGMSM	*T-Spherical Fuzzy GMSM Operator*
GMSM	*T-Spherical Fuzzy Weighted GMSM Operator*
R&D	*Research And Development*
Lt-SFNs	*Linguistic Spherical Fuzzy Numbers*
Lt-SFSWA	*Linguistic Spherical Fuzzy Weighted Averaging*
MM	*Muirhead Mean*
SFPMM	*Spherical Fuzzy Power Muirhead Mean*
SFPDMM	*Spherical Fuzzy Power Dual Muirhead Mean*
Eq.	*Equation*
DM	*Diabetes Mellitus*

CHAPTER 1: INTRODUCTION

1.1 Overview of research topic

1.1.1 Global startup situation

Entrepreneurship has been increasingly recognized for its role in creating jobs and economic growth. It has been acknowledged as helpful in increasing a region, state, or country (Davey *et al.*, 2016; Zahra, 1991). According to Davey et al. (2016), entrepreneurship can also be understood as a career opportunity, with new business startups simultaneously increasing job opportunities within society. Entrepreneurship works as a catalyst for national welfare (Martinez *et al.*, 2011), and global interest in entrepreneurship education (EE) is increasing as a consequence (Bell and Bell, 2016).

According to the 2020 Adult Population Survey (APS) results, this chapter will show that entrepreneurial activity varies considerably within and between global regions, with significant consequences for each economy. Economies with relatively low levels of entrepreneurial activity are missing out on a whole range of positive effects, from incomes and job creation to innovation and productivity growth. This variation between economies is not just in overall levels of entrepreneurial activity but also in that activity. Recall that GEM defines and measures entrepreneurship very carefully and precisely. Key measures include:

- Those starting or running a new business, or Total early-stage Entrepreneurial Activity (TEA), measured as a percentage of the adult population (% adults);
- Those running an established business, or Established Business Ownership (EBO) (% adults);
- Those started or ran a business on behalf of their employer or Entrepreneurial Employee Activity (EEA, % adults). This chapter will consider each of these in turn and the distribution of early-stage entrepreneurship by sector. It will then present whether the new business is independent or sponsored through shared ownership, usually with the individual's employer. It concludes with assessing business exits, the opposite end of the entrepreneurial pipeline, and whether those exits have changed due to pandemics.

In period strangest— owing to the 2020/21 global pandemic, this chapter will compare levels of early-stage and established business for those 35 economies participating in APS both 2020 and 2019, to provide some insight into the impact of the pandemic on both new and existing businesses. The 2020 APS included some new questions about the effects of

the pandemic, including whether those running new or established businesses consider that there are new opportunities as a result of the pandemic. Results for this question are outlined below.

Chart 1.1 charts the 43 economies participating in the APS (2020), both the TEA's level and the level of EBO, each as a percentage of the adult population. Three of those economies — Italy, Poland, and Germany — have one in 20 adults or less starting or running a new business in 2020, signifying a relatively low level of entrepreneurial culture in those economies. At the other end of the scale, two adults in Angola and around one in three adults in Togo, Panama, and Colombia are starting or running a new business.

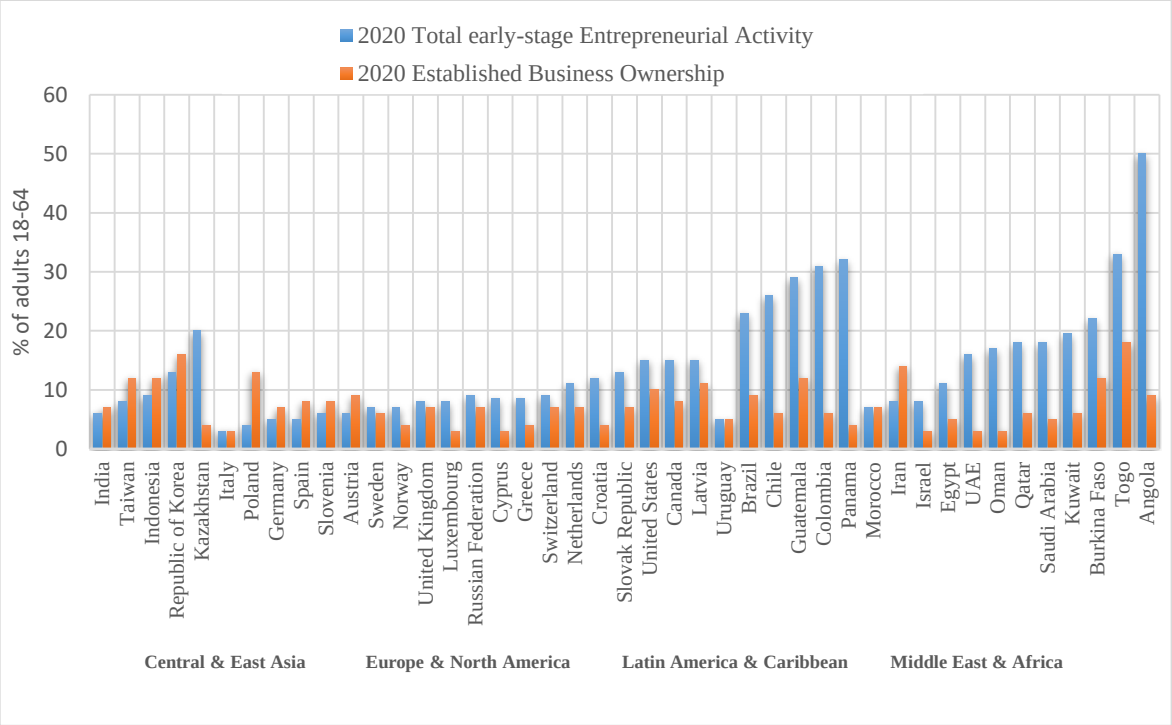


Chart 1. 1 Total early-stage Entrepreneurial Activity (TEA) and Established Business Ownership (EBO) (both % of adults aged 18–64, 2020) (Bosma *et al.*, 2021)

All six participating economies in the Latin America & Caribbean region have at least one in five adults starting or running a new business. Europe & North America have the lowest levels of early-stage entrepreneurship, with 14 of their 20 economies having less than one in 10 adults starting or running a new business. The Middle East & Africa region is the most varied in early-stage entrepreneurship, ranging from one in 14 adults in Morocco to one in two in Angola. Finally, the proportion of adults starting or running a new business in Central & East Asia ranges from one in 20 in India to one in five in Kazakhstan. There are many reasons for these variations, from the lack of national entrepreneurial culture to the dearth of alternative employment opportunities and from social security systems' presence

(or absence) to the strengths and weaknesses of local entrepreneurial ecosystems. While starting or running a new business is rarely easy, neither is sustaining that business into the longer term, and this evidence indicates that many fail to make that transition. Established businesses are essential in any economy, providing stable jobs and incomes by producing the goods and services that people want, need, and buy. Chart 1.1 shows that the EBO level across the 43 economies in 2020 is much less varied than TEA. Ten of these economies have less than one in 20 adults owning and managing an established business, including Italy with just one in 40. All of the four global regions are represented in this group.

Conversely, 11 economies have one in 10 adults or more owning and managing an established business, with all four regions represented, including three out of five Central & East Asia economies. The highest level is in Togo, with just under one in five adults owning and managing an established business. Many individuals who create and run a new business in conjunction with established firms might point to a dynamic, expanding economy that does not transfer new high levels of startups into an established business. However, a low ratio of new to established businesses may suggest difficulty in starting a business and future problems in replenishing the stock of established businesses. There may be little incentive to start a business but more support for sustaining businesses. In 2020, 12 of the 43 economies have fewer adults starting or running a new business than owning and managing an established business, including four of the five Central & East Asia economies, seven economies from Europe & North America, just one from the Middle East & Africa and none from Latin America & Caribbean.

The relationship between age and entrepreneurial activity is ambiguous, just as the relationship between income and entrepreneurial activity was shown to be earlier, and perhaps for the same reasons since income and age are often closely related. Younger people may have more energy and drive, have longer to reap the benefits of starting a business, are more familiar with technology and trends, and, perhaps most importantly, have not yet learned what they cannot do. Older people are likely to have more skills and knowledge, including awareness of markets and better access to the information, networks, and other resources needed to launch a successful business. On the other hand, older people may have more responsibilities, including mortgages and dependent family members, and have more to lose in giving up a well-paid job. So there is a balance of influences affecting the age–entrepreneurial activity relationship. Add in national culture and demographics, and it is not surprising that the relationship between age group and entrepreneurial activity is variable.

Chart 1.2 and 1.3 show the level of TEA for five different age groups across the 43 economies participating in the 2020 GEM APS. That is much information, but some patterns are evident. The vast majority of economies, including 18 out of 20 in Europe and North America, all in Latin America and the CAR and nine out of 12 in the Middle East and Africa, have the lowest TEA level: not necessarily, in Central and Eastern Asia, because it is the oldest age group with the lowest TEA level in India, Taiwan, and Korea.

The typical but not exclusive pattern is for the level of TEA to increase with age group and then decline. This is the case for most GEM economies, with the age group 25–34 having the highest level of TEA in 21 of these. However, there were also nine economies in which the level of TEA declined continuously with age: five from Europe & North America, two from the Middle East & Africa, and one from Latin America & the Caribbean. The overall level of TEA varies considerably across this group, but one thing in common, for eight of the nine is that the level of TEA for the 55–64 age group is less than half of the 18–24 age group. The exception is Sweden, where TEA declines with age from 10% to 6%. Finally, it is worth noting that the lowest level of TEA in any age group in Angola is greater than the highest level of TEA in any age group in all but two economies: Togo and Colombia.

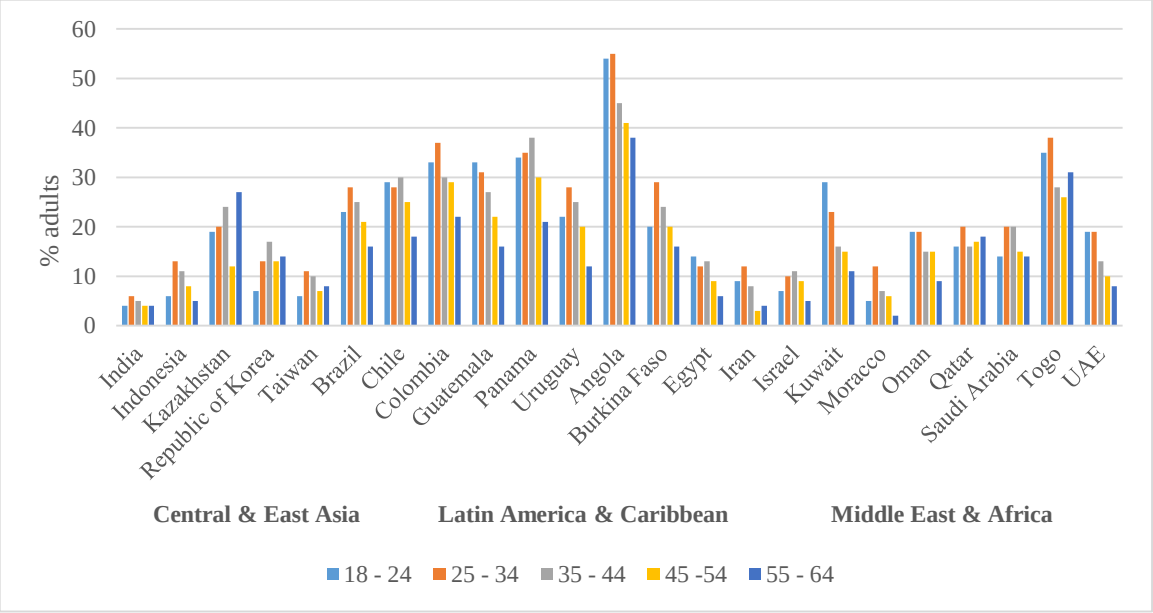


Chart 1. 2 Total early-stage Entrepreneurial Activity (TEA) by age (% of adults in each age group): Central & East Asia, Latin America & Caribbean and Middle East & Africa

(Bosma *et al.*, 2021)

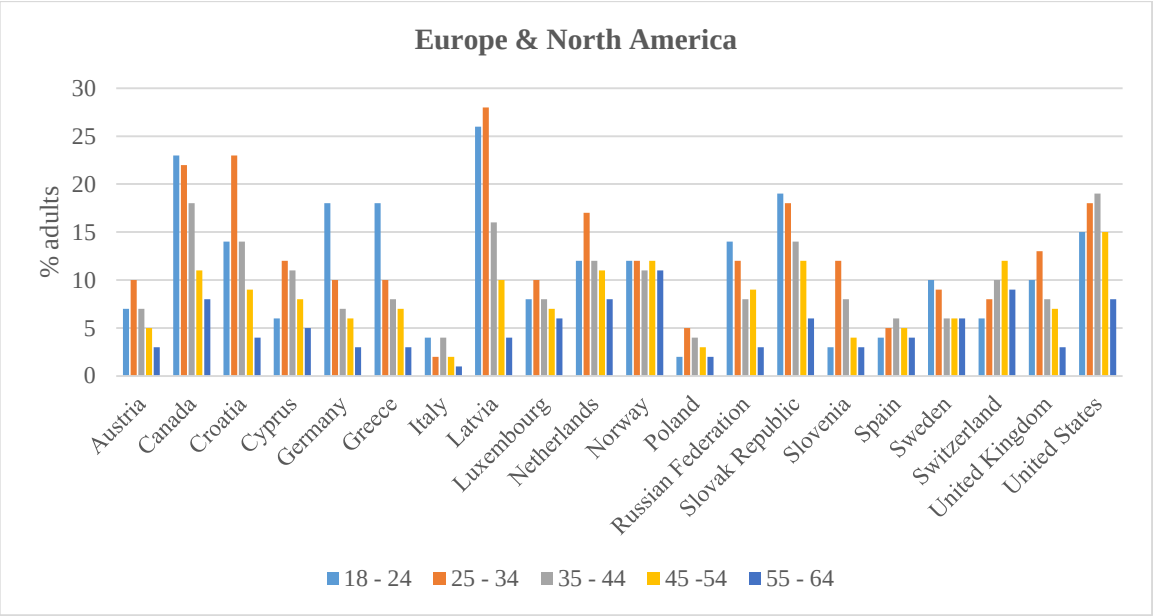


Chart 1. 3 Total early-stage Entrepreneurial Activity (TEA) by age (% of adults in each age group): Europe & North America (Bosma *et al.*, 2021)

The question of the impact of the pandemic on the entrepreneurship's age profile is an interesting one. It may seem reasonable to assume that, just as the pandemic has had much more impact on older people, so levels of entrepreneurial activity among older adults must have declined relative to younger adults. The evidence, as ever, is less clear. Recall that 35 economies participated in both APS 2020 and APS 2019. One simple test is to compare TEA levels in each age group between those years, and hence whether TEA increased or decreased for that age group, keeping in mind that TEA in 2020 was, in general, a little lower than in 2019. Table 1.1 shows that, for the oldest age group (55–64), more economies saw an increase than a decrease in TEA, while for all of the other age groups, there were more economies experiencing declines than increases in TEA.

Age group	TEA increases	TEA decreases
18-24	17	18
25-34	14	21
35-44	10	25
45-54	11	24
55-64	19	16

Table 1. 1 Changes in Total early-stage Entrepreneurial Activity (TEA) by age group: number from 35 economies, 2019-2020 (Bosma *et al.*, 2021)

1.1.2 Startup opportunities and potential in Vietnam

Assessing the nation's attitudes and perceptions towards business will help insight into individuals' motivations for starting a business. People's perception of starting and developing a business is assessed based on the following indicators:

- Awareness of startup opportunities:

The adults' proportion who perceive an opportunity to start a new business in Vietnam, after rising sharply to 56.8% in 2015 (ranked 9/60), has fallen to 46.4% in 2017 (ranked 23/54). Although this rate decreased compared to 2015, but increased higher than the years 2013-2014 and followed the increasing trend of these years. As can be seen, it seems that the growth rate of 2015 is just a surge, the beginning of startup-waves in Vietnam years recently. In 2017, the awareness of business opportunities in Vietnam is still higher than the average level of countries in a similar stage of development as Vietnam, with input-based economic growth & developed countries at a higher stage.

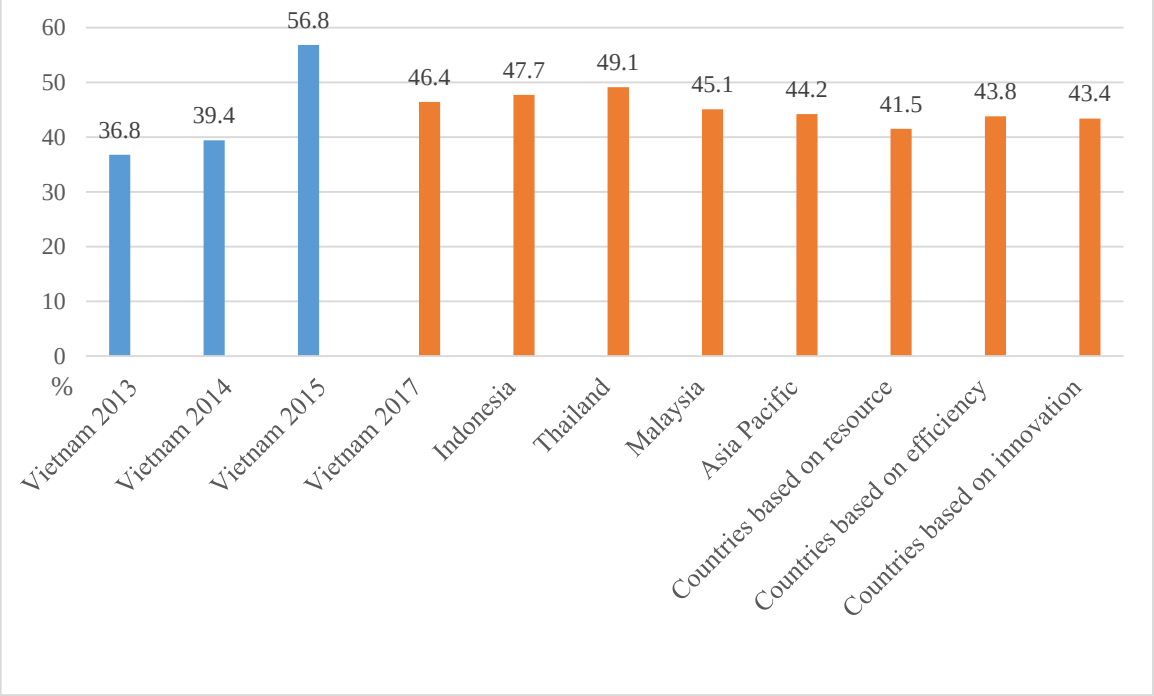


Chart 1. 4 Perception of startup opportunities in Vietnam in 2017 (Huan, 2018)

Compared to other countries in the ASEAN region that participated in the survey in 2017, adults' proportion aware of startup opportunities in Vietnam is higher than in Malaysia but lower than in Indonesia and Thailand. Compared with the general level of the Asia-Pacific region, the people percentage who perceive having business opportunities in Vietnam in 2017 is higher.

➢ Perception of business capacity

In 2017, Vietnam adults' proportion who self-assessed with necessary knowledge, skills, and experience to start a business still tended to decrease, from 58.2% in 2014 to 56.8% in 2015 and 53% in 2017. Vietnamese people percentage who are confident in their business ability has decreased compared to 2014 and 2015. However, there are many training support programs for startups businesses, showing concerns about the increasingly fierce competition in business in the context of Vietnam's more deep integration into the world economy. Notably, the percentage of Vietnamese who self-assessed business ability is still lower than the average of developed countries in phase I (53.8%). Vietnam ranked 19th out of 54 economies in terms of entrepreneurship in 2017, the same ranking in 2015 but compared to 60 economies.

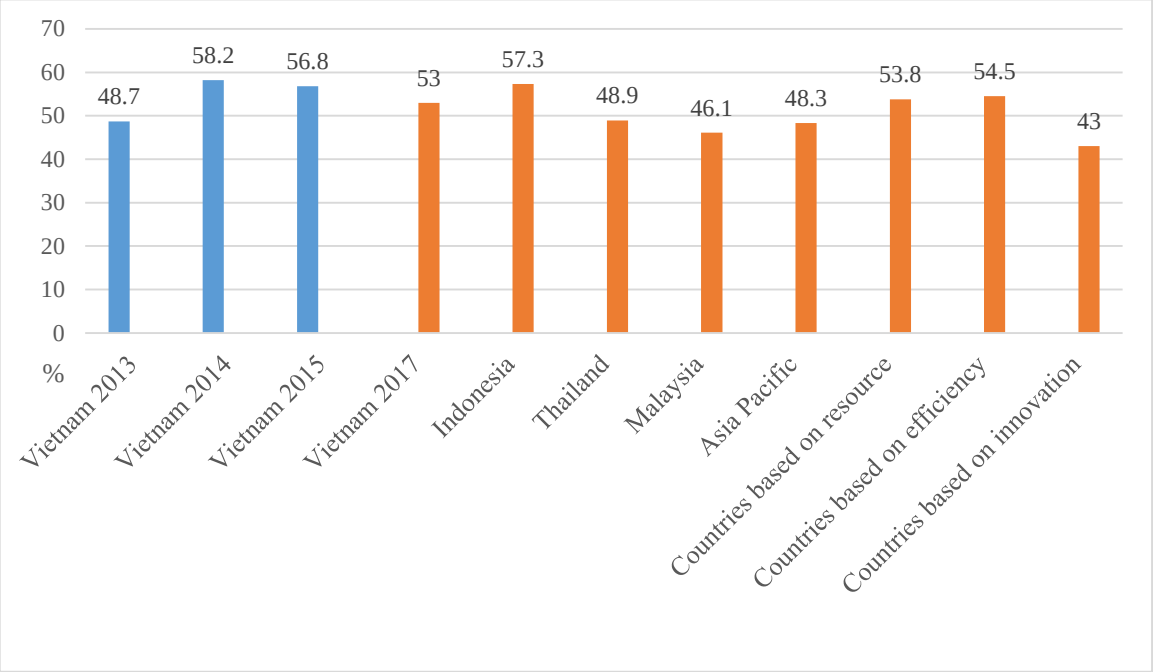


Chart 1. 5 Perception of entrepreneurship in Vietnam 2017 (Huan, 2018)

Although the rate of people aware of business ability has decreased, compared with other countries in the ASEAN region, this rate of Vietnam is still higher than that of Thailand (48.9%, ranked 27/54) and Malaysia (46.1%, ranked 33/54), just below Indonesia (57.3%, ranked 12/54). However, Malaysia is an innovation-based country in group III. In contrast, in group II, Thailand and Indonesia, but emerging nations, Vietnam is still a resource-based development group (more precisely, in the transition from group I to group II). The Global GEM Study 2017/18 also shows that the more developed countries are the lower people' proportion who perceive entrepreneurship than countries in the previous period. Therefore, this rate in Vietnam is still low and needs to be improved, although it is still slightly higher

than the average level of the Asia-Pacific region (48.3%). This shows that Vietnam still needs to continue improving the education system to train people in entrepreneurship knowledge and skills, operate business activities, and develop programs to support startup training.

- Ability to deal with risks

Vietnam's fear of business failure index in 2017 increased slightly, to 46.6%, after falling sharply from 56.7% in 2013, to 50.1% in 2014 and 45, respectively. 6% in 2015. The fear of failure increasing in 2017 seems to be a common trend in many countries. Despite the increase, Vietnam's ranking has decreased from 8/60 position in 2015 to 10/54 position in 2017 (higher position means fear of failure higher rate). In recent years, Vietnam has made many efforts to improve the business environment and build a constructive government, thereby helping to regain the trust of business people. However, people who are afraid of business failure in Vietnam are still high, especially compared to the expected level of countries at the same level of development as Vietnam. GEM research consistently shows that, in developed countries, people are more careful when engaging in business, so the fear of failure is more of a hindrance in these countries. However, for a developing country at an early stage, the rate of fear of failure when doing business among Vietnamese in 2017 is still high compared to other countries at the same level of development and higher than the average of developed countries in stage III.

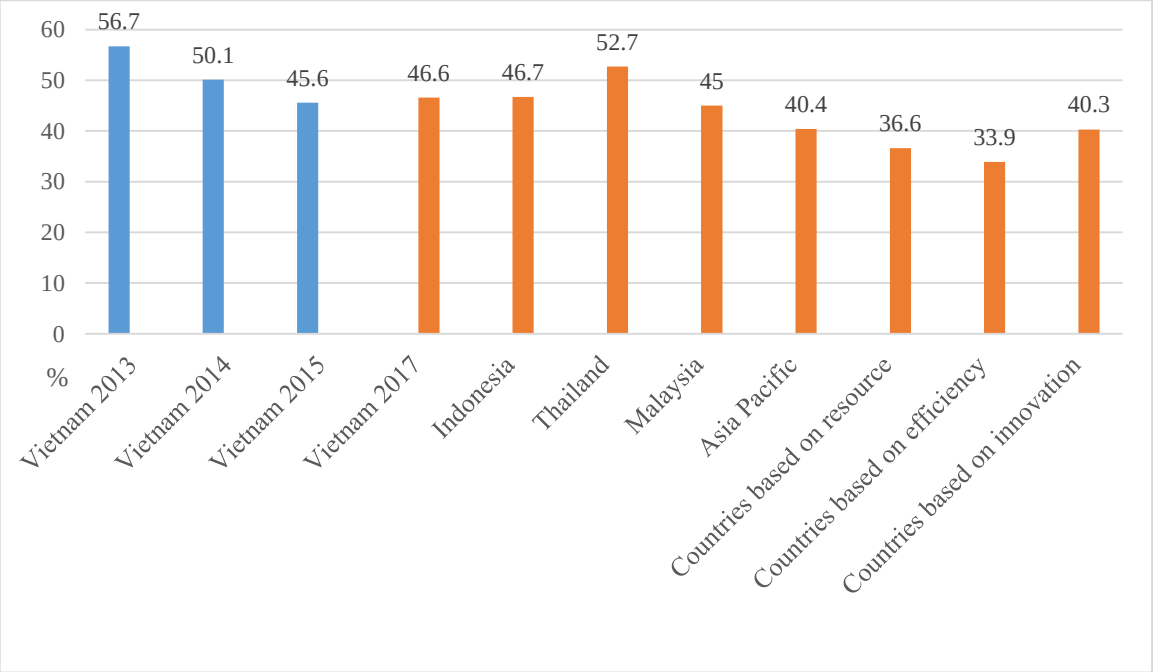


Chart 1. 6 Fear of failure when doing business in Vietnam in 2017 (Huan, 2018)

The ASEAN region seems to be where the percentage of people who fear failure in business is always high when Thailand (reached 52.7% and ranked 5/54) and Indonesia (46.7%, ranked 9/54) is higher than Vietnam and Malaysia, although lower than Vietnam, still has 45% of people fearing failure, ranked 11/54 right after Vietnam. Fear of failure is one of the critical barriers that prevent many people from starting a business even though they have seen a business opportunity. To help people overcome this barrier and improve the business environment, Vietnam needs to have solutions to improve the business ability for people. The GEM 2015/16 study results showed an inverse relationship between entrepreneurship and fear of failure. In countries where many people feel capable of doing business, people who fear business failure are often low.

- Intention to start a business

The GEM 2017/18 study results showed an inverse relationship between economic development and the percentage of people intending to start a business. Developed countries in stage I have the highest average proportion of people intending to start a business, at 30.3%, developed countries in stage II with 26.3%, and finally countries in stage III with 15.2%. In Vietnam, people' percentage who intend to start a business has continued to increase since 2014, reaching 25% in 2017, ranking 19th out of 54 economies. This means that 1 in 4 people intend to start a business within the next three years in Vietnam, which is essential to help realize 1 million businesses operating by 2020 according to Resolution 35/NQ-CP. However, compared with the average rate of developed countries in stage I, this rate is still lower, even lower than the average rate of developed countries in stage II.

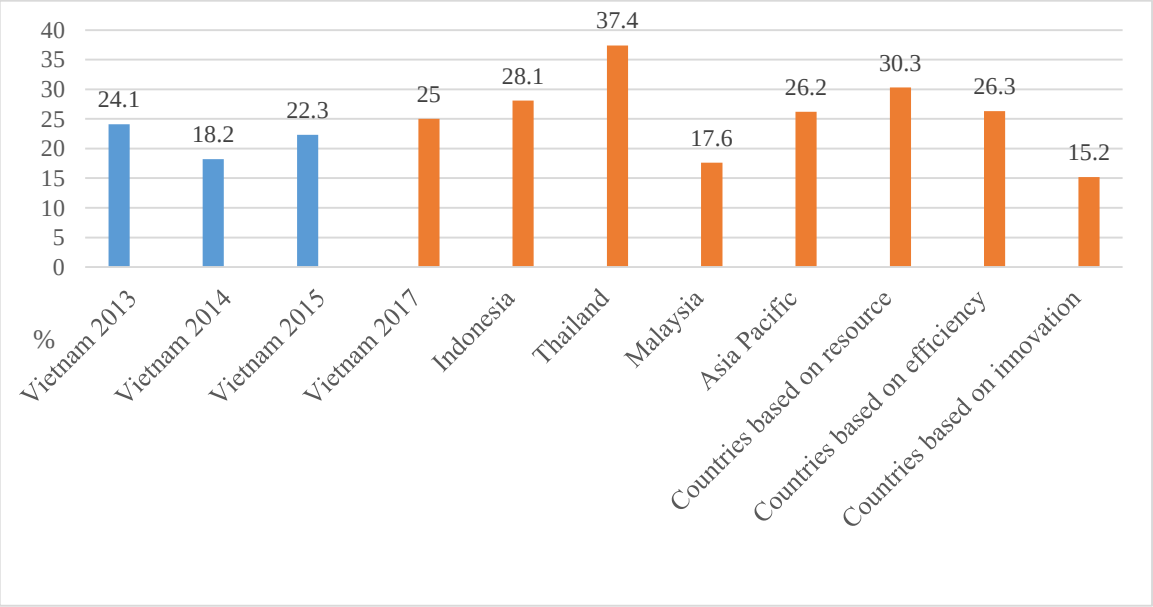


Chart 1. 7 Intention to start a business in Vietnam 2017 (Huan, 2018)

Compared with other countries in the ASEAN region, the percentage of people intending to start a business in Vietnam is lower than in Thailand (37.4%, ranked 11/54) and Indonesia (28.1%, ranked 14/14). 54), countries in group II are higher than Malaysia (17.6%, ranked 24/54), in group III. This shows that the percentage of people intending to start a business in Vietnam in the next three years is still low. It is necessary to encourage startups, primarily through capacity-building training, education, and training. Get business startup knowledge for adults in Vietnam.

- Society's perception of entrepreneurs

The GEM research relied upon three factors to evaluate the company's impression of entrepreneurs and companies:

- Percentage of individuals agree to make a good career choice for the company.
- Proportions of individuals agree with the high social standing of successful business persons.
- The number of individuals who hear about the success tales of a company through mass media has been enhanced.

The annual GEM study results determine that today's business and entrepreneurship are recognized and respected worldwide. In most countries, the majority of people see business as a desirable career option.

In Vietnam, the respondents' percentage who want to choose a career as an entrepreneur is 62.1%, ranked 27/54, lower than the average 65% of developed countries based on resources. In addition, 74.8% of Vietnamese respondents agreed with the statement that successful business people often have a high position in society and are respected by everyone, ranking 15/54. The development of media has contributed significantly to promoting images of successful business people in Vietnam; 81.1% of adults surveyed confirmed to have heard stories about entrepreneurs through media, helping Vietnam rank 7/54 on this index in 2017.

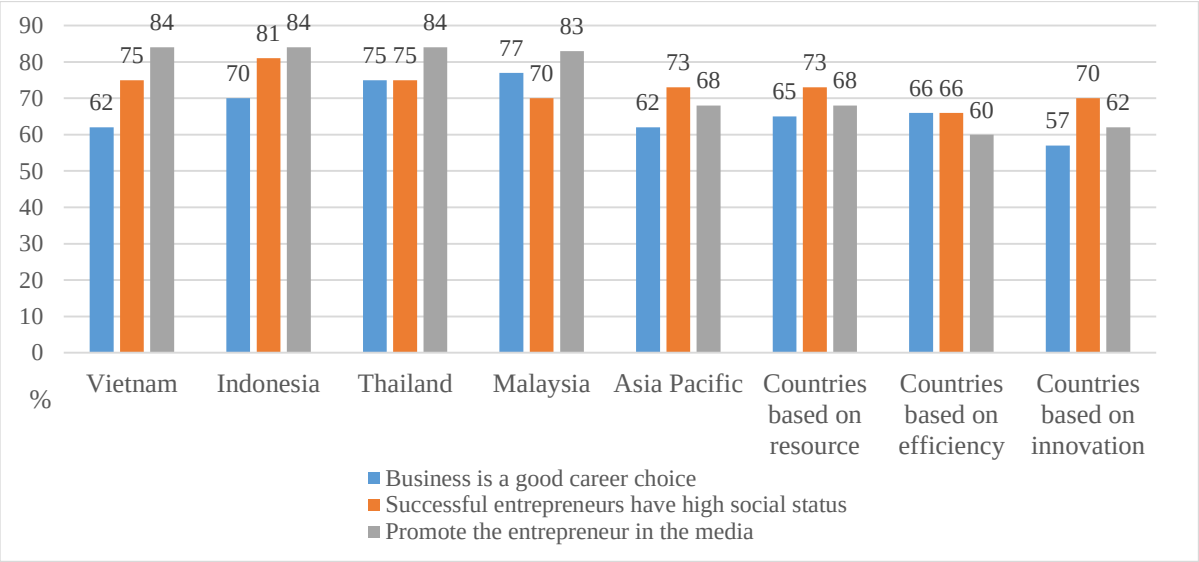


Chart 1. 8 Society's perception of business in Vietnam 2017 (Huan, 2018)

Compared to previous years, people who wish to become entrepreneurs decreased to only 62% in 2017, after increasing from 2013-2015, from 63% to 73%. This percentage already remains lower than that of the developing nations of ASEAN like Vietnam, showing that while the media still have a good propaganda role, people know that the beginning company is more transparent than the movement, following a highlight of the "startup country" tale.

In the ASEAN region, according to Vietnam Tech Investment 2019 (ESP Capital, N.D.) Vietnam has now risen to third place in the growth rate of the innovative startup ecosystem, just behind Indonesia and Singapore. The amount of venture capital in 2020 accounts for 17% of the total investment capital in the region, up from 5% in 2018. Specifically, the total value of investment deals in Vietnamese startups reached USD 290.43 million; the number of investment deals reached 56 deals, and 34 investment deals were announced. Fields were attracting a lot of investment capital, including 12 financial technology deals totaling 61.2 million USD; 8 e-commerce deals totaling 143.85 million USD; 6 human resource management deals of 36.88 million USD.

The Vietnamese capital, Hanoi, made the top 200, rising 33 places to 196th, while Ho Chi Minh City was 225th. Vietnam is expected to have at least 10 "unicorns" by 2030, and if the target is achieved, Vietnam can quickly increase its ranking naturally.

According to venture capital fund Ventures (Vietnam Tech Investment 2019 | Esp Capital, N.D.), startup projects decreased due to general difficulties. The number of projects calling for investment capital from venture funds decreased accordingly.

However, Vietnam is still one of the priority markets of these funds because of the great potential for startups, especially innovation. Particularly at the Vietnam Innovative Startup Investment Fund Forum on November 25, 2020, there were 33 investment funds committed to pouring 815 million USD into Vietnam's innovative startups filed in 5 years (2021-2025).

More than 150 domestic and foreign investors and investment funds, with over 14 million US dollars in total, also participated in Techfest in October 2020, as were the outcomes of private investment matching operations in private sector incubators and tech villages.

In 2020, Vietnam had the second "unicorn" startup business (i.e., a startup valued at 1 billion USD or more). In November 2020, the E-Conomy SEA 2020 Annual Digital Economy Report, conducted by Google and Temasek (Singapore), acknowledged that Vietnam Payment Solutions Joint Stock Company (VNPay) officially became the second-largest technology in Vietnam after VNG Group.

Vietnam's startup ecosystem is ranked 59th in the world (Startup Genome, 2019). In the Asia-Pacific region alone, Vietnam's innovative startup ecosystem is in the top 20-25.

Assessing the prospects, Ms. Hoang Thi Kim Dung, Chief Representative of Genesia Ventures Japan Investment Fund in Vietnam, said that investors are very confident in the potential of Vietnam’s innovative startup ecosystem. Venture capital funds also rate Vietnam as the top priority market in Southeast Asia in 2021 and expect Vietnam to become a significant investment market in the region and globally.

Figure 1. 1 Vietnam Innovation Startup Ecosystem Map 2021

1.1.3 Project of the Government of Vietnam

The Government issued Project 844, "Supporting the innovation startup ecosystem until 2025", according to Decision No. 844/QD-TTg on May 18, 2016, which has gradually built a bright startup ecosystem sustainability and development. Over 53 localities have issued plans to implement the project, selecting 58 leading units and 44 competent and experienced coordination units, and have implemented 82 tasks across the country. In order to continue promoting Vietnam's innovative startup ecosystem to develop in-depth, the Prime Minister issued Decision No. 188/QD-TTg amending and supplementing several articles of Decision No. 844.

Accordingly, supplementing objectives of the project such as building a system of Innovation Centers to support research and development, innovative startups, ensuring the successful operation of centers with unique mechanisms and policies adversarial, superior, and competitive compared to the region the world. At the same time, develop the National Center for Support for Creative Startups in Hanoi, Da Nang, and Ho Chi Minh City and innovation startup centers in ministries, branches, and localities, an organization with potential for innovative startups. At the same time, promote the attraction of international resources to support innovative domestic startups, cooperate with experts and international organizations in training, coaching, and consulting on technology transfer.

The newly issued Decision No. 188/QD-TTG adjusted and extended Project 844, with a focus on solutions to attract domestic-foreign investors and resources, the resources of corporations, experts and universities to create a more favorable environment for innovative startups, according to Pham Hong Quat, Director of the Market Development Dept. and of Technology Enterprises. From there, they were unleashing resources, accelerating the development of startups, and perfecting the innovative startup ecosystem in Vietnam.

In addition, on October 30, 2017, the Government issued Decision No. 1665/QD-TTg approving the project "Supporting students and students to start a business until 2025". This project will foster the entrepreneurial spirit among students, equip students with the knowledge and skills of entrepreneurship in schools, provide a suitable environment for students to train and implement their ideas, initiate ventures, and help create jobs for post-graduate students.

With the Government's support, authorities, startups, especially students, students will have highly favorable opportunities to start and develop startup projects and actualize their ideas and desires.

1.2 Problem statement

1.2.1 Global entrepreneurship monitor Vietnam

Based on the survey results of 2,118 individuals and 36 experts, GEM Viet Nam 2017/2018 Report has provided a broad view of the entrepreneurship characteristics in Vietnam in different stages, from intending to start to just starting, to running a new or established enterprise and even to discontinuing a business. The report has focused on the first stage of the business cycle, from startup to operating for three and a half years. Moreover, the report also suggests an analytical framework condition for business development in Vietnam to see the advantages and barriers when starting a business. These analyses are all compared with other economies globally, especially those with the same entrepreneurial rates, factor-driven economies, and countries in the ASEAN region.

Some key findings from GEM Viet Nam 2017/2018:

- Awareness of business opportunities in Vietnam in 2017 has decreased compared to 2015 but still higher than in 2013 and 2014: 46.4% of adults in Vietnam noticing business opportunities in 2017, ranking 23rd out of 54 countries (in 2015, it was 56.8% ranked 9th out of 60 economies). The average rate in factor-driven economies is 41.5%.
- The perception about entrepreneurial capabilities tends to be lower: the rate of perceived entrepreneurial capabilities in 2017 is 53%, ranking the 19th out of 54 economies, lower than in 2015 at 56.8%, ranking the 19th out of 60 economies. The average rate in factor-driven economies is 53.8%.
- The adults' percentage in Vietnam who fear business failure after reducing from 56.7% in 2013 to 45.6% in 2015 has slightly increased to 46.6% in 2017, ranking 10th out of 54 economies, higher than average 36.6% in factor-driven economies.
- The rate of adults having entrepreneurial intentions in Vietnam in the next three years increases from 18.2% in 2014 to 22.3% in 2015 and reached 25% in 2017, ranked 19/54, but still lower than the average rate at 30.3% in factor-driven economies.
- Like other countries in the globe, in Vietnam, successful entrepreneurs are highly appreciated by the society (74.8%, ranking the 15th out of 54 economies) and becoming

an entrepreneur is a desirable career choice of 62.1% of surveyed adults, ranking the 27th out of 54 countries, which is lower than the 73.5% of 2015.

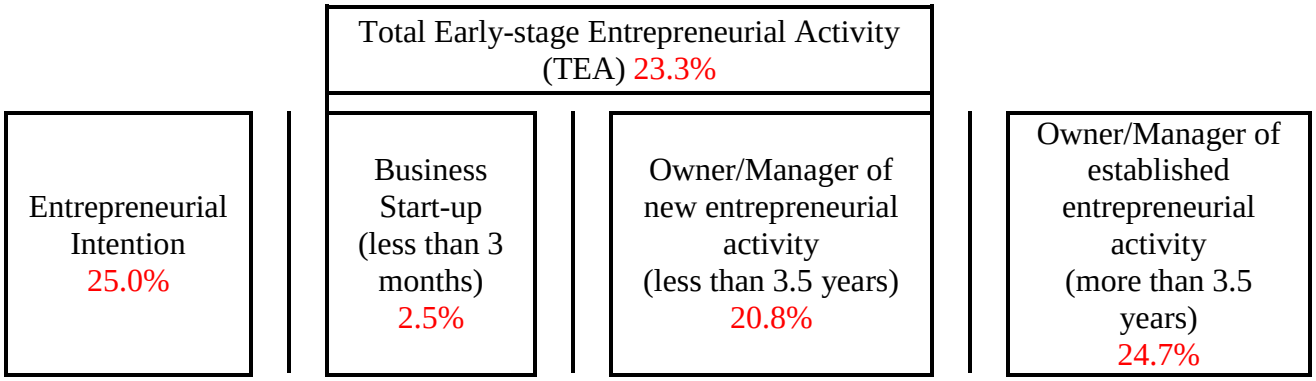


Figure 1. 2 Entrepreneurship activities in Vietnam in 2017 (Huan, 2018)

- The proportion of Vietnamese company startups in 2017 grew and achieved the most outstanding level for the period 2013-2017 and ranked sixth out of 54 countries (up from 20-60 in 2015), above the factor-driven economies' average of 16.4 percent.
- Like other economies, Vietnamese adults start business primarily to take advantage of opportunities (84.1%) rather than no better choice for work (15.9%). However, Vietnamese take the opportunities mainly to increase their income (49.4%) rather than being more independent (23.5%). The motivation index of Vietnam reached 4.6 points, ranking 9th of 54 economies.
- In Vietnam, women participating in business startup activities is higher than males in 2017 (25% versus 22%). The gender equity index of business startups of Vietnam continues to rank first among 54 economies in 2017, reached 1.14. However, the rate of women participating in business startups due to necessity-driven motives is much higher than males (18% versus 13%).
- The business activities in a TEA in Vietnam mainly aim to serve consumers (74.8%). However, the rate of business startups in other sectors has changed positively. The proportion of business activities in the processing field has increased from 14.4% to 17.7%, and business services from 3.3% to 6.6%.
- The startup rate in businesses in Vietnam is still at a deficient level of 0.6%, ranking the 45th out of 54 countries, lower than the average rate at 1.4% in the factor-driven economies.
- The percentage of the adults who discontinued business in 2017 is 4.2% (ranking 26/54), 2.5% of them had to stop business, and 1.7% continued to be operated. These rates are

much lower than countries at the same level of development. The three main reasons mentioned by Vietnamese adults are financial problems (26.3%), lack of profit (24.4%) and having another job or business opportunities (18.8%).

- The prospects of job creation growth in Vietnam achieve 6.2%, higher than the 5.1% rate of 2015, but lower than the average rate at 8.4% of other countries having the same stage of development, ranking 43th out of 54 countries.
- Although the startup activities in 2017 are more innovative than in 2015, especially in terms of technology, business activities in Vietnam are generally not innovative. The innovation index of startup activities in Vietnam in 2017 only reached 13.9%, ranked 48/54.
- Compared with 2015, entrepreneurial activities in Vietnam having international orientation have been improved. However, they remain low, with only 1.8% of operations having more than 25% international customers, while this average rate in the countries at stage I is 8%.
- The startup ecosystem in 2017 continues to improve the highest indicators but degrade the lowest ones. Among 12 indicators of entrepreneurial condition, Vietnam has three highest-ranking indicators, which are: Internal Market - Dynamics (5/54), Cultural and Social Norms (6/54), Infrastructure (10/54). Three indicators Vietnam has been the lowest ranking are Finance (39/54), Education - Post-school (40/54), Governmental Programs (43/54).

Based on these findings, GEM Vietnam 2017/2018 Report has proposed some policy recommendations to improve business conditions, promote entrepreneurship, and support the development of entrepreneurial activities in Vietnam. The recommendations mainly focus on five groups of solutions:

- Firstly, it is necessary to continue improving the business environment by stabilizing the macroeconomy, removing barriers, creating more credibility for business people, and promoting the entrepreneurial spirit.
- Secondly, develop supporting programs that encourage oriented startups in priority areas and promote innovation and international orientation activities.
- Thirdly, it should improve the entrepreneurship ecosystem to promote entrepreneurship and business development in Vietnam.

- Fourthly, it is necessary to encourage business households' transformation to enterprises and support startups in successfully maintaining and developing their business.
- Fifthly, recommendations for business associations, businesses and startup communities.

Entrpreneurial conditions	2017		2015		2013	
	Score	Ranking /54	Score	Ranking /62	Score	Ranking /69
Internal Market - Dynamics	4.15	5	3.59	11	3.50	15
Cultural and Social Norms	3.62	6	3.23	14	3.10	20
Physical Infrastructure	4.19	10	4.07	17	3.58	43
Internal Market - Openness	2.79	12	2.51	28	2.66	32
National Policy - General Policy	2.40	13	2.78	15	2.89	20
National Policy - Regulation	3.02	25	2.62	25	2.77	13
R&D transfer	2.19	34	2.33	30	2.54	20
Education - Primary & Secondary	1.83	34	1.57	47	1.97	46
Commercial Infrastructure	2.82	36	2.93	42	2.89	45
Education - Post-School	2.61	40	2.53	47	2.64	50
Governmental Program	2.09	43	2.14	50	2.50	38

Table 1. 2 Ranking of the entrepreneurship ecosystem in Vietnam in 2013-2017 (Hens *et al.*, 2018)

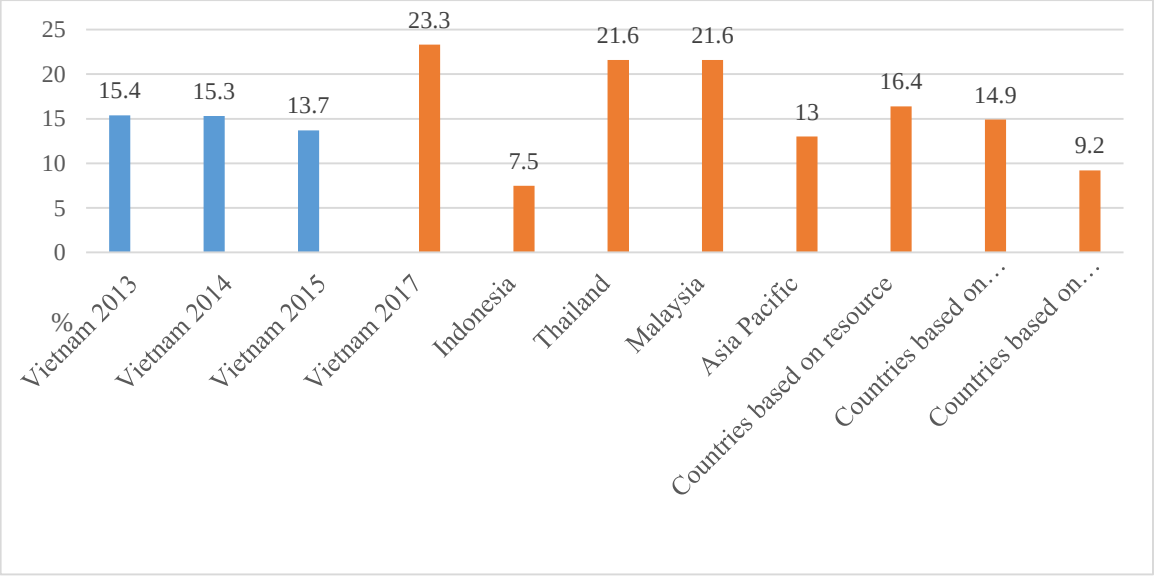


Chart 1. 9 Starting a business in Vietnam compared to other countries in the world in 2017 (Huan, 2018)

In terms of age, according to the GEM 2017/18 study, the people percentage aged 25-34 participating in the startup stage is the highest. The same is true in Vietnam, where up to 32% of people in this age group are involved in the startup stage, far behind other age groups. Like in developed countries in phase I, the proportion of people aged 18-24 participating in

startups in Vietnam is also relatively high compared to developed countries in stages II and III, reaching 22%. The main reason is that the youth unemployment rate in Group I countries is often higher, so the tendency for startups is also higher. According to the Ministry of Labor and Social Affairs report, the youth unemployment rate in 2017 in Vietnam has increased.

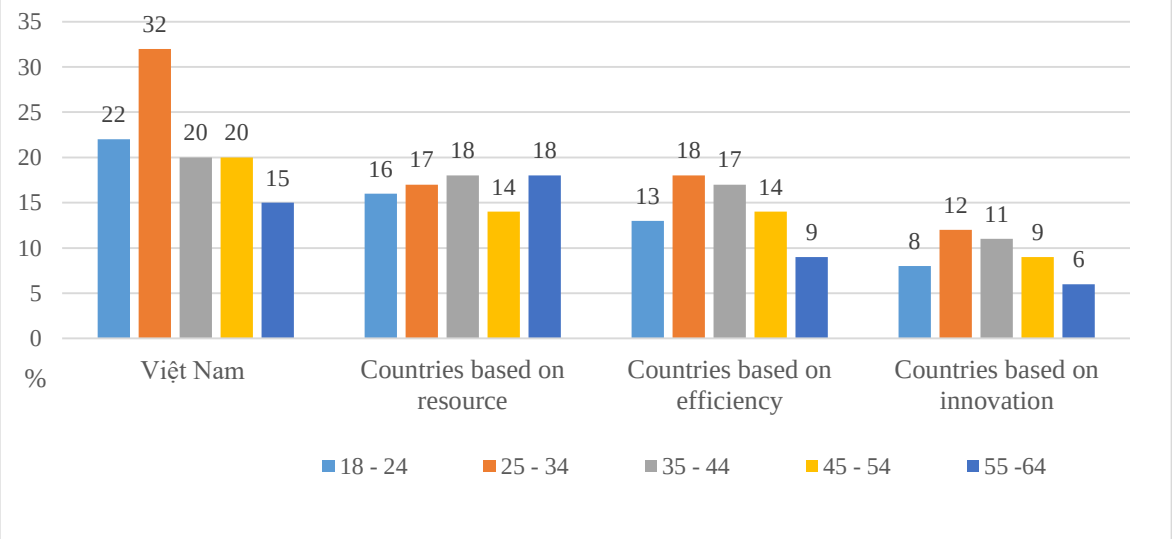


Chart 1. 10 Starting a business in Vietnam by age in 2017 (Huan, 2018)

1.2.2 Entrepreneurship trends of students in the world in Vietnam

Studies show that, since the COVID-19 pandemic appeared, student interest in entrepreneurship education has spiked. That trend has proved one thing again: Crisis has indeed boosted entrepreneurship. After the 2002-2004 SARS epidemic, travel restrictions and human contact restrictions spurred e-commerce companies like Alibaba. Another example is after the 2008 financial crisis, which created opportunities for startups like Uber and Airbnb to become accepted. However, recessions caused by COVID-19 will have an even more significant impact. Such influences quickly become the basis for new developments in almost every aspect of life, especially startups.

- **USA**: According to Jordyn Dahl ("An entrepreneurial renaissance is here | LinkedIn," n.d.), Linkedln News editor, rising unemployment spurred company owners in 2020 to seek new ideas. Their grandeur and increasing numbers of people go from 'employees' to 'enterprises.'
- **Europe:** This same trend was happening in Europe even before the pandemic hit. According to Atomico's State of European Tech 2019 report, a tsunami worth more than 42 billion euros ($50.3 billion) has hit Europe over the past five years. In 2020, venture capital firm Sequoia - best known for its investments in companies like

Apple, Google, and YouTube - opened a small London office to support its plan to invest more heavily in the European industry startup community.

Stories like these show the explosion of innovative business and investment opportunities in the United States, Europe, and globally. As startup founders and their teams grow increasingly sophisticated, they will have a lasting impact on their national economies. Therefore, higher education has changed over the years. Universities promote the shift to digital learning so students can continue to study online during the pandemic.

According to data from Studyportals ("Decrease of international enrolments expected to continue beyond Fall 2020 | Studyportals", n.d.), 41% of students said they are thinking about changing their study plans due to the pandemic. Also, in Studyportals, internal data shows that student interest in direct bachelor's and master's degree programs in entrepreneurship increased by 7.3% compared to 2019. Interest in programs Online submissions on this topic increased by 25%.

This jump is partly a continuation of pre-pandemic trends. However, in March 2020 – perhaps the most tumultuous time of the pandemic – demand for entrepreneurship education grew 66% year on year. This is a strong indication that students see creating new businesses as the catalyst that helps them overcome challenges and find opportunities in times of great crisis.

- **Opportunities for entrepreneurship education programs**

According to AACSB International, business schools worldwide added to their startup offerings even before the pandemic hit. For example, this major's number of undergraduate programs has increased by 23.75 percent between 2017–2018 and 2019–2020. Schools in Northern Europe and North America accounted for the largest share of this growth. In the Master's Degree in Management Ranking 2020 ("Decrease of international enrolments expected to continue beyond Fall 2020 | Studyportals", n.d.), the Financial Times reports that 11 percent of alumni from the 2017 MIM class have launched new companies since the start of their comprehensive study. For this 15% of entrepreneurs, their company is their primary source of income. Additionally, the report predicts that "telework and online education have the potential to become a lasting feature of our lives — once again providing opportunities for entrepreneurs." This fact, its authors' stress, means that education and training in entrepreneurship will become increasingly important to the world economy in the coming years.

- **Vietnam:** Several universities have paid attention to and included in university curricula in Vietnam through skill classes, propaganda sessions, seminars, and startup clubs. Hanoi University, Ho Chi Minh National University, University of Economics Ho Chi Minh City, Ho Chi Minh City University of Technology and Education and the Foreign Trade University are the startup development centers. However, many things need to be talked about in a methodological, synchronous and practical manner. Today, most universities do not have the right set of programs to train students with the knowledge and skills of entrepreneurship. Entrepreneurship education seems to be encapsulated in only a few business administration subjects, and most are only found in universities that train economics. Many training programs have no consistency in content, lack of specificity, and systematicity. Many students after graduation are still unfamiliar with business administration knowledge and lack other necessary soft skills to develop their startup ideas. Even after graduating from university, many students still do not fully understand starting a business *(Le, 2017)*. Currently, it is necessary to build and standardize programs that provide a cross-section of knowledge, skills, thinking, and tools to start a business. In addition to the lack of educational programs on entrepreneurship, the current entrepreneurship skills training program is mainly in the form of a movement, on the surface, with many limitations in practical effectiveness *(Le et al., 2016)*.

Former Prime Minister Nguyen Xuan Phuc stressed during the inauguration ceremony of the Youth Entrepreneurship Program on 16 October 2016: "One measure of the institution's performance is how many students start and succeed. not only the number of pupils in employment."*(Phuong, 2017)*. Not only requiring educational institutions to include startup content in their training programs, the number of successful criterion alumni and students has also begun to be added as one of the measures of quality university training. This is because the ability of Vietnamese students to meet the expectations of startup activities is still minimal after graduation, focusing on technical issues, not equipping students with necessary knowledge in the field of entrepreneurship such as business planning, market demand assessment, investment presentations.

1.3 Company background

1.3.1 FPT Education

FPT Group is one of the leading IT services providers in Vietnam, FPT Joint Stock Company (previously known as the Technological Investment and Development Corporation) provides IT goods and services. Currently, FPT has 46 offices in 22 countries

worldwide, and telecommunications infrastructure covers 59/63 provinces and cities in Vietnam. The company is headquartered at FPT Building, Duy Tan Street, Cau Giay District, Hanoi, with seven member companies and four associate companies. FPT Education is one of the member units, holding one of the three core activities of FPT Corporation. FPT educational organization was established in 1999 and now has 65,000 students, with many high schools, universities, colleges, and management institutes and technology established such as FPT University, Greenwich University, FPT Polytechnic,… Always carrying with them "Dream of Innovation," a clear mission, profound educational philosophy that has helped FPT education grow stronger and stronger and win won many awards over the years. FPT Education was officially appointed a member of the World CDIO Association in 2017. In 2018, FPT Education was awarded the Excellent Education Organization Award and became an AUN-QA partner. FPT Education and FPT University earned the 2019 Asia-Pacific Influential Education Organization and University Award.

1.3.2 FPT University

FPT University is the first Vietnamese university to receive a 3-star QS Star rating in 2012. FPT University has three leading majors: Internet of Things, Business Administration, Languages, and many specific narrow majors to help students learn and study the subject they love in-depth. Every year, contests such as Vietnam AI Hackathon, FPT - FQ Research Contest, FPT Edu Research Festival, and FPT Edu Biz Talent give students various, rich, and valuable experiences, helping to inspire students to generate ideas about entrepreneurship. Especially in the FPT Edu Biz Talent contest, students will have to create products/services, which helps promote the practical applicability of the discipline. Thanks to the experience, applying the knowledge they have learned into practice while still in school helps students realize their inclinations, define their success, and increasingly more students who create their startup ideas. FPT University is always creative and innovative in teaching and training. Hence, in 2020 FPT University is recognized as the best business school in Vietnam. In addition, FPT University won the Excellent School in Education Award and the ICT Education Award from the Asia Pacific Computing Industry Organization in 2018. Moreover, in 2019, the Business Administration major of FPT University Hanoi officially achieved the full accreditation of ACBSP (“FPT tổ chức chuỗi sự kiện công nghệ cho cộng đồng,” n.d.).

1.4 Research objectives

This study examines the extent to which the characteristics of entrepreneurship education programs, i.e., business plan activities, the introduction of role models, the introduction of entrepreneurial networks, and feedback provided by mentors or teachers influence entrepreneurial intention. In the current research, the teachers provide and record the feedback regularly through summative and formative forms. Also, the research is exploring the impact of the above-mentioned entrepreneurial education characteristics on entrepreneurial intention's antecedents such as perceived behavioral control, subjective norm, and attitude. The reason for choosing these characteristics is their popularity in research and entrepreneurship education programs. These four characteristics are based on experiential learning (in-depth justification has been given in the literature review chapter and conceptual framework chapter). This study seeks to advance the theoretical discussion in the relationship between entrepreneurship courses and entrepreneurial intention and identify a practical relevance for the findings. Specifically, the aims can be categorized into particular objectives:

OBJ1. *Review overview of research related intention and trend of entrepreneurship of students in the world in general and in Vietnam in particular and determine main factors affecting entrepreneurial intention;*

OBJ2. *Identify the relative importance of selected factors affecting entrepreneurial intention;*

OBJ3. *Propose an SFAHP method to assess the factors affecting the entrepreneurial intention of FPT University students, thereby offering some suitable methods and solutions to support schools to build entrepreneurship education programs.*

1.5 Research questions

These objectives give rise to the Research Question and certain specific sub-questions about the specific course characteristics:

RQ1. *What factors affect the entrepreneurial intention of FPT University students?*

RQ2. *How do the selected factors affect the entrepreneurial intention of FPT University students?*

RQ3. *How does the proposed method of SFAHP investigate factors affecting the entrepreneurial intention of FPT University students and implications?*

1.6 Research scope

In this study, we will focus on the factors affecting the entrepreneurial intention of FPT University students. Our research method for data collection was face-to-face interviews, focusing on a group of experts, business and economic experts, and senior staff of FPT University.

- Type of survey: Direct interview with 20 specialists;
- Number of respondents expected: 10 experts;
- Respondent: 10 experts: FPT University's Alumni who have startups; FPT University Lecturers.

1.7 Methodology and data review

In this research, multiple methods were applied to collect and analyze data. The primary research was implemented based on quantitative research, gathered through direct interviews, and analyzed by SF-AHP.

SF-AHP methods determine the weights of criteria and evaluate the factors affecting the intention to start a business.

Primary data was extracted from experts' opinions through interviews. Secondary data was based on online references (such as news, FPT University's official website, research articles and books), consultation with economic experts, and FPT University's internal data.

1.8 Conclusion

This thesis introduces the entrepreneurial intention background and an overview of the practical problem of students' entrepreneurial intention in Vietnam. Investigate this problem, the research subject, research scope, and proposed research questions are identified.

1.9 Thesis outline

The rest part of the thesis (excluding the abstract, appendix, reference, list of tables and figure, abbreviations, and acronyms list) is laid out as follows:

Chapter 1: Introduction

Chapter 1 briefly provides basic information about the background, objective, research question, and methodology.

Chapter 2: Literature review

Chapter 2 presents relevant theories that are the basis to develop research questions. Different methods to evaluate factors affect the entrepreneurial intention.

Chapter 3: Methodology

Chapter 3 presents research methods such as qualitative, quantitative, and observational studies. Data collection and analysis methods are clarified in this chapter.

Chapter 4: Empirical Case

Chapter 4 analyses and applies the model and methods proposed in Chapter 3 to evaluate factors that affect the entrepreneurial intention for FPT University.

Chapter 5: Conclusions and Implications

The final chapter answers the research questions by summarizing the findings and suggesting methods and solutions suitable for students in entrepreneurial intention. Limitations and implications of this study are also reminded for applying our results in future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of the literature relevant to entrepreneurship education and its impact on entrepreneurial intention so that the research questions of this study may be accurately defined. It includes the fundamental theories and research of three key areas: (i) experiential education, (ii) social cognitive theory, and (iii) entrepreneurship research and associated theories. The initial discussion is of various definitions of entrepreneurship, then essential research on entrepreneurship intention and entrepreneurship education will be examined. Later the critical theories of these areas will be explored, and a brief conclusion will be given.

2.2 Meaning of Entrepreneurship Intention

2.2.1 Definition of Entrepreneurship

There are various opinions about the nature of entrepreneurship within different disciplines. Thus, there are many studies of entrepreneurship but no mutual agreement about the definition of it.

Cunningham and Lischeron (1991) interpreted entrepreneurship through several tasks, including fundraising, sourcing, and starting up the venture. Vesper and Gartner (1997) indicated that entrepreneurship is a business owner by starting a new or buying an existing company. Hindle and Rushworth (2000) defined entrepreneurship as creating and managing new, innovative, and unique organizations.

Kuratko (2005) suggests that entrepreneurship is about creating new ventures but also includes ongoing innovation activities. Kobia and Sikalieh (2010) suggested that entrepreneurship overlaps several disciplines, for example, sociology, psychology, anthropology, and economics; hence, the simple categorization based on the trait, behavioral, and opportunity identification may not be complete the definition.

Even though there are various definitions, including the entrepreneurial process, they generally include recognizing business opportunities.

2.2.2 Entrepreneurship Intention

It is a challenging field to research the intention to start a business of university students. The term "entrepreneurial intention" is usually clarified as the choice to establish a new firm (Krueger et al., 2000; Fitzsimmons & Douglas, 2011; De Clercq et al., 2013).

For the student, it is related to the decisions that are not required to make at present, but potentially in the future periods, usually several years and at the time they were graduated, left their university. In addition, several scholars have clarified the term "entrepreneurial intention" as a judicial process in the way of thinking and behave, turning into the motivation and plan to launch a new business or generate new scope in the current firms (Churchill & Bygrave, 1989; Obschonka et al., 2010; Remeikiene et al., 2013).

Besides that, Krueger (2007) believed that the decision-making process leads to individuals work, create, and establish organizations willfully, which is a consequence of the choice to become an entrepreneur. By conducting empirical research, Krueger et al. (2000) and Obschonka et al. (2010) confirmed the notion that intention is the best indicator of entrepreneurial attitudes. Based on the suggestion of (Ajzen 1987, 1991; Krueger, 2017) proved that entrepreneurial intention could be constructed through a meaning of bridge that links the organization's creations and exogenous impacts.

2.3 Proposed Factors

After a comprehensive reviewing literature, 13 main factors were proposed to investigate the entrepreneurial intention of FPT University students (Table 2.1).

Perceived desirability of self-employment (PDSE):

Wolbarsht et al. (1981) defined perceived desirability as the degree to which an individual perceives the attractiveness to establish a business. A practical judgment (an emotive response) helps entrepreneurs make decisions in perplexing situations (Mitchell *et al.*, 2002). The perceived desirability of self-employment diverts the appeal of the person into an independent or organizational career option. These are individual's attitudes towards performing entrepreneurial behavior through their entrepreneurial intentions (Krueger et al., 2000).

Personal Attitude (PA):

Entrepreneurial skills are associated with attitudes with a specific object and can be approached as something that can be changed through communication or experience (Deakins et al., 2016). PA is considered one of the significant factors in entrepreneurial intention (Ajzen, 1991; Kolvereid, 1996; Autio *et al.*, 2001; Fayolle et al., 2006; Zhao et al., 2010; Muhammad et al., 2015). Establishing a business is dominantly related to PA toward entrepreneurship, individuals' desire to become rich, and self-improvement (Bozkurt, 2014).

Previous studies revealed that PA had a positive and significant effect on entrepreneurial intention (Kolvereid, 1996; Fayolle et al., 2006; Esfandiar *et al.*, 2019).

Motivation (MOT):

Entrepreneurial motivation is vital for developing entrepreneurial behavior (Carsrud & Brännback, 2011; Malebana, 2014; Sivarajah & Achchuthan, 2013). While entrepreneurial intentions best predict entrepreneurial behavior, researchers suggest entrepreneurial motivation is influential in determining an individual's intentions (Carsrud & Brännback, 2011; Malebana, 2014; Schlaegel & Koenig, 2014). Entrepreneurial motivation influences the choices of individuals, their persistent effort, and finally, their desire (intentions) for entrepreneurial behavior. Entrepreneurial motivation influences an individual's decision to search, assess and utilize these entrepreneurial opportunities (Shane *et al.*, 2010). Different motivations lead to different actions that an individual pursues. Hence, motivation is an antecedent of individuals' intentions and actions.

Entrepreneurial self-efficacy (ESE):

Self-efficacy is an individual's self-confidence in skills and abilities to perform a particular action in a given domain (Ahlin et al ., 2014; Oyugi et al., 2015; Wilson et al., 2007). This concept shows individuals' innermost thoughts and beliefs on whether they can accomplish a task and perceive their ability to convert those skills into a chosen action effectively (Wood & Bandura, 1989). Furthermore, self-efficacy is explained in the literature as a cognitive process, and entrepreneurs decide on their cognitive reasoning, i.e., their perceptual skills (Mitchell *et al.*, 2002).

Social Norms (SN):

According to Ajzen (1991), social norms are those factors that an individual perceives before acting. These factors comprised the expectations of relevant people or reference groups who influence the individual's decision choice (for example, family aspirations, friends' wishes, or any social pressure). A positive perception of a social group about starting a new business will positively influence the attractiveness and desire towards a self-employment career choice and vice versa. Social norms will influence the desirability and intention of an individual towards the career choice.

Achievement striving (AS):

Achievement striving is a self-centered construct (McClelland *et al.*, 1955). Costa & McCrae (1992) defined it as follows: Individuals who score high on this facet have high

aspiration levels and work hard to achieve their goals. They are diligent and purposeful and have a sense of direction in life. Very high scorers, however, may invest too much in their careers and become workaholics. Low scorers are lackadaisical and perhaps even lazy. They are not driven to succeed. They lack ambition and may seem aimless, but they are often perfectly content with their low levels of achievement.

Innovativeness (INNO):

Innovativeness, another personality trait, reflects the tendency of an individual to engage in and support new ideas, novelty, experimentation, and creative processes resulting in new products, services, ideas, or technological processes. This concept as early as 1934 by Schumpeter (1934), describing the role of innovation in the entrepreneurial process. (Schumpeter 1942) used the term "creative destruction," which stated that, in an economic process, when existing market structures were disrupted by the introduction of new goods or services that shifted resources away from existing firms and caused new firms to grow, wealth is created in the economy. An entrepreneur plays a crucial role in the whole process Schumpeter (1934). Thus "innovativeness" is an essential factor to characterize an individual as an entrepreneur.

Locus of Control (LOC):

Locus of Control was another extensively researched entrepreneurial trait. It was a personality variable that explained an individual's expectations as to whether they would be able to control life events (Espíritu-Olmos and Sastre-Castillo, 2015). Clark and Stoffel (1992) first developed this theory, who split it into two measures- internal and external locus of control. Individuals with an external locus of control believed that circumstances were beyond their control, and it was a matter of luck, fate, or destiny, and other people influenced their performance. Individuals with an internal locus of control believed that they could control the circumstances, events, and consequences in their lives (Koh, 1996). Thus, internal locus of control was considered an entrepreneurial trait that referred to an individual's belief that they can considerably influence their fate through their behavior.

Perceived Relational Support (PRS):

PRS is strongly associated with social and cultural support. According to the theory of (Hofstede 2003), people's decisions are influenced by their culture. Culture and social life have a substantial impact on people's behavior and thinking. In this manner, family and close friends play an essential role in shaping people's behavior and intentions about particular issues (Fizza, 2017).

Perceived University Support (PUS):

The literature review suggests that the university environment and its support system affect student's entrepreneurial intention directly or indirectly through motivational factors such as personal attitudes and perceived behavioral control (Shirokova et al., 2016); Bae *et al.*, 2014; Fishbein & Ajzen, 2009).

Perceived Government Support (PGS):

Legal and government support plays a critical role in influencing individuals (Stephen et al., 2005). They can provide training centers, financial support, and different incentives to encourage entrepreneurs (Bridge et al., 2014). Government is the main body for setting up rules and procedures that enhance the implementation of entrepreneurship (Fini *et al.*, 2011). Different researchers explained that financial capital is directly related to entrepreneurship (Kim et al., 2013). It is a barrier for startups (Steier and Greenwood, 2000; Meier, Pilgrim and others, 1994).

Perceived Environmental Support (PES):

Individuals do not decide to open a new business in isolation from the environment they live within; however, students' intention towards an entrepreneurial career is directly influenced by perceived barriers and supportive factors (Lüthje &Franke, 2003). It is reasonable to concentrate on the entrepreneurial intention as part of a social, political, and economic context.

Risk-taking (RT):

Risk-taking propensity refers to the inclination of an individual to be a risk-taker or risk-averse when confronted with a situation (Gürol & Atsan, 2006). An individual's willingness to decide or an action in a situation of the uncertainty of outcome and some targeted reward (Jackson, 1994; Espíritu-Olmos & Sastre-Castillo, 2015; Zhao et al., 2010). The risk-taking attribute was connected with a contractor mentality in the first works in Cantillon (1755). It was explained that the main factor in differentiating entrepreneurs from other workers was the risks that they took Espíritu-Olmos & Sastre-Castillo, 2015; Zhao et al., 2010). As demonstrated by their activities with profits and losses, entrepreneurs liked to take risks.

Table 2.1 Proposed factors

No.	Factors
(PDSE)	**Perceived desirability of self-employment (PDSE)** **PDSE1** I wish to start a business because I want more freedom of activity. **PDSE2** I wish to start a business because I want to be my own master. **PDSE3** I wish to start a business because I want to be more respected. **PDSE4** I wish to start a business because I want to be in the vanguard of technological ideas. **PDSE5** I wish to start a business because I want to develop a hobby through the business. **PDSE6** I wish to start a business because I want to gain a better position in society. **PDSE7** I wish to start a business because I want to put one to the test. **PDSE8** I wish to start a business because I want to earn a good income.
(PA)	**Personal Attitude (PA):** **PA1** Being an entrepreneur has more advantages than disadvantages. **PA2** A career as an entrepreneur is attractive for me. **PA3** If I had the opportunity and resources, I would start a firm. **PA4** Being an entrepreneur would greatly satisfy me. **PA5** Among various options, I would rather be an entrepreneur.
(MOT)	**Motivation (MOT)** **MOT1** I might start a business for the high (social-economic) status of a business owner. **MOT2** I might start a business because I want to be my boss. **MOT3** I might start a business. I want to earn money. **MOT4** I might start a business for self-actualization. **MOT5** I might start a business because I want to determine my working hours. **MOT6** I might start a business for my future children or family. **MOT7** I might start a business if I did not have a job.
(ESE)	**Entrepreneurial self-efficacy (ESE)** **ESE1** I have business knowledge. **ESE2** I can develop new business ideas and products. **ESE3** I can create products that fulfill customers' unmet needs. **ESE4** I can develop a well-conceived plan and make a presentation to potential investors. **ESE5** I can tolerate unexpected changes in business conditions. **ESE6** I can react quickly to take advantage of business opportunities. **ESE7** I know how to manage the budget. **ESE8** I have business experience.
(SN)	**Social Norms (SN)** **SN1** I wish to start a business because I want to continue family traditions. **SN2** I wish to start a business because I want to manage and motivate others. **SN3** I wish to start a business because I want to implement an idea or innovation. **SN4** I wish to start a business because I want to follow someone's example.
(AS)	**Achievement striving (AS)** **AS1** I always feel I must better my last test/assignment result. **AS2** I constantly pressurize myself to do the best I can. **AS3** I try to get the perfect mark-100%. **AS4** Excelling in my course assignments and exams means just about everything to me. **AS5** I get annoyed with myself if I do not get a top mark for assignments and exams.

(INNO)	**Innovativeness (INNO)** **INNO1** I often surprise people with my novel ideas. **INNO2** People often ask me for help in creative activities. **INNO3** I obtain more satisfaction from mastering a skill than coming up with a new idea. **INNO4** I prefer work that requires original thinking. **INNO5** I usually continue doing a new job in precisely the way it was taught to me. **INNO6** I like a job that demands practice rather than inventiveness. **INNO7** I am not a creative person. **INNO8** I like to experiment with various ways of doing the same thing.
(LOC)	**Locus of control (LOC)** **LOC1** My success depends on whether I am lucky enough to be in the right place at the right time. **LOC2** To a great extent, accidental happenings control my life. **LOC3** When I get what I want, it is because I am lucky usually. **LOC4** My life is determined by my actions. **LOC5** When I get what I want, it is because I worked hard for it usually. **LOC6** It is not wise for me to plan too far ahead because things turn out to be a matter of bad fortune. **LOC7** Whether or not I am successful in life depends mainly on my ability. **LOC8** I feel that what happens in my life is mainly determined by people in powerful positions. **LOC9** I feel in control of my life. **LOC10** Success in business is mostly a matter of luck.
(PRS)	**Perceived Relational Support (PRS)** **PRS1** If I decided to become an entrepreneur, my family members would support me. **PRS2** If I decided to become an entrepreneur, my friends would support me. **PRS3** If I decided to become an entrepreneur, my close network (work, school and neighborhood) would support me.
(PUS)	**Perceived University Support (PUS)** **PUS1** My university/ school provided me with the knowledge and information required to start a business. **PUS2** My university/ school encourages me to develop creative ideas for being an entrepreneur. **PUS3** During classes, teachers provide students with real business examples. **PUS4** University/ school helped me to identify business opportunities. **PUS5** University/ school provided me with information regarding startup centers in Vietnam. **PUS6** University/ school taught me how to prepare a feasibility study. **PUS7** University/ school often prepares workshops, seminars and training regarding entrepreneurship.
(PGS)	**Perceived Government Support (PGS)** **PGS1** Vietnamese government supports youth entrepreneurship. **PGS2** Vietnamese government supports the creation of new business. **PGS3** Vietnamese to start a business is easy in Vietnam. **PGS4** Vietnamese government provides tax facilities for startups. **PGS5** Vietnamese government provides financial incentives for startups.
(PES)	**Perceived Environmental Support (PES)** **PES1** In Vietnamese society having own business is better than being employed. **PES2** Vietnamese economy provides many opportunities for entrepreneurs. **PES3** It is easy to obtain loans in Vietnam. **PES4** Infrastructure (electricity, internet, water…) in Vietnam supports startup companies. **PES5** The political stability in Vietnam does affect the decision to open a business.

(RT)	**Risk-taking (RT)** **RT1** I believe that I am a risk-taker. **RT2** I usually trust my judgment, even if those around me do not agree with me. **RT3** I am the sort of person who handles uncertainty well. **RT4** I am not scared of debt. **RT5** I enjoy the challenge of situations that may contain risk. **RT6** I would instead work for a small business than a large business (reversed).

2.4 Methodology

2.4.1 MCDM Models

MCDM models are frequently developed to support decision-makers in solving complex multicriteria decision-making problems in different industries and sectors, including hospitability and hotel (Nguyen, 2021; Popovic *et al.*, 2019), finance and banking (Nguyen *et al.*, 2020; Nguyen *et al.*, 2020; Nguyen *et al.*, 2020), supply chain management (Govindan and Chaudhuri, 2016; Hsiao *et al.*, 2018) and so on. From the beginning of the 1970s, these decision-making problems can be supported using multicriteria decision-making MCDM models. There are many multicriteria decision-making methods identified, such as the Analytical Hierarchical Process (AHP), Analytic Network Process (ANP), Fuzzy Analytic Network Process (FANP), Artificial Neural Network (ANN), Data Envelopment Analysis (DEA), etc. that can be employed to solve similar decision-making problems. MCDM methods provide a possibility to evaluate these and other conflicting factors and to decide which alternative is the most suitable according to different criteria" (Siksnelyte-Butkiene *et al.*, 2020). Due to multifaceted decision-making problems' characteristics, entrepreneurial intention can be regarded as a complicated multi-criteria decision-making (MCDM) problem due to the availability of quantitative, qualitative, and multiple criteria in the natural decision-making process.

2.4.2 Fuzzy Concepts

People often confuse the degree of truth with probability. However, these two concepts are pretty different; Fuzzy logic's correctness represents the dependence on fuzzy sets, not the likelihood of an event or condition. The degree of influence of factors with specific circumstances may not be apparent, subjective, or ambiguous. If the humans' fuzziness and uncertainty in making the choices are not considered, the consequences can be deceptive. When building an entrepreneurship education program, it is understood that choices affect several individuals joining the decision-making phase (Board of Directors, Principal, and Specialists). Making more participants involved enables the selection process to be more

rational because the group's view (prejudice) is not carrying much force. For the system to conclude a sensible final decision, it must reflect human thinking. In making decisions, decision-makers are more comfortable evaluating criteria for a certain degree of tolerance in some cases than deciding on a set value. As a result, one system was implemented, which suggests a human-like thinking style, known as fuzzy logic.

2.5 Research gap

The research results show that it has contributed in many ways to theoretical, practical, and methodological aspects. The results suggest that the feedback provided by mentors or teachers and business plan activities can directly impact entrepreneurial intention. This is a very relevant and valuable outcome. Entrepreneurship education research suggests that there should be clarity about which characteristics are more relevant to developing an entrepreneurial intention. Hence, from the results conclusion, feedback and business plan activities should be considered while designing and delivering entrepreneurship education courses. According to the current research results, feedback and business plan activities directly impact the intention to start their ventures; education policymakers, particularly in entrepreneurship, should implement these two characteristics and ensure that participants get maximum benefit.

Also, the link between entrepreneurial networking and change in intention is mediated by Penaluna *et al.*, 2016; European Commission, 2006; Canto García, 1991, participants' subjective norm through entrepreneurial networking does not directly influence intention can mediate through subjective norms. Similarly, the introduction of role models does not directly impact, but participants' attitude towards behavior also mediates it. This knowledge can also provide valuable guidelines for entrepreneurship education courses and their providers. Katz (2003) suggests that there has been a significant development in entrepreneurship from the last decade. It has also been argued that some research such as Hönig and Merten (2004) and Robinson and Sexton (1994) has a good link between enterprise education and startups. Entrepreneurship education helps in enhancing participants' attitudes, behavior, and intention to start the business (Hansemark, 1998; Roberts, Krauss and Kennedy, 1998) and develops entrepreneurial and business management skills (Sperber, 1984; Sair and Sair and Charney, 2000).

The most significant aspect is to analyze the impact of on participant's intention towards starting a business by exploring the relevance of specific education characteristics, which may be helpful to design effective entrepreneurship education programs. However,

without considering some specific education characteristics, it would be complicated to understand their relevance. Hence, the current research is a vital stepping stone in the right direction since it examines specific characteristics based on experiential learning for a duration to understand their role in influencing entrepreneurial intention.

According to our literature review, given the abovementioned importance of entrepreneurial intention, there is scarce research by combining spherical fuzzy set and MCDM method to investigate the factors affecting entrepreneurial intention in developing countries, especially in Vietnam. Therefore, this study proposes an integrated Spherical Fuzzy Sets and AHP model to evaluate different entrepreneurial intention factors among FPT University students, especially under uncertain decision-making environments.

2.6 Conclusion

This study addresses a pressing problem that is important to individuals and policymakers: making entrepreneurship education as effective as possible in motivating people to become entrepreneurs. Entrepreneurship is essential for economic growth, technical innovation, and creating a society where individuals can achieve their potential.

This is a carefully organized and systematic study that leads to evidence-based and valuable conclusions. It makes a theoretical-methodological and practical contribution.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter provides a better understanding of the methodology in this study, plus the rationale for why it was chosen.

3.1.1 Research philosophy

The research philosophy addresses the source, nature and evolution of information (Clementz *et al.*, 2011). Philosophy consists of the notion that a phenomenon is collected, analyzed and used. Four major corporate and management ideologies are given below.

Realism, in philosophy, is the viewpoint that accords to things that are known or perceived as existence or nature, which is independent of whether anyone is thinking about or perceiving them based on a personal viewpoint.

Interpretivism determines the degree of interest one has in the research. Recognizing the gap between people is the premise of this approach.

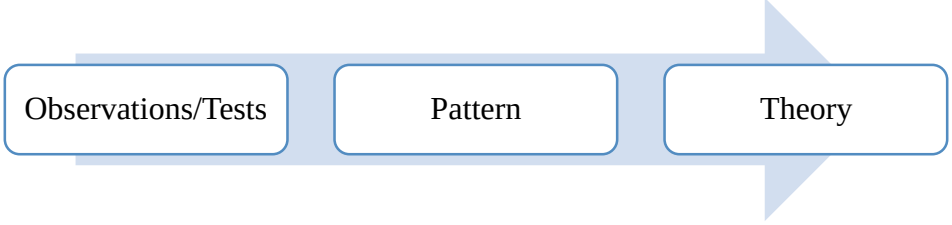
Positivism is dependent on statistical analysis based on quantifiable observations.

Pragmatism deals with similar concepts that facilitate actual actions. This is a study approach through which understanding why issues arise and attempt to differentiate them. In the area of pragmatics, different kinds of analysis may be performed at the same time.

3.1.2. Research approaches

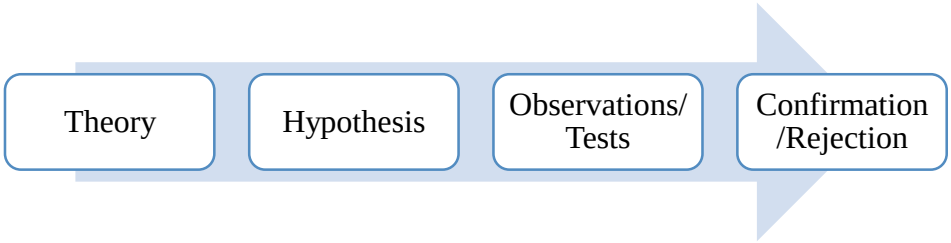
There are three types of research approaches including inductive, deductive, and abductive.

Inductive is data collected and theory developed from the data analysis. In inductive inference, known premises generate untested hypotheses that generalizability is from specific to general. Data collection is used to explore a phenomenon, identify themes and patterns, and create a conceptual framework. The theory in this research approach is theory generation and building (Saunder *et al.*, 2010).



Inductive process in research approach

Deductive reasoning is generalizing from the general to the specific. The reasoning always starts with a theory and leads to a new hypothesis. Then, narrow down the results after collection to check the hypothesis. In order to conclude, it uses facts, laws, descriptions, or objects. In deductive inference, when the premises are correct, the conclusion must also be correct. Data collection is used to evaluate propositions or hypotheses related to an existing theory (Saunder *et al.*, 2010).



Deductive process in research approach

Abductive is combined with inductive and deductive. It is a combination of inductive and deductive. In an abductive inference, known premises are used to generate testable conclusions that generalizability is from the specific and general interactions. Data collection is used to explore a phenomenon, identify themes and patterns, locate these in a conceptual framework, and test this through data collection. The theory in this research approach is theory generation or modification, incorporating existing theory where appropriate to build a new theory or modify the existing theory (Saunder *et al.*, 2010).

This research is conducted by the inductive method. In certain instances, hypotheses are relatively straightforward since the process starts with findings that serve as proof of regularities. If proven, the pattern is detected; in some situations, it is hard since there is little as a shred of prior evidence, and the assumptions proceed. This is the most suitable way to assess businesses.

3.1.3 Research methods

There are two main types to collect data: qualitative and quantitative. For discriminating between the two types of data, it is essential to use numerical (numbers) data or not numeric (words) data.

Quantitative research is characterized by the results shown in the form of statistics and graphs. When conducting this kind of study, broad, generalizable facts on the subject are established. These three techniques are the most often used in research: experiments, observations recorded as numbers, and surveys with closed-ended questions.

Qualitative research is expressed in words. It is used to understand concepts, thoughts or experiences. This type of research enables gathering in-depth insights on topics that are not well understood. Standard methods include interviews with open-ended questions, observations described in words, and literature reviews that explore concepts and theories.

This research used quantitative and qualitative data to improve the strengths of one particular type of data and balance the limitations of its drawback.

3.2. Proposed Method

3.2.1. Fuzzy Sets

Fuzzy sets have been trendy in almost all branches of science since they emerged (Zadeh, 1965). The standard fuzzy sets have been extended to many new types: Type 2 fuzzy sets (Zadeh, 1975), interval-valued fuzzy sets (Sambuc, 1975; Zadeh, 1975; Grattan-Guinness, 1976), intuitionistic fuzzy sets (Atanassov, 1986), fuzzy multi-sets (Yager, 1986), neutrosophic fuzzy sets (Smarandache, 1998), non-stationary fuzzy sets (Garibaldi and Ozen, 2007), hesitant fuzzy sets (Torra, 2010), Pythagorean fuzzy sets (Yager and Abbasov, 2013; Yager, 2013), picture fuzzy sets (Cuong 2014), fuzzy orthopedic sets (Yager, 2016), and spherical fuzzy sets (Kutlu Gündouğdu and Kahraman, 2019) It starts from ordinary fuzzy sets and extends to recently developed types of fuzzy sets as shown in Figure 3.1.

Ordinary Fuzzy Sets: Let a set U be a universe of discourse. An ordinary fuzzy set $\tilde{A}$ does an object have the form $\tilde{A} = \{\langle u,\mu_{\tilde{A}}(u) \mid u \in U\}$ the function $0 \leq \mu_{\tilde{A}}(u) \leq 1$ is the degree of membership of u to $\tilde{A}$. Its range is the subset of nonnegative real numbers whose supremum is finite. Zadeh (1965) introduced fuzzy sets as a class of objects with a continuum of grades of membership. He extended the notions of inclusion, union, intersection, complement, relation, convexity, linguistic hedges, etc., to such sets and established various properties of these notions in the context of fuzzy sets.

Type 2 Fuzzy Sets: Zadeh (1975) introduced type 2 fuzzy sets to extend the standard fuzzy sets. Such sets are fuzzy sets whose membership grades themselves are type 1 fuzzy sets. They are beneficial when it is difficult to determine an exact membership function for a fuzzy set. This type of fuzzy set requires too many parameters to be used in problem modeling.

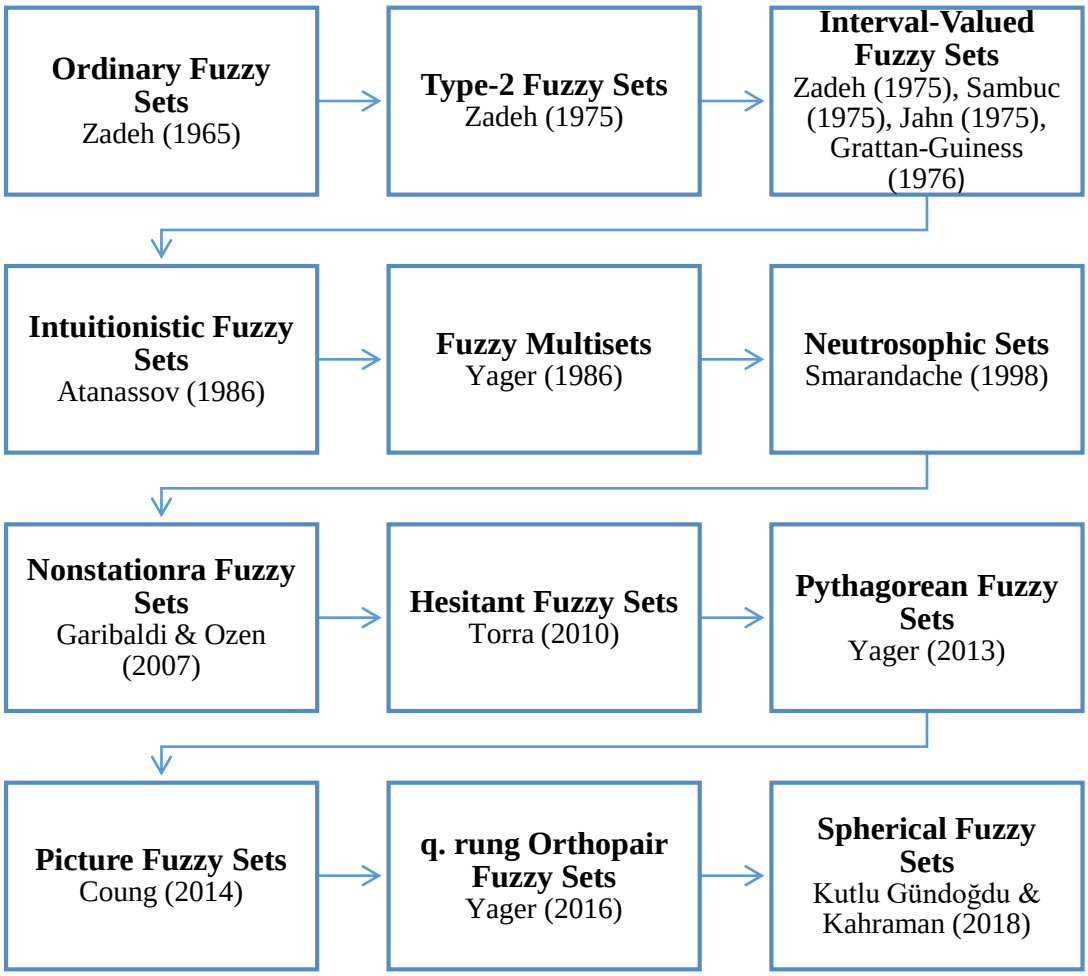


Figure 3. 1 Extension of fuzzy sets

Besides, the third dimension is ignored by many researchers for simplification purposes, and these sets are called interval-valued type 2 fuzzy sets. A type 2 membership function can represent a type 2 fuzzy set in the universe of discourse U $\mu_{\tilde{\tilde{A}}}(u)$ shown as follows:

$$\tilde{\tilde{A}} = \{\langle (u, x), \mu_{\tilde{A}}(u, x) \mid \forall u \in U, \forall x \in I_u \subseteq [0,1], 0 \leq \mu_{\tilde{A}}(u,x) \leq 1\} \quad (1)$$

Where I_u denotes an interval [0, 1].

Interval-Valued Fuzzy Sets: Interval-valued fuzzy sets were introduced independently by sets Zadeh (1975), Grattan-Guinness (1976), and Sambuc (1975). An interval-valued fuzzy set is a special case of type 2 fuzzy sets. An interval-valued fuzzy set (IVFS) is defined by a mapping F from the universe U to the set of closed intervals in [0, 1]. Let $F(u) = [F_L(u), F^U(u)]$. The union, intersection, and complementation of IVFSs are obtained by canonically extending fuzzy set-theoretical operations to intervals.

Intuitionistic Fuzzy Sets: Intuitionistic fuzzy set (IFS) theory is one of the significant extensions of the standard fuzzy set (FS) theory to deal with the vagueness in the data, which utilizes a membership degree and a non-membership degree sum is less than or equal to 1 (Alhazaymeh *et al.*, 2012; Ju *et al.*, 2020; Thao and Duong, 2019). Let a set U be a universe of discourse. An IFS $\tilde{A}$ does an object have the form $\tilde{A} = \{\langle u, \mu_{\tilde{A}}(u), v_{\tilde{A}}(u)) \mid u \in U\}$ where the functions $\mu_{\tilde{A}}(u) : U \rightarrow [0, 1]$, $v_{\tilde{A}}(u) : U \rightarrow [0, 1]$ and $0 \leq \mu_{\tilde{A}}(u) + v_{\tilde{A}}(u) \leq 1$ is the degree of membership, non-membership of u to $\dot{A}$, respectively. For any IFS $\tilde{A}$ and $u \in U$, $\pi_{\tilde{A}}(u) = 1 - \mu_{\tilde{A}}(u), v_{\tilde{A}}(u)$ is called degree of indeterminacy of u to $\tilde{A}$.

Fuzzy Multi-sets: The bag structure is a set-like object in which repeated elements were significant. Basic operations on bags such as intersection, union, and addition were discussed and introduced to select elements based upon their membership in a set and showed the usefulness of the bag structure in relational databases (Yager, 1986). Let U be a non-empty set. A fuzzy multi-set $\tilde{A}$ drawn from U is characterized by a function, "count membership" of $\tilde{A}$ denoted by $CrM_{\tilde{A}}$ such that $CrM_{\tilde{A}} : \mathrm{U} \rightarrow \mathrm{X}$ where X is the set of all crisp multi-sets drawn from the unit interval [0, 1]. Then, for any $u \in U$, $CrM_{\tilde{A}}$ value is a crisp multi-set drawn from [0, 1]. For each $u \in U$, the membership sequence is defined as the decreasingly ordered sequence of elements in $CrM_{\tilde{A}}$. It is denoted by $(\mu^1{}_{\tilde{A}}(u), \mu^1{}_{\tilde{A}}(u), \dots, \mu^{\mathrm{n}}{}_{\tilde{A}}(u))$ where $\mu^1{}_{\tilde{A}}(u) \geq \mu^1{}_{\tilde{A}}(u) \geq \cdots \geq \mu^{\mathrm{n}}{}_{\tilde{A}}(u)$.

Neutrosophic Sets: Neutrosophic sets (NS) are represented by the three dimensions: a truthiness degree, an indeterminacy degree, and a falsity degree (Smarandache, 1998). NS not only deals with the hesitancy of the system but also decreases indecisiveness of conflicting information. Thus, truthiness, falsity, and indeterminacy values can be independently assigned (Smarandache, 1998). Let U be a universe of discourse. Neutrosophic set $\tilde{A}$ in U is an object having the form $\tilde{A} = \{u, (T_{\tilde{A}}(u), I_{\tilde{A}}(u), F_{\tilde{A}}(u)) | u \in U\}$where$T_{\tilde{A}}$is the truth-membership function, $I_{\tilde{A}}$is the indeterminacy-membership function, and $F_{\tilde{A}}$ Is the falsity membership function. There is no restriction on their sum and so $0 \leq T_{\tilde{A}}(u) + I_{\tilde{A}}(u) + F_{\tilde{A}}(u) \leq 3$.

Non-stationary Fuzzy Sets: Garibaldi and Ozen (2007) presented a case study in which the introduction of vagueness into a fuzzy system's membership functions was investigated to model the variation exhibited by decision-makers in a medical decision-making context through non-stationary fuzzy reasoning. Let $\tilde{A}$ denote a fuzzy set of a universe of discourse U characterized by a membership function $\mu_{\tilde{A}}(u)$. Let T be a set of time points t_i, possibly infinite, and $f: T \rightarrow \Re$ denote a perturbation function. A non-stationary

fuzzy set $\tilde{A}$ of the universe of discourse, *A non-stationary membership function characterizes u…* $T \times U \rightarrow [0, 1]$ that associates each element *(t, x)* with a time-specific variation of $T \times U$. The non-stationary fuzzy set $\tilde{A}$ is denoted by:

$$\tilde{A} = \int_{t \in T} \int_{u \in U} \mu_{\tilde{A}}(t, u)/u/t \tag{2}$$

Hesitant Fuzzy Sets: Torra and Narukawa (2009) defined hesitant fuzzy sets and presented an extension principle, which permits to generalization of existing operations on fuzzy sets to this new type of fuzzy sets. Torra and Narukawa (2009) proposed hesitant fuzzy sets (HFSs) and introduced some basic operations for HFS. He proved that the envelope of the hesitant fuzzy sets was an intuitionistic fuzzy set. Hesitant fuzzy sets can be used as a functional tool allowing many potential degrees of membership of an element to a set. These fuzzy sets force the membership degree of an element to be possible values between zero and one. Torra and Narukawa (2009) defined hesitant fuzzy sets (HFSs) as follows: Let $M = \{\mu_1, \dots, \mu_N\}$ be a set of N membership functions. Then, the hesitant fuzzy set associated with M, that is h_M, is defined as follows:

$$h_M(u) = \bigcup_{\mu \in M} \{\mu(u)\} \tag{3}$$

Pythagorean Fuzzy Sets: In the real-life, the decision-makers might express their preferences about membership degrees and non-membership degrees of an alternative concerning a criterion that dissatisfies the condition that the sum of the membership and non-membership degrees should be less than or equal to 1.0. Pythagorean fuzzy sets (PFS) developed by Yager (2013), which had been called as Intuitionistic type 2 fuzzy sets (IFS2) by Atanassov previously (Atanassov, 1989), is characterized by a membership degree and a non-membership degree satisfying the condition that their squared sum is at most equal to one, which is a generalization of intuitionistic fuzzy sets (IFS) (Yager and Abbasov, 2013). This concept provides a larger preference area for decision-makers. In other words, all the intuitionistic fuzzy degrees are a part of the Pythagorean fuzzy sets, which shows that the PFS is more powerful to handle uncertain problems.

Definition of PFS is given as follows:

Let a set U be a universe of discourse. A PFS $\tilde{P}$ does an object have the form $\tilde{P} = \{\langle u, (\mu_{\tilde{P}}(u), v_{\tilde{P}}(u)) | u \in U\}$ where the functions $\mu_{\tilde{P}}(u): U \rightarrow [0,\ 1], v_{\tilde{P}}(u): U \rightarrow [0, 1]$ and $0 \leq \mu_{\tilde{P}}^2(u) + v_{\tilde{P}}^2(u) \leq 1$ is the degree of membership, non-membership of u to P,

respectively. For any PFS $\tilde{A}$ and $u \in U, \pi_{\tilde{P}}(u) = \sqrt{1 - \mu_{\tilde{P}}^2(u) - v_{\tilde{P}}^2(u)}$ is called the degree of the hesitancy of *u* to $\tilde{P}$.

As seen from the above formula, a hesitancy degree is based on membership and non-membership degrees in the PFS. However, DM wants to define their hesitancy degrees like a third dimension as irrelevant from membership and non-membership degrees. It is not allowed to define hesitancy degree by the decision-maker in the PFS.

Picture Fuzzy Sets: Fundamentally, picture fuzzy set-based models may be adequate in situations when we face human opinions involving more answers of type: yes, abstain, no, and refusal. Voting can be an excellent example of such a situation as the human voters may be divided into four groups: abstain, vote against, and refusal of voting. A picture fuzzy set on a $\tilde{A}_s$ of the universe of discourse U is given by;

$\tilde{A}_s = \{\langle u, (\mu_{\tilde{A}_s}(u), v_{\tilde{A}_s}(u), \pi_{\tilde{A}_s}(u)) | u \in U\}$ where $\mu_{\tilde{A}_s}(u): U \to [0,1]$, $v_{\tilde{A}_s}(u)$: $U \to [0,1]$, $\pi_{\tilde{A}_s}(u): U \to [0,1]$ and $0 \leq \mu_{\tilde{A}_s}(u) + v_{\tilde{A}_s}(u) + \pi_{\tilde{A}_s}(u) \leq 1 \quad \forall u \in U$.

Then, $x = 1 - (\mu_{\tilde{A}_s}(u) + v_{\tilde{A}_s}(u) + \pi_{\tilde{A}_s}(u))$ could be called the degree of refusal membership of u in U (Cuong and Kreinovich, 2013).

q-Rung Orthopair Fuzzy Sets (q-ROFS): Yager (2016) proposed a general class of these sets called q-rung orthopedic fuzzy sets in which the sum of the qth power of the support against is bonded by one. They note that as q increases, the space of acceptable orthopedics increases and thus gives the user more freedom in expressing their belief about membership grade. The characteristic of q-ROFS is that it allows the sum to be greater than one but qth sum of membership degree and non-membership degrees to be less than one, providing more freedom for DMs, results in less information loss.

Let a set U be a universe of discourse. A q-rung orthopedic fuzzy set $\tilde{O}$ does an object have the form $\tilde{O} = \{\langle u, (\mu_{\tilde{O}}(u), v_{\tilde{O}}(u)) | u \in U\}$ where the function $\mu_{\tilde{O}}(u): U \to [0,1], v_{\tilde{O}}(u): U \to [0,1]$and $0 \leq \mu_{\tilde{O}}^q(u) + v_{\tilde{O}}^q(u) \leq 1$ is the degree of membership, non-membership of *u* to *P*, respectively. For any PFS $\tilde{A}$ and $u \in U$, $\pi_{\tilde{O}}(u) = \sqrt{1 - \mu_{\tilde{O}}^q(u) - v_{\tilde{O}}^q(u)}$ is called the degree of the hesitancy of *u* to $\tilde{O}$.

In the following section, we introduce the last extension of fuzzy sets that are spherical fuzzy sets (SFSs), which provide a larger preference domain for decision-makers.

Spherical Fuzzy Sets: In this section, the complete publications, including the word *spherical fuzzy* in their titles and abstract, are classified concerning their publication years, authors, the countries of the authors, and subject areas. The graphical illustrations enhance each classification type. Chart 3.2 illustrates the subject areas of the published fuzzy papers and their frequencies. Kutlu Gündouğdu and Kahraman (2018) introduced spherical fuzzy sets as an extension of picture fuzzy sets. The idea behind SFS is to let decision-makers generalize other extensions of fuzzy sets by defining a membership function on a spherical surface and independently assigning that membership function's parameters with a larger domain.

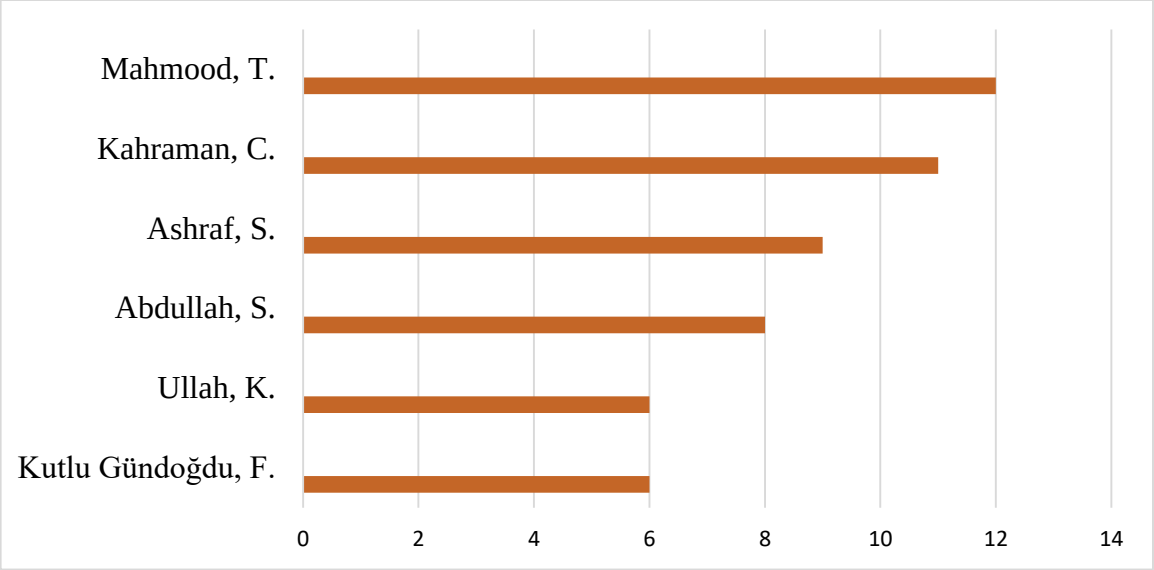


Chart 3. 1 Author publishing spherical fuzzy papers

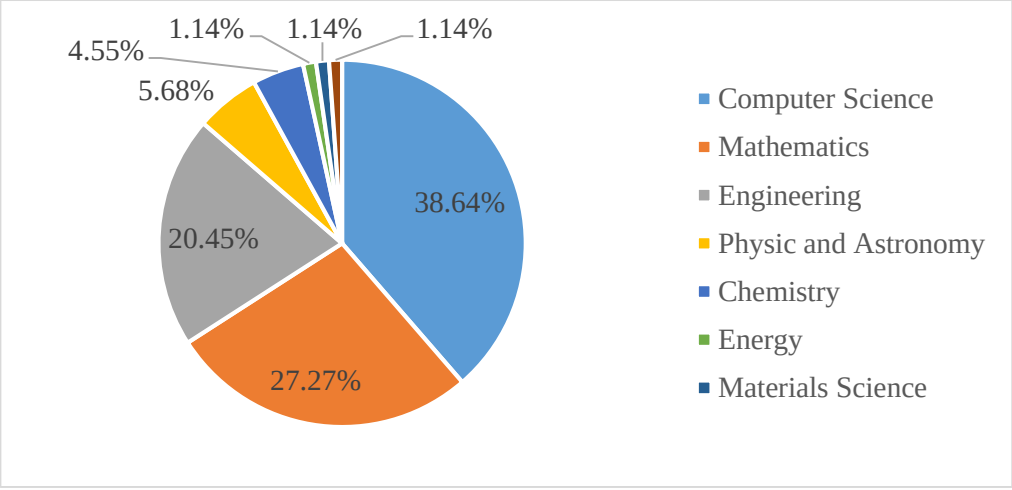


Chart 3. 2 Subject areas of spherical fuzzy sets

At the same time, Ashraf *et al.* (2019) defined spherical fuzzy sets as an extension of picture fuzzy sets. They defined some operational rules and aggregation operations based on

Archimedean t-norm and t-conorm. This study extended some valuable operations such as spherical fuzzy t'-norms and spherical fuzzy t'-conorms by Ashraf *et al.* (2019a). Ashraf *et al.* (2019b) developed spherical fuzzy Dombi weighted averaging, spherical fuzzy Dombi ordered weighted averaging, spherical fuzzy Dombi hybrid weighted averaging, spherical fuzzy Dombi weighted geometric (SFDWG), spherical fuzzy Dombi ordered weighted geometric, and spherical fuzzy Dombi hybrid weighted geometric aggregation operators and discussed several properties of these aggregation operators. These operators were used to get a successful solution to the decision problems. Ashraf *et al.* (2019c) described spherical fuzzy distance-weighted averaging, spherical fuzzy distance order-weighted averaging, and spherical fuzzy distance order-weighted average weighted averaging operators algorithm to help decision analysis. Rafiq *et al.* (2019) investigated the novel similarity measures between spherical fuzzy sets based on cosine function by considering the membership, hesitancy, non-membership and refusal grades in SFS.

Gündoğdu (2019a) summarized the previously introduced spherical fuzzy sets, and as an application spherical fuzzy TOPSIS method was applied to the site selection of photovoltaic power stations in this study. They also presented novel interval-valued spherical fuzzy sets, employed them to develop the extension of TOPSIS under fuzziness, and used it in solving a multiple criteria selection problem for 3D printers (Gündoğdu and Kahraman 2019b). Gündoğdu and Kahraman (2019c,d) introduced the spherical fuzzy analytic hierarchy process (SF-AHP), and they applied this method to industrial robot selection and renewable energy selection. Gündoğdu and Kahraman (2019e) extended the classical (VIKOR) method to the spherical fuzzy VIKOR (SF-VIKOR) method and to show its applicability; this method was applied to a warehouse location selection problem. They were also extended the traditional WASPAS method to the spherical fuzzy WASPAS (SF-WASPAS) method and showed its application with an industrial robot selection problem Gündoğdu and Kahraman (2019f). Gündoğdu (2019b) also proposed some decision-making methods under a spherical fuzzy environment like MULTIMOORA, and they applied this method to the personnel selection problem.

Boltürk (2019) applied spherical fuzzy TOPSIS and neutrosophic TOPSIS methods and compared the results of each other. The methods are applied to an Automated Storage and Retrieval Systems technology selection problem. Gündoğdu and Kahraman (2020a,b) proposed the spherical fuzzy QFD (SF-QFD) method under certainty and uncertainty, including linguistic assessment. Gündoğdu and Kahraman (2020a,b) summarized the

spherical fuzzy sets and used the spherical fuzzy CODAS method in the hospital location selection problem.

Jin *et al.* (2019a) proposed a linguistic spherical fuzzy set (LSFS), combining fuzzy linguistic sets and spherical fuzzy sets. They also developed linguistic spherical fuzzy weighted averaging and geometric operators. For validity, proposed aggregation operators of the linguistic spherical fuzzy number were applied to multi-attribute group decision-making problems. Zeng *et al.* (2019) adopted a new covering-based spherical fuzzy rough set (CSFRS) models to hybrid spherical fuzzy sets with notions of covering the rough set and presented the TOPSIS approach through CSFRS models. Jin *et al.* (2019b) introduced some novel logarithmic operations of spherical fuzzy sets and proposed the spherical fuzzy entropy to find the unknown weights information of the criteria. Ullah *et al.* (2018) proposed some new similarity measures in the framework of spherical fuzzy sets and T-spherical fuzzy sets, including cosine similarity measures, gray similarity measures, and set-theoretical similarity measures. The new similarity measures were applied to a well-known problem of building material recognition. Garg *et al.* (2018) improved interactive aggregation operators for the T-spherical fuzzy sets and applied them to multi-attribute decision-making problems.

Mahmood *et al.* (2019) introduced the concept of spherical fuzzy set (SFS) and T-spherical fuzzy set (T-SFS) as a generalization of picture fuzzy sets. In this study, the novelty of SFS and T-SFS is shown by examples and graphical comparison with earlier established concepts. Some operations of SFSs and T-SFSs, along with fuzzy spherical relations, were defined, and medical diagnostics and decision-making problems were discussed in the environment of SFS and T-SFS as practical applications.

Some basic notions over a universal set *U* are defined as follows: Let q be a positive actual number, a T-spherical fuzzy set (SFS) $\tilde{A}_s$ of the universe of discourse U, is given by;

$$\tilde{A}_s = \{\langle u, (\mu_{\tilde{A}_s}(u), v_{\tilde{A}_s}(u), \pi_{\tilde{A}_s}(u)) | u \in U\} \qquad (6)$$

where

$$\mu_{\tilde{A}_s}(u): U \to [0,1], \qquad v_{\tilde{A}_s}(u): U \to [0,1], \quad \pi_{\tilde{A}_s}(u): U \to [0,1]$$

and

$$0 \leq \mu^q_{\tilde{A}_s}(u) + v^q_{\tilde{A}_s}(u) + \pi^q_{\tilde{A}_s}(u) \leq 1 \quad \forall u \in U \qquad (7)$$

For each *u*, the numbers $\mu_{\tilde{A}_s}(u), v_{\tilde{A}_s}(u)$ and $\pi_{\tilde{A}_s}(u)$ are the degree of *membership*, *non-membership* and *hesitancy* of *u* to $\tilde{A}_s$, respectively.

$x_{\tilde{A}_s}(u) = \sqrt{1 - \mu_{\tilde{A}_s}^q(u) - v_{\tilde{A}_s}^q(u) - \pi_{\tilde{A}_s}^q(u)}$ is called a refusal degree.

Liu *et al.* (2019b) extended the generalized Maclaurin symmetric mean (GMSM) operator to the T-spherical fuzzy environment. They proposed the T-spherical fuzzy GMSM operator (T-SFGMSM) and the T-spherical fuzzy weighted GMSM operator (T-SFWGMSM). They successfully solved an R&D project selection problem for Yunnan Baiyao Co., Ltd. by the proposed method. Quek *et al.* (2019) developed some new operational laws for T-spherical fuzzy sets. Based on these new operations, proposed two types of Einstein aggregation operators, namely the Einstein interactive averaging aggregation operators and the Einstein interactive geometric aggregation operators under T-spherical fuzzy environment. The T-spherical fuzzy aggregation operators were then applied to multi-attribute decision-making (MADM) problems related to the degree of pollution of five major cities in China. Liu *et al.* (2020) proposed the linguistic spherical fuzzy numbers (Lt-SFNs) to suggest the public's knowledge of language valuation. They proposed the linguistic spherical fuzzy weighted averaging (Lt-SFSWA) operator for integrating the language assessment knowledge. They also improved the TODIM method and a MABAC method based on Lt-SFNs. Ullah *et al.* (2019a) developed some correlation coefficients for T-spherical fuzzy sets and used these sets for clustering and multi-attribute decision-making algorithms. Ullah *et al.* (2019b) enhanced T-spherical fuzzy sets to interval-valued T-spherical fuzzy sets with aggregation operators. In this study, the advantages of using the framework of interval-valued T-spherical fuzzy were described theoretically and numerically. Liu *et al.* (2019a) proposed Muirhead mean (MM) operator and power average operator, the spherical fuzzy power Muirhead mean (SFPMM) operator, weighted SFPMM operator, spherical fuzzy power dual Muirhead mean (SFPDMM) operator, weighted SFPDMM operator and discussed their anticipated properties under T-spherical fuzzy environment. Guleria and Bajaj (2020) introduced the concept of a T-spherical fuzzy graph along with the operations of product, composition, union, join, and complement. They applied T-spherical fuzzy graphs to solve the decision-making problems in supply chain management and evaluation problems of service centers.

3.2.2 Proposed method of spherical fuzzy analytic hierarchy process

Kutlu and Kahraman (2019) have recently introduced spherical fuzzy sets (SFS). These sets are based on the fact that the hesitancy of a decision-maker can be defined

independently from membership and non-membership degrees, satisfying the following condition:

$$0 \leq \mu_{\tilde{A}}^2(u) + v_{\tilde{A}}^2(u) + \pi_{\tilde{A}}^2(u) \leq 1 \qquad \forall u \in U \qquad (1)$$

where $\mu_{\tilde{A}}(u), v_{\tilde{A}}(u)$ and $\pi_{\tilde{A}}(u)$ are the degrees of membership, non-membership, and hesitancy of u to $\tilde{A}$ For each u, respectively. On the surface of the sphere, Eq. (1) becomes**:**

$$\mu_{\tilde{A}}^2(u) + v_{\tilde{A}}^2(u) + \pi_{\tilde{A}}^2(u) = 1 \qquad \forall u \in U \qquad (2)$$

Definition 1 (Spherical fuzzy sets (SFS) $\tilde{A}_S$) Let U_1 and U_2 be two universes. Let two spherical fuzzy sets $\tilde{A}_S$ and $\tilde{B}_S$ of the universe of discourse U_1 and U_2be as follows:

$$\tilde{A}_S = \{x, (\mu_{\tilde{A}_S}(x), v_{\tilde{A}_S}(x), \pi_{\tilde{A}_S}(x)) \mid x \in U_1\} \qquad (3)$$

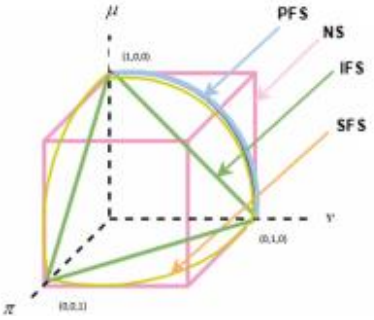


Figure 3. 2 Geometric representations of IFS, PFS, NS and SFS

where

$$\mu_{\tilde{A}_S}(x): U_1 \to [0;1],\ v_{\tilde{A}_S}(x): U_1 \to [0;1],\ \pi_{\tilde{A}_S}(x): U_1 \to [0;1]$$

and

$$0 \leq \mu_{\tilde{A}_S}^2(x) + v_{\tilde{A}_S}^2(x) + \pi_{\tilde{A}_S}^2(x) \leq 1 \qquad \forall u \in U_1 \qquad (4)$$

For each x, the $\mu_{\tilde{A}}(x), v_{\tilde{A}}(x)$ and $\pi_{\tilde{A}}(x)$are the degrees of membership, non-membership, and hesitancy of x to $\tilde{A}_S$, respectively.

$$\tilde{B}_S = \{y, (\mu_{\tilde{B}_S}(y), v_{\tilde{B}_S}(y), \pi_{\tilde{B}_S}(y)) \mid y \in U_2\} \qquad (5)$$

where

$$\mu_{\tilde{B}_S}(y): U_2 \to [0;1],\ v_{\tilde{B}_S}(y): U_2 \to [0;1],\ \pi_{\tilde{B}_S}(y): U_2 \to [0;1]$$

and

$$0 \leq \mu_{\tilde{B}_S}^2(y) + v_{\tilde{B}_S}^2(y) + \pi_{\tilde{B}_S}^2(y) \leq 1 \qquad \forall u \in U_2 \qquad (6)$$

For each *y*, the numbers $\mu_{\tilde{B}_S}(y), v_{\tilde{B}_S}(y)$ and $\pi_{\tilde{B}_S}(y)$ are the degrees of membership, non-membership, and hesitancy of *y* to $\tilde{B}_S$, respectively (Gündouğdu and Kahraman, 2019).

Zadeh's extension principle extends the classical arithmetic operations to their fuzzy correspondings. In the following, we defined the extension principle for single-valued spherical fuzzy sets.

Proposition 1 *The following Cartesian product of SFS is considered:*

$$\tilde{A}_S \times 2\tilde{B}_S = \{((x, y), min\,(\mu_{\tilde{A}_S}(x), \mu_{\tilde{B}_S}(y)), \\ Max\,(v_{\tilde{A}_S}(x), v_{\tilde{B}_S}(y)), min\,(\pi_{\tilde{A}_S}(x), \pi_{\tilde{B}_S}(y)) \mid x \in U_1, y \in U_2\} \quad (7)$$

Let for $i = 1, \ldots, n$, Ui be a universe and $\tilde{A}_i = \{(x, (\mu_{\tilde{A}_i}(x), v_{\tilde{A}_i}(x), \pi_{\tilde{A}_i}(x)) \mid x \in U_i$ Be an SFS. Then, Cartesian product of SFS:

$\widetilde{B}_s^n = X_{i=1}^n \tilde{A}_{si} = \{((x_{1,} x_{2,} \ldots x_n),\ \min_{i=1} \mu_{\tilde{A}_{Si}}(x_i),\ \max_{i=1} v_{\tilde{A}_{Si}}(x_i),\ \min_{i=1} \pi_{\tilde{A}_{Si}}(x_i)) \mid \forall x_i \in U_i, i=1, \ldots\ldots, n\}$ is a SFS on is $X_{i=1}^n U_i$.

Proof *We prove by inductive reasoning. For n = 2, the result is given in Eq. (5). By inductive reasoning,* $B^{n-1} = X_{i-1}^{n-1} A_i$ *is an SFS on* $X_{i-1}^{n-1} U_i$ *And hence,* $B^n = B^{n-1} \times 2\tilde{A}_n = X_{i-1}^{n-1} A_i$ *is an SFS on* $X_{i-1}^{n-1} U_i$.

Proposition 2 *Zadeh's Extension Principle for SFS. Let for i = 1, . . ., n,* U_i *be a universe and let V =* $\emptyset$*. Let f:* $X_{i-1}^{n-1} U_i \rightarrow V$ *be a mapping, where y = f (*$z_1, \ldots, z_n$*. Let* z_i *be a linguistic variable on* U_i *for i = 1, . . ., n. Assume that for all i,* $\tilde{A}_{Si}$ *is an SFS on* U_i *And then, the output of mapping f is* $\tilde{B}_S$*. For y ∈ V, the set* $\widetilde{B}_S$ *is an SFS on V defined as follows:*

$\tilde{B}_s(y) = \{(\max_{\boldsymbol{Z(y)}}(\min_{\boldsymbol{i=1}}^{\boldsymbol{n}} \mu_{\tilde{A}_{Si}}(u_i)), \min_{\boldsymbol{Z(y)}}(\max_{\boldsymbol{i=1}}^{\boldsymbol{n}} v_{\tilde{A}_{Si}}(u_i)), min_{\boldsymbol{Z(y)}}(\min_{\boldsymbol{i=1}}^{\boldsymbol{n}} \pi_{\tilde{A}_{Si}}(u_i)) \mid \forall u_i \in U_i, i=1, \ldots, n\}, if\ f^{-1}(y) \neq \emptyset\ where\ Z(y) = f^{-1}(y)$.

For the addition and multiplication operators

$$\tilde{A}_S \oplus \tilde{B}_S \\ = \{z, (\max_{z=x+y} \min\{\mu_{\tilde{A}_S}(x), \mu_{\tilde{B}_S}(y)\}), (\min_{z=x+y} max\,\{v_{\tilde{A}_S}(x), v_{\tilde{B}_S}(y)\}), \\ (\min_{z=x+y} min\{\pi_{\tilde{A}_S}(x), \pi_{\tilde{B}_S}(y)\})\} \quad (8)$$

$$\tilde{A}_S \otimes \tilde{B}_S \\ = \{z, (\max_{z=x*y} min\,\{\mu_{\tilde{A}_S}(x), \mu_{\tilde{B}_S}(y)\}), (\min_{z=x*y} max\,\{v_{\tilde{A}_S}(x), v_{\tilde{B}_S}(y)\}), \\ (\min_{z=x*y} min\{\pi_{\tilde{A}_S}(x), \pi_{\tilde{B}_S}(y)\})\} \quad (9)$$

Based on the relationship between SFS and PFS, (Kutlu Gündouğdu and Kahraman, 2019) further define some novel operations for SFS as below:

Definition 2 Basic operators (Kutlu Gündouğdu and Kahraman, 2019) Union

$$\tilde{A}_S \cup \tilde{B}_S = \{max\,\{\mu_{\tilde{A}_S}, \mu_{\tilde{B}_S}\}, min\,\{v_{\tilde{A}_S}, v_{\tilde{B}_S}\}, \quad (10)$$

$$\min \{(1- ((max\{\mu_{\tilde{A}_S}, \mu_{\tilde{B}_S}\})^2 + (min\{v_{\tilde{A}_S}, v_{\tilde{B}_S}\})^2))^{1/2}, max\{\pi_{\tilde{A}_S}, \pi_{\tilde{B}_S}\}\}$$

Intersection

$$\tilde{A}_S \cap \tilde{B}_S = \{min\{\mu_{\tilde{A}_S}, \mu_{\tilde{B}_S}\}, max\{v_{\tilde{A}_S}, v_{\tilde{B}_S}\}, \max\{(1- ((min\{\mu_{\tilde{A}_S}, \mu_{\tilde{B}_S}\})^2 + (max\{v_{\tilde{A}_S}, v_{\tilde{B}_S}\})^2))^{1/2}, min\{\pi_{\tilde{A}_S}, \pi_{\tilde{B}_S}\}\}\} \quad (11)$$

Addition

$$\tilde{A}_S \oplus \tilde{B}_S = \{(\mu_{\tilde{A}_S}^2 + \mu_{\tilde{B}_S}^2 - \mu_{\tilde{A}_S}^2\mu_{\tilde{B}_S}^2)^{1/2}, v_{\tilde{A}_S}v_{\tilde{B}_S}, ((1-\mu_{\tilde{B}_S}^2)\pi_{\tilde{B}_S}^2 + (1-\mu_{\tilde{B}_S}^2)\pi_{\tilde{B}_S}^2 - \pi_{\tilde{A}_S}^2\pi_{\tilde{B}_S}^2)^{1/2}\} \quad (12)$$

Multiplication

$$\tilde{A}_S \otimes \tilde{B}_S = \{\mu_{\tilde{A}_S}^2\mu_{\tilde{B}_S}^2(v_{\tilde{A}_S}^2 + v_{\tilde{B}_S}^2 - v_{\tilde{A}_S}^2v_{\tilde{B}_S}^2)^{1/2}, ((1-v_{\tilde{B}_S}^2)\pi_{\tilde{A}_S}^2 + (1-v_{\tilde{A}_S}^2)\pi_{\tilde{B}_S}^2 - \pi_{\tilde{A}_S}^2\pi_{\tilde{B}_S}^2)^{1/2}\} \quad (13)$$

Multiplication by a scalar; $\lambda > 0$

$$\lambda . \tilde{A}_S = \{(1 - (1-\mu_{\tilde{A}_S}^2)^{\lambda})^{1/2}, v_{\tilde{A}_S}^{\lambda}, ((1-\mu_{\tilde{A}_S}^2)^{\lambda} - (1-\mu_{\tilde{A}_S}^2 - \pi_{\tilde{A}_S}^2)^{\lambda})^{1/2}\} \quad (14)$$

Power of $\tilde{A}_S$; $\lambda > 0$

$$\tilde{A}_S^{\lambda} = \{\mu_{\tilde{A}_S}^{\lambda}, (1-(1-v_{\tilde{A}_S}^2)^{\lambda})^{1/2}, ((1-v_{\tilde{A}_S}^2)^{\lambda} - (1-v_{\tilde{A}_S}^2 - \pi_{\tilde{A}_S}^2)^{\lambda})^{1/2}\} \quad (15)$$

Definition 3 For these SFS $\tilde{A}_S = (\mu_{\tilde{A}_S}, v_{\tilde{A}_S}, \pi_{\tilde{A}_S})$ and $\tilde{B}_S = (\mu_{\tilde{B}_S}, v_{\tilde{B}_S}, \pi_{\tilde{B}_S})$ the followings are valid under the condition $\lambda, \lambda_1, \lambda_2 > 0$ (Gündouğdu and Kahraman, 2019)

i. $\widetilde{A}_S \oplus \widetilde{B}_S = \widetilde{B}_S \oplus \widetilde{A}_S$ (16)

ii. $\widetilde{A}_S \otimes \widetilde{B}_S = \widetilde{B}_S \otimes \widetilde{A}_S$ (17)

iii. $\lambda(\widetilde{A}_S \oplus \widetilde{B}_S) = \lambda\widetilde{A}_S \oplus \widetilde{\lambda B}_S$ (18)

iv. $\lambda_1\widetilde{A}_S \oplus \lambda_2\widetilde{A}_S = (\lambda_1 + \lambda_2)\widetilde{A}_S$ (19)

v. $(\widetilde{A}_S \otimes \widetilde{B}_S)^{\lambda} = \widetilde{A}_S^{\lambda} \otimes \widetilde{B}_S^{\lambda}$ (20)

vi. $\widetilde{A}_S^{\lambda_1} \otimes \widetilde{A}_S^{\lambda_2} = \widetilde{A}_S^{\lambda_1+\lambda_2}$ (21)

Definition 4 Spherical weighted arithmetic mean (SWAM) concerning, $w=(w_1, w_2 \ldots, w_n)$; $w_i \in [0;1]$; $\sum_{i=1}^{n} w_i = 1$ SWAM is defined as:

$$SWAM_w(\tilde{A}_{S1}, \ldots, \tilde{A}_{Sn}) = w_1\tilde{A}_{S1} + w_2\tilde{A}_{S2} + w_n\tilde{A}_{Sn} = \{[1 - \prod_{i=1}^{n}(1-\mu_{\tilde{A}_{Si}}^2)^{w_i}]^{1/2}, \prod_{i=1}^{n} v_{\tilde{A}_{Si}}^{w_i}, [\prod_{i=1}^{n}(1-\mu_{\tilde{A}_{Si}}^2)^{w_i} - \prod_{i=1}^{n}(1-\mu_{\tilde{A}_{Si}}^2 - \pi_{\tilde{A}_{Si}}^2)^{w_i}]^{1/2}\} \quad (22)$$

Definition 5 Spherical weighted geometric mean (SWGM) concerning, $w=(w_1, w_2 \ldots, w_n)$; $w_i \in [0; 1]$; $\sum_{i=1}^{n} w_i = 1$, SWGM is defined as:

$$SWGM_w(\tilde{A}_{S1}, \ldots, \ddot{A}_{Sn}) = \tilde{A}_{S1}^{w_1} + \tilde{A}_{S2}^{w_2} + \ldots + \tilde{A}_{Sn}^{w_n}$$
$$= \{\prod_{i=1}^{n} \mu_{\tilde{A}_{Si}}^{w_i}, \quad [1 - \prod_{i=1}^{n}(1 - v_{\tilde{A}_{Si}}^2)^{w_i}]^{1/2}, \quad [\prod_{i=1}^{n}(1 - v_{\tilde{A}_{Si}}^2)^{w_i} - \prod_{i=1}^{n}(1 - v_{\tilde{A}_{Si}}^2 - \pi_{\tilde{A}_{Si}}^2)^{w_i}]^{1/2}\} \quad (23)$$

The proposed spherical fuzzy AHP method is composed of several steps, as given in this section. Before giving these steps, we present the flowchart of the SF-AHP method in Figure 3.1 in order to make it easily understandable.

Step 1 Construct the hierarchical structure.

A hierarchical structure consisting of at least three levels is developed (Fig. 7). Based on the score index, level 1 represents a goal or an objective (selecting the best alternative). The scoring index is estimated based on a finite set of criteria $C = \{C_1, C_2, \ldots C_n\}$, which are shown at Level 2. There are many sub-criteria defined for any criterion C in this hierarchical structure. Therefore, at Level 3, a discrete set of *m* feasible alternative X = $\{x_{1,}x_{2,}\ldots x_m\}$ ($m \geq 2$) is defined.

Step 2 Constitute pairwise comparisons using spherical fuzzy judgment matrices based on the linguistic terms given in Table 3.1.

Equations (24) and (25) are used to obtain the score indices (SI) in Table 3.1.

	(μ, v, π)	Score Index (SI)
Absolutely more Importance (AMI)	(0.9, 0.1, 0.0)	9
Very High Importance (VHI)	(0.8, 0.2, 0.1)	7
High Importance (HI)	(0.7, 0.3, 0.2)	5
Slightly More Importance (SMI)	(0.6, 0.4, 0.3)	3
Equally Importance (EI)	(0.5, 0.4, 0.4)	1
Slightly Low Importance (SLI)	(0.4, 0.6, 0.3)	1/3
Low Importance (LI)	(0.3, 0.7, 0.2)	1/5
Very Low Importance (VLI)	(0.2, 0.8, 0.1)	1/7
Absolutely Low Importance (ALI)	(0.1, 0.9, 0.0)	1/9

Table 3. 1 Linguistic measure of importance used for pairwise comparisons

$$\text{SI} = \sqrt{|\ 100 * \ [(\mu_{\bar{A}_S} - \pi_{\bar{A}_S})^2 - (v_{\bar{A}_S} - \pi_{\bar{A}_S})^2]} \quad (24)$$

for AMI, VHI, HI, SMI, and EI

$$\frac{1}{SI} = \frac{1}{\text{SI} = \sqrt{|\ 100 * \ [(\mu_{\bar{A}_S} - \pi_{\bar{A}_S})^2 - (v_{\bar{A}_S} - \pi_{\bar{A}_S})^2]|}} \quad (25)$$

for EI; SLI; LI; VLI; and ALI.

Step 3 Check for the consistency of each pairwise comparison matrix (*J*). To do that, convert the linguistic terms in the pairwise comparison matrix to their corresponding score indices. Then, apply the classical consistency check. The threshold of the CR is 10%. For instance, the pairwise comparison matrix $J=\begin{matrix} C_1 \\ C_2 \\ C_3 \end{matrix}\begin{vmatrix} EI & SLI & SMI \\ SMI & EI & HI \\ SLI & LI & EI \end{vmatrix}$ is converted to $J=\begin{matrix} C_1 \\ C_2 \\ C_3 \end{matrix}\begin{vmatrix} 1 & 1/3 & 3 \\ 3 & 1 & 5 \\ 1/3 & 1/5 & 1 \end{vmatrix}$ Moreover, the consistency ratio is calculated using the classical way and found to be 0.03457, which indicates that the pairwise comparison matrix is consistent.

Step 4 Calculate the spherical fuzzy local weights of criteria and alternatives.

Determine the weight of each alternative using SWAM operator is given in Eq. (26) concerning each criterion. The weighted arithmetic mean is used to compute the spherical fuzzy weights.

$$SWAM_w(\tilde{A}_{S1}, \dots, \tilde{A}_{Sn}) = w_1 A_{S1} + w_2 A_{S2} + \dots + w_n A_{Sn}$$
$$= \langle \left[1 - \prod_{i=1}^{n}(1 - \mu_{A_{Si}}^2)^{w_i}\right]^{1/2}, \prod_{i=1}^{n} v_{A_{Si}}^{w_i}, \left[\prod_{i=1}^{n}(1 - \mu_{A_{Si}}^2)^{w_i} - \prod_{i=1}^{n}(1 - \mu_{A_{Si}}^2 - \pi_{A_{Si}}^2)^{w_i}\right]^{1/2} \rangle \quad (26)$$

where $w = 1/n$

Step 5 Establish the hierarchical layer sequencing to obtain global weights.

The spherical fuzzy weights at each level are aggregated to estimate final ranking orders for the alternatives—this computation from bottom level (alternatives) to top-level (goal), as Chart 3.1.

At this point, there are two possible ways to follow. The first one is to denazify the criteria weights by using the score function (*S*) in Eq. (27) and then normalize them by Eq. (28).

$$S(\widetilde{w}_j^s) = \sqrt{\left|100 * \left[\left(3\mu_{\bar{A}_s} - \frac{\pi_{\bar{A}_s}}{2}\right)^2 - \left(\frac{v_{\bar{A}_s}}{2} - \pi_{\bar{A}_s}\right)^2\right]\right|} \quad (27)$$

Normalize the criteria weights by using Eq. (28).

$$\overline{w}_j^s = \frac{S(\widetilde{w}_j^s)}{\sum_{J=1}^{n} S(\widetilde{w}_j^s)} \quad (28)$$

CHAPTER 4: EMPIRICAL CASE ANALYST

4.1. Case study

SF-AHP, which Kutlu and Kahraman first introduced, is utilized (Figure 4.2). The reason for selecting SF-AHP is that in spherical fuzzy sets (SFS), the decision-makers can characterize all the parameters in a larger space. That increases the strength of the methodology against the uncertainties. Therefore, the SF-AHP model is deployed to analyze factors affecting the entrepreneurial intention, in which 13 factors as Perceived Desirability of Self-employment, Personal Attitude, Social Norms, etc., are proposed, thereby offering some suitable methods and solutions to support schools build entrepreneurship education programs.

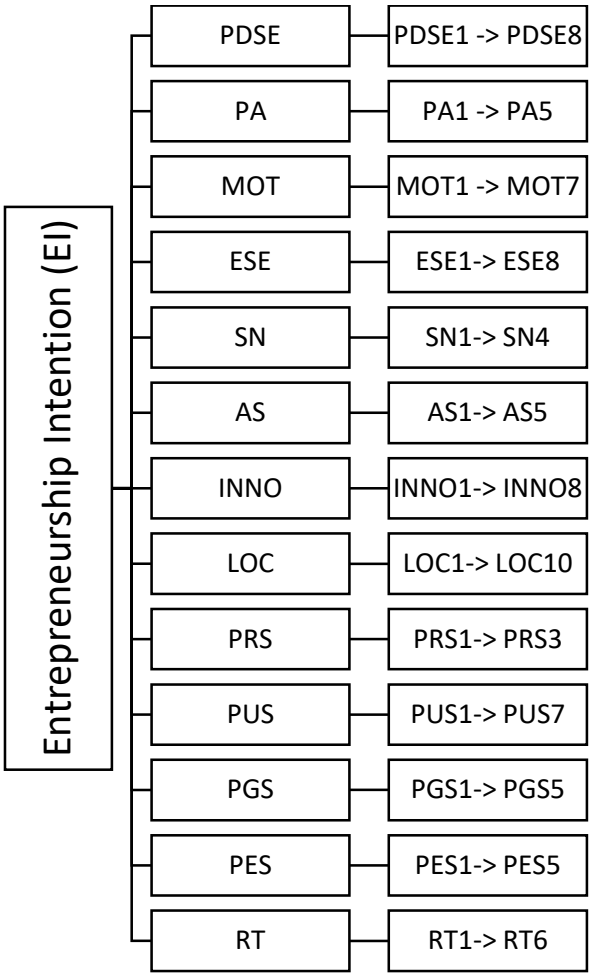


Figure 4. 1 The hierarchical structure of the criteria set.

This study assessed the factors impacting FPT University students' entrepreneurial intentions. The survey was performed between May and June 2021. In this real-life case

study, there are ten experts, including FPT University's Alumni, FPT University's Lecturer, Director Center for Quantitative Research. The hierarchical spherical fuzzy analysis was also analyzed to assess aggregated data from 13 main criteria and 81 sub-criteria. Figure 4.1 illustrates this hierarchy which consists of all criteria and sub-criteria are related to them.

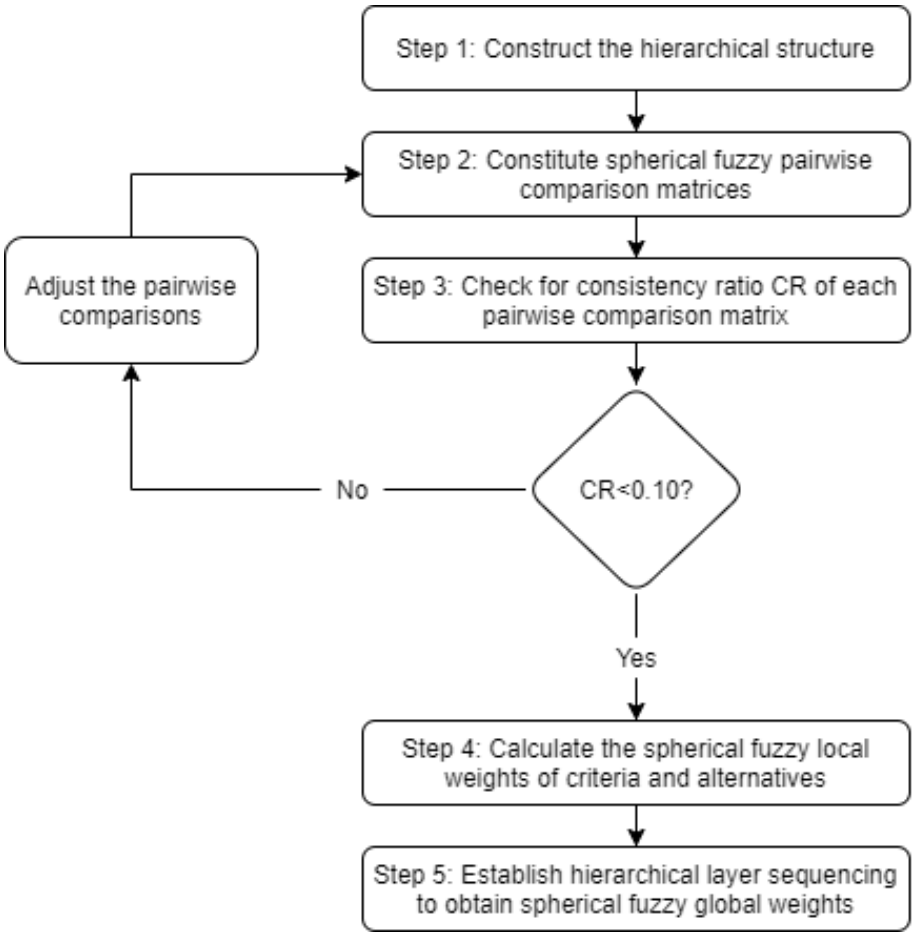


Figure 4. 2 Flowchart of proposed SF-AHP method

4.2 Results Spherical Fuzzy AHP

4.2.1 Main Criteria

The questionnaires are sent to ten experts who have deep experience in the business world as a first step. Regarding the purpose of the study, the significance of the criteria and the questionnaire structure are explained in depth. The consistency ratios of the pairwise comparison matrices are calculated based on the corresponding numerical values in the classical AHP method for the linguistic scale given in Table 3.1. Pairwise comparisons and the obtained spherical weights $S(\widetilde{w}^s)$ and crisp weights $(\widetilde{w}^s)$ of main criteria are given in Tables 4.3 together with their consistency ratios (CR).

	Left Criteria Is Greater					Right Criteria Is Greater					Number of Experts
	9	7	5	3	1	1/3	1/5	1/7	1/9		
	AMI	**VHI**	**HI**	**SMI**	**EI**	**SLI**	**LI**	**VLI**	**ALI**		
PDSE				3	4	3				**PA**	**10**
PDSE				2	2	5	1			**MOT**	**10**
PDSE			1	3	3	2	1			**ESE**	**10**
PDSE					4	3	3			**SN**	**10**
PDSE				1	5	3	1			**AS**	**10**
PDSE				3	3	2	1	1		**INNO**	**10**
PDSE					3	4	2	1		**LOC**	**10**
PDSE			1	2	3	4				**PRS**	**10**
PDSE					4	3	2	1		**PUS**	**10**
PDSE				3	2	2	2	1		**PGS**	**10**
PDSE			1	2	3	3	1			**PES**	**10**
PDSE			1	3	2	3	1			**RT**	**10**
PA					1	3	3	3		**MOT**	**10**
PA				1	4	4	1			**ESE**	**10**
PA					3	4	2	1		**SN**	**10**
PA			1	2	4	2	1			**AS**	**10**
PA					4	5	1			**INNO**	**10**
PA					3	4	2	1		**LOC**	**10**
PA			1	1	4	2	2			**PRS**	**10**
PA				1	3	2	2	2		**PUS**	**10**
PA				1	4	3	2			**PGS**	**10**
PA				3	2	2	3			**PES**	**10**
PA				2	3	3	2			**RT**	**10**
MOT				3	4	2	1			**ESE**	**10**
MOT				2	4	3	1			**SN**	**10**
MOT			2	3	3	2				**AS**	**10**
MOT				2	6	2				**INNO**	**10**
MOT			2	2	2	4				**LOC**	**10**
MOT		1	2	2	3	2				**PRS**	**10**
MOT				5	2	2	1			**PUS**	**10**
MOT				2	5	3				**PGS**	**10**
MOT			1	2	4	2	1			**PES**	**10**
MOT				2	5	2	1			**RT**	**10**
ESE					5	3	2			**SN**	**10**
ESE			1	2	6	1				**AS**	**10**
ESE				3	5	2				**INNO**	**10**
ESE					1	3	5	1		**LOC**	**10**
ESE			3	3	3	1				**PRS**	**10**
ESE			1	2	5	2				**PUS**	**10**

ESE				3	4	3				**PGS**	**10**
ESE		2	4	2	1	1				**PES**	**10**
ESE					4	3	3			**RT**	**10**
SN	1	3	3	2	1					**AS**	**10**
SN			2	2	2	2	2			**INNO**	**10**
SN				1	7	2				**LOC**	**10**
SN				2	6	2				**PRS**	**10**
SN					5	4	1			**PUS**	**10**
SN				2	5	2	1			**PGS**	**10**
SN			1	3	2	3	1			**PES**	**10**
SN					2	4	4			**RT**	**10**
AS		1	1	1	3	3	1			**INNO**	**10**
AS					2	3	4	1		**LOC**	**10**
AS			1	2	6	1				**PRS**	**10**
AS				3	4	2	1			**PUS**	**10**
AS				2	6	1	1			**PGS**	**10**
AS					3	5	1	1		**PES**	**10**
AS			1	2	2	4	1			**RT**	**10**
INNO		1	3	3	2	1				**LOC**	**10**
INNO			1	2	5	1	1			**PRS**	**10**
INNO			3	3	2	2				**PUS**	**10**
INNO				2	3	3	2			**PGS**	**10**
INNO				1	4	4	1			**PES**	**10**
INNO			1	2	5	2				**RT**	**10**
LOC		1	1	2	4	2				**PRS**	**10**
LOC					2	4	3	1		**PUS**	**10**
LOC			1	1	5	2	1			**PGS**	**10**
LOC			1	2	5	2				**PES**	**10**
LOC		1	2	4	2	1				**RT**	**10**
PRS				1	3	3	2	1		**PUS**	**10**
PRS				1	3	4	2			**PGS**	**10**
PRS				2	2	4	2			**PES**	**10**
PRS		1	1	1	4	2	1			**RT**	**10**
PUS		3	3	2	1	1				**PGS**	**10**
PUS			1	2	5	2				**PES**	**10**
PUS		1	1	2	5	1				**RT**	**10**
PGS				2	4	3	1			**PES**	**10**
PGS			3	3	2	1	1			**RT**	**10**
PES	1	1	1	1	5	1				**RT**	**10**

Table 4. 1 Initial Comparison Matrices main criteria

	PDSE			PA			MOT			ESE			SN			AS			INNO			LOC			PRS			PUS			PGS			PES			RT		
PDSE	0.500	0.400	0.400	0.494	0.475	0.342	0.441	0.550	0.311	0.496	0.487	0.316	0.401	0.577	0.309	0.453	0.513	0.340	0.438	0.552	0.300	0.377	0.611	0.289	0.491	0.490	0.326	0.385	0.597	0.299	0.416	0.582	0.280	0.477	0.508	0.316	0.485	0.508	0.306
PA	0.452	0.510	0.345	0.500	0.400	0.400	0.305	0.695	0.221	0.443	0.532	0.330	0.377	0.611	0.289	0.487	0.487	0.326	0.425	0.550	0.329	0.377	0.611	0.289	0.455	0.524	0.315	0.366	0.626	0.269	0.430	0.547	0.320	0.433	0.561	0.290	0.438	0.547	0.310
MOT	0.518	0.465	0.319	0.658	0.338	0.500	0.500	0.400	0.400	0.480	0.493	0.332	0.430	0.547	0.320	0.540	0.438	0.321	0.496	0.452	0.362	0.507	0.484	0.310	0.556	0.425	0.312	0.498	0.493	0.312	0.485	0.475	0.351	0.487	0.487	0.326	0.471	0.493	0.341
ESE	0.446	0.531	0.319	0.498	0.461	0.396	0.459	0.504	0.340	0.500	0.400	0.400	0.422	0.547	0.329	0.524	0.419	0.358	0.505	0.452	0.353	0.331	0.668	0.241	0.571	0.403	0.315	0.513	0.445	0.347	0.494	0.475	0.342	0.637	0.365	0.257	0.401	0.577	0.309
SN	0.534	0.422	0.332	0.564	0.405	0.120	0.478	0.483	0.341	0.505	0.440	0.348	0.500	0.400	0.400	0.700	0.299	0.231	0.479	0.518	0.288	0.487	0.452	0.371	0.496	0.452	0.362	0.435	0.532	0.339	0.471	0.493	0.341	0.485	0.508	0.306	0.373	0.619	0.280
AS	0.478	0.470	0.352	0.446	0.520	0.242	0.410	0.568	0.313	0.405	0.541	0.353	0.259	0.740	0.194	0.500	0.400	0.400	0.491	0.498	0.307	0.348	0.646	0.260	0.524	0.419	0.358	0.480	0.493	0.332	0.482	0.472	0.351	0.388	0.599	0.299	0.466	0.527	0.305
INNO	0.4	0.4	0.3	0.5	0.4	0.2	0.4	0.5	0.3	0.4	0.5	0.3	0.4	0.5	0.2	0.4	0.5	0.2	0.5	0.4	0.4	0.5	0.3	0.2	0.4	0.4	0.3	0.5	0.4	0.3	0.4	0.5	0.3	0.4	0.5	0.3	0.5	0.4	0.3

	92	85	22	18	37	70	34	07	65	34	18	54	58	34	91	33	51	98	00	00	00	99	89	92	98	65	37	59	30	04	38	47	10	43	32	30	13	45	47
LOC	0.564	0.405	0.316	0.5644	0.4005	0.4655	0.444	0.544	0.303	0.640	0.352	0.262	0.434	0.495	0.375	0.606	0.375	0.287	0.357	0.633	0.272	0.5000	0.400	0.400	0.538	0.433	0.329	0.358	0.636	0.270	0.479	0.487	0.336	0.513	0.445	0.347	0.590	0.398	0.300
PRS	0.457	0.518	0.325	0.4715	0.495	0.252	0.382	0.601	0.293	0.382	0.596	0.303	0.434	0.507	0.365	0.405	0.541	0.353	0.428	0.528	0.340	0.393	0.579	0.313	0.5000	0.400	0.400	0.392	0.597	0.289	0.420	0.564	0.310	0.428	0.564	0.300	0.502	0.476	0.318
PUS	0.541	0.416	0.329	0.557	0.419	0.297	0.459	0.527	0.318	0.421	0.534	0.344	0.498	0.447	0.353	0.459	0.504	0.340	0.398	0.590	0.292	0.596	0.384	0.295	0.541	0.432	0.316	0.500	0.400	0.400	0.646	0.358	0.252	0.513	0.445	0.347	0.550	0.406	0.340
PGS	0.520	0.470	0.304	0.505	0.454	0.380	0.452	0.498	0.356	0.452	0.510	0.345	0.459	0.492	0.351	0.441	0.501	0.360	0.505	0.468	0.325	0.446	0.509	0.341	0.526	0.444	0.325	0.310	0.689	0.222	0.500	0.400	0.400	0.461	0.513	0.331	0.543	0.451	0.292
PES	0.464	0.512	0.319	0.513	0.474	0.211	0.446	0.520	0.330	0.323	0.675	0.232	0.464	0.524	0.308	0.555	0.413	0.323	0.498	0.461	0.342	0.421	0.534	0.344	0.526	0.458	0.313	0.421	0.534	0.344	0.478	0.483	0.341	0.500	0.400	0.400	0.572	0.389	0.330
RT	0.464	0.524	0.308	0.505	0.468	0.318	0.459	0.492	0.351	0.534	0.422	0.332	0.588	0.390	0.299	0.483	0.504	0.308	0.421	0.534	0.344	0.367	0.623	0.282	0.416	0.558	0.309	0.378	0.586	0.323	0.404	0.586	0.287	0.329	0.647	0.291	0.500	0.400	0.400

Table 4. 2 Integrated Spherical Fuzzy Comparison Matrix main criteria

	Spherical Fuzzy Weights ($\widetilde{w}^s$)			Calculations to obtain crisp weights $S(\widetilde{w}^s)$	Crisp Weights ($\widetilde{w}^s$)	Rank
PDSE	0.453	0.524	0.321	11.977	0.073	10
PA	0.426	0.549	0.316	11.205	0.068	13
MOT	0.515	0.458	0.360	13.580	0.082	4
ESE	0.494	0.474	0.336	13.101	0.079	5
SN	0.511	0.457	0.319	13.695	0.083	3
AS	0.444	0.523	0.322	11.709	0.071	11
INNO	0.490	0.477	0.327	13.050	0.079	6
LOC	0.519	0.454	0.336	13.836	0.084	2
PRS	0.433	0.533	0.324	11.362	0.069	12
PUS	0.521	0.446	0.326	13.970	0.085	1
PGS	0.476	0.488	0.338	12.548	0.076	8
PES	0.482	0.486	0.324	12.812	0.078	7
RT	0.458	0.512	0.323	12.118	0.073	9
Consistency Ratio (CR) = **0.0647**						

Table 4. 3 Pairwise comparisons of main criteria

$$\boldsymbol{\mu_{PDSE}} = \left[1 - \prod_{i=1}^{n}(1 - \mu_{A_{Si}}^2)^{w_i}\right]^{1/2}$$

$$= \left[1 - (1 - 0.5^2)^{\frac{1}{13}} * (1 - 0.494^2)^{\frac{1}{13}} * (1 - 0.441^2)^{\frac{1}{13}} * (1 - 0.496^2)^{\frac{1}{13}} * (1 - 0.401^2)^{\frac{1}{13}} * (1 - 0.453^2)^{\frac{1}{13}}\right.$$

$$\left. * (1 - 0.438^2)^{\frac{1}{13}} * (1 - 0.377^2)^{\frac{1}{13}} * (1 - 0.491^2)^{\frac{1}{13}} * (1 - 0.385^2)^{\frac{1}{13}} * (1 - 0.416^2)^{\frac{1}{13}} * (1 - 0.477^2)^{\frac{1}{13}} * (1 - 0.485^2)^{\frac{1}{13}}\right]^{1/2}$$

$$= 0.453$$

$$\boldsymbol{v_{PDSE}} = \prod_{i=1}^{n} v_{A_{Si}}^{w_i}$$

$$= 0.4^{\frac{1}{13}} * 0.475^{\frac{1}{13}} * 0.55^{\frac{1}{13}} * 0.487^{\frac{1}{13}} * 0.577^{\frac{1}{13}} * 0.513^{\frac{1}{13}} * 0.552^{\frac{1}{13}} * 0.611^{\frac{1}{13}} * 0.49^{\frac{1}{13}} * 0.597^{\frac{1}{13}} * 0.582^{\frac{1}{13}} * 0.508^{\frac{1}{13}}$$

$$* 0.508^{\frac{1}{13}} = 0.524$$

$$\boldsymbol{\pi_{PDSE}} = \left[\prod_{i=1}^{n}(1-\mu_{A_{Si}}^2)^{w_i} - \prod_{i=1}^{n}(1-\mu_{A_{Si}}^2-\pi_{A_{Si}}^2)^{w_i}\right]^{1/2}$$

$$= \Big[(1-0.5^2)^{\frac{1}{13}} * (1-0.494^2)^{\frac{1}{13}} * (1-0.441^2)^{\frac{1}{13}} * (1-0.496^2)^{\frac{1}{13}} * (1-0.401^2)^{\frac{1}{13}} * (1-0.453^2)^{\frac{1}{13}} * (1-0.438^2)^{\frac{1}{13}}$$

$$* (1-0.377^2)^{\frac{1}{13}} * (1-0.491^2)^{\frac{1}{13}} * (1-0.385^2)^{\frac{1}{13}} * (1-0.416^2)^{\frac{1}{13}} * (1-0.477^2)^{\frac{1}{13}} * (1-0.485^2)^{\frac{1}{13}}$$

$$- (1-0.5^2-0.4^2)^{\frac{1}{13}} * (1-0.494^2-0.342^2)^{\frac{1}{13}} * (1-0.441^2-0.311^2)^{\frac{1}{13}} * (1-0.496^2-0.316^2)^{\frac{1}{13}}$$

$$* (1-0.401^2-0.309^2)^{\frac{1}{13}} * (1-0.453^2-0.304^2)^{\frac{1}{13}} * (1-0.438^2-0.3^2)^{\frac{1}{13}}$$

$$* (1-0.377^2-0.289^2)^{\frac{1}{13}} * (1-0.491^2-0.326^2)^{\frac{1}{13}} * (1-0.385^2-0.299^2)^{\frac{1}{13}} * (1-0.416^2-0.28^2)^{\frac{1}{13}}$$

$$* (1-0.477^2-0.316^2)^{\frac{1}{13}} * (1-0.485^2-0.306^2)^{\frac{1}{13}}\Big]^{1/2} = 0.321$$

$$\boldsymbol{S}\,(\widetilde{\boldsymbol{w}}_{\boldsymbol{PDSE}}^{\boldsymbol{s}}) = \sqrt{\left|100 * \left[\left(3\mu_{\bar{A}_s} - \frac{\pi_{\bar{A}_s}}{2}\right)^2 - \left(\frac{v_{\bar{A}_s}}{2} - \pi_{\bar{A}_s}\right)^2\right]\right|} = \sqrt{\left|100 * \left[\left(3 * 0.453 - \frac{0.321}{2}\right)^2 - \left(\frac{0.524}{2} - 0.321\right)^2\right]\right|} = 11.977$$

$$\bar{\boldsymbol{w}}_{\boldsymbol{PDSE}}^{\boldsymbol{s}} = \frac{S\,(\widetilde{w}_j^s)}{\sum_{J=1}^{n} S(\widetilde{w}_j^s)}$$

$$= \frac{11.977}{11.977 + 11.205 + 13.58 + 13.101 + 13.695 + 11.709 + 13.050 + 13.836 + 11.362 + 13.97 + 12.548 + 12.812 + 12.118} = 0.073$$

4.2.2 Sub criteria

Similar steps are followed for the evaluation of sub-criteria.

- **Perceived desirability of self- employment (PDSE)** sub-criteria

	Left Criteria Is Greater					**Right Criteria Is Greater**					**Number of Experts**
	9	7	5	3	1	1/3	1/5	1/7	1/9		
	AMI	**VHI**	**HI**	**SMI**	**EI**	**SLI**	**LI**	**VLI**	**ALI**		
PDSE1					5	3	2			**PDSE2**	**10**
PDSE1				1	6	3				**PDSE3**	**10**
PDSE1						8	2			**PDSE4**	**10**
PDSE1			1	2	6	1				**PDSE5**	**10**
PDSE1				1	5	3	1			**PDSE6**	**10**
PDSE1				2	4	4				**PDSE7**	**10**
PDSE1				6	4					**PDSE8**	**10**
PDSE2					5	3	2			**PDSE3**	**10**
PDSE2				2	8					**PDSE4**	**10**
PDSE2					7	3				**PDSE5**	**10**
PDSE2				3	7					**PDSE6**	**10**
PDSE2				4	6					**PDSE7**	**10**
PDSE2					4	6				**PDSE8**	**10**
PDSE3				2	4	4				**PDSE4**	**10**
PDSE3				6	4					**PDSE5**	**10**
PDSE3					5	5				**PDSE6**	**10**
PDSE3				2	2	6				**PDSE7**	**10**
PDSE3					4	6				**PDSE8**	**10**
PDSE4			2	3	5					**PDSE5**	**10**
PDSE4				1	8	1				**PDSE6**	**10**
PDSE4				2	4	4				**PDSE7**	**10**
PDSE4					2	3	5			**PDSE8**	**10**
PDSE5				1	2	6	1			**PDSE6**	**10**
PDSE5			1	2	1	6				**PDSE7**	**10**
PDSE5					2	6	2			**PDSE8**	**10**
PDSE6					1	6	3			**PDSE7**	**10**
PDSE6					5	3	2			**PDSE8**	**10**
PDSE7				2	7	1				**PDSE8**	**10**

Table 4. 4 Initial Comparison Matrices PDSE sub-criteria

	PDSE1			PDSE2			PDSE3			PDSE4			PDSE5			PDSE6			PDSE7			PDSE8		
PDSE1	0.500	0.400	0.400	0.422	0.547	0.329	0.476	0.475	0.360	0.378	0.623	0.280	0.524	0.419	0.358	0.453	0.513	0.340	0.474	0.497	0.341	0.558	0.400	0.345
PDSE2	0.505	0.440	0.348	0.500	0.400	0.400	0.422	0.547	0.329	0.519	0.400	0.383	0.468	0.475	0.369	0.528	0.400	0.374	0.538	0.400	0.364	0.437	0.535	0.339
PDSE3	0.452	0.486	0.366	0.505	0.440	0.348	0.500	0.400	0.400	0.474	0.497	0.341	0.558	0.400	0.345	0.447	0.517	0.349	0.454	0.535	0.321	0.437	0.535	0.339
PDSE4	0.619	0.383	0.285	0.400	0.523	0.381	0.470	0.490	0.346	0.500	0.400	0.400	0.565	0.383	0.343	0.498	0.427	0.381	0.474	0.497	0.341	0.362	0.630	0.270
PDSE5	0.405	0.541	0.353	0.452	0.473	0.377	0.400	0.564	0.341	0.378	0.581	0.332	0.500	0.400	0.400	0.423	0.567	0.310	0.469	0.530	0.306	0.395	0.595	0.299
PDSE6	0.478	0.470	0.352	0.400	0.534	0.371	0.490	0.454	0.358	0.417	0.503	0.383	0.540	0.441	0.320	0.500	0.400	0.400	0.375	0.621	0.280	0.422	0.547	0.329
PDSE7	0.470	0.490	0.346	0.400	0.544	0.361	0.510	0.471	0.325	0.470	0.490	0.346	0.496	0.502	0.303	0.603	0.386	0.292	0.500	0.400	0.400	0.507	0.427	0.372
PDSE8	0.400	0.564	0.341	0.510	0.444	0.348	0.510	0.444	0.348	0.598	0.381	0.291	0.571	0.407	0.313	0.505	0.440	0.348	0.417	0.515	0.373	0.500	0.400	0.400

Table 4. 5 Integrated Spherical Fuzzy Comparison Matrix PDSE sub-criteria

	Spherical Fuzzy Weights ($\widetilde{w}^s$)			Calculations to obtain crisp weights $S(\widetilde{w}^s)$	Crisp Weights ($\widetilde{w}^s$)	Rank
PDSE1	0.478	0.479	0.348	12.549	0.124	6
PDSE2	0.492	0.446	0.365	12.862	0.128	4
PDSE3	0.481	0.473	0.353	12.610	0.125	5
PDSE4	0.496	0.460	0.347	13.095	0.130	3
PDSE5	0.430	0.528	0.343	11.167	0.111	8
PDSE6	0.457	0.492	0.352	11.914	0.118	7
PDSE7	0.499	0.461	0.344	13.213	0.131	2
PDSE8	0.508	0.446	0.346	13.448	0.133	1
Consistency Ratio (CR) = **0.0927**						

Table 4. 6 Pairwise comparisons of PDSE sub-criteria

- **Personal Attitude (PA)** sub-criteria

	Left Criteria Is Greater					Right Criteria Is Greater					Number of Experts
	9	7	5	3	1	1/3	1/5	1/7	1/9		
	AMI	**VHI**	**HI**	**SMI**	**EI**	**SLI**	**LI**	**VLI**	**ALI**		
PA1				3	2	5				**PA2**	**10**
PA1					5	5				**PA3**	**10**
PA1					1	6	3			**PA4**	**10**
PA1					2	5	3			**PA5**	**10**
PA2				1	7	2				**PA3**	**10**
PA2				2	4	4				**PA4**	**10**
PA2					5	5				**PA5**	**10**
PA3					4	5	1			**PA4**	**10**
PA3					4	5	1			**PA5**	**10**
PA4						1	8	1		**PA5**	**10**

Table 4. 7 Initial Comparison Matrices PA sub-criteria

	PA1			PA2			PA3			PA4			PA5		
PA1	0.500	0.400	0.400	0.472	0.517	0.322	0.447	0.517	0.349	0.375	0.621	0.280	0.384	0.607	0.290
PA2	0.490	0.493	0.325	0.500	0.400	0.400	0.487	0.452	0.371	0.474	0.497	0.341	0.447	0.517	0.349
PA3	0.490	0.454	0.358	0.434	0.495	0.375	0.500	0.400	0.400	0.425	0.550	0.329	0.425	0.550	0.329
PA4	0.603	0.386	0.292	0.470	0.490	0.346	0.518	0.437	0.343	0.500	0.400	0.400	0.296	0.704	0.201
PA5	0.579	0.399	0.306	0.490	0.454	0.358	0.518	0.437	0.343	0.699	0.304	0.207	0.500	0.400	0.400

Table 4. 8 Integrated Spherical Fuzzy Comparison Matrix PA sub-criteria

	Spherical Fuzzy Weights ($\widetilde{w}^s$)			**Calculations to obtain crisp weights** $S\,(\widetilde{w}^s)$	**Crisp Weights** ($\widetilde{w}^s$)	**Rank**
PA1	0.440	0.526	0.335	11.496	0.179	**5**
PA2	0.480	0.470	0.359	12.551	0.195	**3**
PA3	0.457	0.486	0.361	11.835	0.184	**4**
PA4	0.493	0.471	0.329	13.126	0.204	**2**
PA5	0.569	0.395	0.323	15.391	0.239	**1**
Consistency Ratio (CR) = **0.0778**						

Table 4. 9 Pairwise comparisons of PA sub-criteria

- **Motivation (MOT)** sub-criteria

	Left Criteria Is Greater					**Right Criteria Is Greater**					**Number of Experts**
	9	7	5	3	1	1/3	1/5	1/7	1/9		
	AMI	**VHI**	**HI**	**SMI**	**EI**	**SLI**	**LI**	**VLI**	**ALI**		
MOT1				2	5	3				**MOT2**	**10**
MOT1					8	1	1			**MOT3**	**10**
MOT1						1	7	2		**MOT4**	**10**
MOT1						7	3			**MOT5**	**10**
MOT1					1	2	6	1		**MOT6**	**10**
MOT1						2	3	5		**MOT7**	**10**
MOT2				2	7	1				**MOT3**	**10**
MOT2					8	2				**MOT4**	**10**
MOT2						8	2			**MOT5**	**10**
MOT2						1	6	3		**MOT6**	**10**
MOT2						2	6	2		**MOT7**	**10**
MOT3				1	7	2				**MOT4**	**10**
MOT3						2	6	2		**MOT5**	**10**
MOT3					1	2	3	4		**MOT6**	**10**
MOT3						1	6	3		**MOT7**	**10**
MOT4				4	3	3				**MOT5**	**10**
MOT4					2	4	4			**MOT6**	**10**
MOT4					1	7	2			**MOT7**	**10**
MOT5					1	2	5	2		**MOT6**	**10**
MOT5						1	6	3		**MOT7**	**10**
MOT6					1	5	3	1		**MOT7**	**10**

Table 4. 10 Initial Comparison Matrices MOT sub-criteria

	MOT1			MOT2			MOT3			MOT4			MOT5			MOT6			MOT7		
MOT1	0.500	0.400	0.400	0.485	0.475	0.351	0.465	0.472	0.369	0.285	0.717	0.191	0.367	0.634	0.271	0.321	0.677	0.231	0.259	0.743	0.173
MOT2	0.452	0.498	0.356	0.500	0.400	0.400	0.507	0.427	0.372	0.478	0.452	0.379	0.378	0.623	0.280	0.273	0.728	0.181	0.293	0.709	0.201
MOT3	0.441	0.476	0.381	0.417	0.515	0.373	0.500	0.400	0.400	0.487	0.452	0.371	0.293	0.709	0.201	0.284	0.716	0.202	0.273	0.728	0.181
MOT4	0.708	0.296	0.200	0.434	0.483	0.385	0.434	0.495	0.375	0.500	0.400	0.400	0.503	0.475	0.333	0.373	0.619	0.280	0.386	0.610	0.290
MOT5	0.628	0.374	0.276	0.619	0.383	0.285	0.697	0.308	0.214	0.452	0.521	0.334	0.500	0.400	0.400	0.308	0.690	0.221	0.273	0.728	0.181
MOT6	0.650	0.342	0.252	0.717	0.287	0.193	0.677	0.320	0.236	0.588	0.390	0.299	0.659	0.335	0.247	0.500	0.400	0.400	0.350	0.648	0.260
MOT7	0.726	0.283	0.193	0.697	0.308	0.214	0.717	0.287	0.193	0.594	0.395	0.299	0.717	0.287	0.193	0.621	0.371	0.280	0.500	0.400	0.400

Table 4. 11 Integrated Spherical Fuzzy Comparison Matrix MOT sub-criteria

	Spherical Fuzzy Weights $(\widetilde{w}^s)$			**Calculations to obtain crisp weights** $S\,(\widetilde{w}^s)$	**Crisp Weights** $(\widetilde{w}^s)$	**Rank**
MOT1	0.398	0.574	0.307	10.403	0.109	6
MOT2	0.425	0.534	0.331	11.076	0.116	5
MOT3	0.399	0.556	0.326	10.339	0.108	7
MOT4	0.499	0.470	0.327	13.299	0.140	4
MOT5	0.533	0.464	0.286	14.562	0.153	3
MOT6	0.613	0.376	0.273	17.009	0.178	2
MOT7	0.664	0.330	0.254	18.627	0.195	1
Consistency Ratio (CR) = **0.0765**						

Table 4. 12 Pairwise comparisons of MOT sub-criteria

- **Entrepreneurial self-efficacy (ESE)** sub-criteria

	Left Criteria Is Greater					**Right Criteria Is Greater**					**Number of Experts**
	9	7	5	3	1	1/3	1/5	1/7	1/9		
	AMI	**VHI**	**HI**	**SMI**	**EI**	**SLI**	**LI**	**VLI**	**ALI**		
ESE1				2	6	2				**ESE2**	**10**
ESE1					3	4	3			**ESE3**	**10**
ESE1					2	5	3			**ESE4**	**10**
ESE1					2	7	1			**ESE5**	**10**
ESE1						2	6	2		**ESE6**	**10**
ESE1					1	2	4	3		**ESE7**	**10**
ESE1							6	4		**ESE8**	**10**
ESE2				2	5	3				**ESE3**	**10**
ESE2					5	3	2			**ESE4**	**10**
ESE2					1	4	5			**ESE5**	**10**
ESE2					1	3	6			**ESE6**	**10**
ESE2						2	8			**ESE7**	**10**
ESE2						2	5	3		**ESE8**	**10**
ESE3				2	4	4				**ESE4**	**10**
ESE3					1	3	6			**ESE5**	**10**
ESE3						1	2	7		**ESE6**	**10**
ESE3						1	3	6		**ESE7**	**10**
ESE3						1	3	6		**ESE8**	**10**
ESE4					1	6	3			**ESE5**	**10**
ESE4						3	5	2		**ESE6**	**10**
ESE4					1	5	4			**ESE7**	**10**
ESE4					2	6	2			**ESE8**	**10**
ESE5					4	5	1			**ESE6**	**10**
ESE5					7	3				**ESE7**	**10**
ESE5						8	2			**ESE8**	**10**
ESE6						3	7			**ESE7**	**10**
ESE6						2	8			**ESE8**	**10**
ESE7							3	7		**ESE8**	**10**

Table 4. 13 Initial Comparison Matrices ESE sub-criteria

	ESE1			ESE2			ESE3			ESE4			ESE5			ESE6			ESE7			ESE8		
ESE1	0.500	0.400	0.400	0.496	0.452	0.362	0.392	0.593	0.299	0.384	0.607	0.290	0.406	0.583	0.309	0.293	0.709	0.201	0.296	0.703	0.211	0.255	0.746	0.161
ESE2	0.434	0.507	0.365	0.500	0.400	0.400	0.485	0.475	0.351	0.422	0.547	0.329	0.354	0.643	0.260	0.344	0.653	0.250	0.318	0.683	0.221	0.281	0.721	0.192
ESE3	0.556	0.410	0.319	0.452	0.498	0.356	0.500	0.400	0.400	0.474	0.497	0.341	0.344	0.653	0.250	0.232	0.769	0.143	0.242	0.759	0.153	0.242	0.759	0.153
ESE4	0.579	0.399	0.306	0.505	0.440	0.348	0.470	0.490	0.346	0.500	0.400	0.400	0.375	0.621	0.280	0.302	0.701	0.211	0.365	0.632	0.270	0.395	0.595	0.299
ESE5	0.562	0.415	0.320	0.622	0.368	0.275	0.632	0.359	0.266	0.603	0.386	0.292	0.500	0.400	0.400	0.425	0.550	0.329	0.468	0.475	0.369	0.378	0.623	0.280
ESE6	0.697	0.308	0.214	0.632	0.359	0.266	0.757	0.251	0.160	0.686	0.319	0.226	0.518	0.437	0.343	0.500	0.400	0.400	0.327	0.674	0.231	0.318	0.683	0.221
ESE7	0.668	0.328	0.242	0.679	0.323	0.226	0.747	0.260	0.169	0.613	0.377	0.284	0.452	0.473	0.377	0.668	0.334	0.237	0.500	0.400	0.400	0.226	0.775	0.131
ESE8	0.738	0.265	0.169	0.706	0.300	0.207	0.747	0.260	0.169	0.571	0.407	0.313	0.619	0.383	0.285	0.679	0.323	0.226	0.769	0.235	0.140	0.500	0.400	0.400

Table 4. 14 Integrated Spherical Fuzzy Comparison Matrix ESE sub-criteria

	Spherical Fuzzy Weights ($\widetilde{w}^s$)			Calculations to obtain crisp weights $S(\widetilde{w}^s)$	Crisp Weights ($\widetilde{w}^s$)	Rank
ESE1	0.391	0.587	0.299	10.229	0.093	8
ESE2	0.402	0.568	0.312	10.495	0.095	7
ESE3	0.406	0.574	0.295	10.714	0.097	6
ESE4	0.449	0.523	0.318	11.866	0.108	5
ESE5	0.537	0.439	0.319	14.476	0.131	4
ESE6	0.594	0.404	0.264	16.490	0.150	3
ESE7	0.606	0.388	0.270	16.802	0.152	2
ESE8	0.680	0.315	0.240	19.190	0.174	1
Consistency Ratio (CR) = **0.0994**						

Table 4. 15 Pairwise comparisons of ESE sub-criteria

- **Social Norms (SN)** sub-criteria

	Left Criteria Is Greater					Right Criteria Is Greater					Number of Experts
	9	7	5	3	1	1/3	1/5	1/7	1/9		
	AMI	**VHI**	**HI**	**SMI**	**EI**	**SLI**	**LI**	**VLI**	**ALI**		
SN1		3	5	2						**SN2**	**10**
SN1				4	5	1				**SN3**	**10**
SN1	1	5	3	1						**SN4**	**10**
SN2					1	5	4			**SN3**	**10**
SN2			3	5	2					**SN4**	**10**
SN3		6	4							**SN4**	**10**

Table 4. 16 Initial Comparison Matrices SN sub-criteria

	SN1			SN2			SN3			SN4		
SN1	0.500	0.400	0.400	0.706	0.300	0.207	0.526	0.427	0.354	0.756	0.255	0.166
SN2	0.281	0.721	0.192	0.500	0.400	0.400	0.365	0.632	0.270	0.606	0.374	0.302
SN3	0.417	0.537	0.353	0.613	0.377	0.284	0.500	0.400	0.400	0.758	0.246	0.150
SN4	0.226	0.776	0.144	0.367	0.619	0.292	0.235	0.766	0.141	0.500	0.400	0.400

Table 4. 17 Integrated Spherical Fuzzy Comparison Matrix SN sub-criteria

	Spherical Fuzzy Weights ($\widetilde{w}^s$)			Calculations to obtain crisp weights $S(\widetilde{w}^s)$	Crisp Weights ($\widetilde{w}^s$)	Rank
SN1	0.645	0.338	0.282	17.895	0.319	1
SN2	0.464	0.511	0.311	12.357	0.220	3
SN3	0.603	0.376	0.297	16.560	0.295	2
SN4	0.356	0.619	0.284	9.253	0.165	4
Consistency Ratio (CR) = **0.0245**						

Table 4. 18 Pairwise comparisons of SN sub-criteria

- **Achievement striving (AS)** sub-criteria

	Left Criteria Is Greater					**Right Criteria Is Greater**					**Number of Experts**
	9	7	5	3	1	1/3	1/5	1/7	1/9		
	AMI	**VHI**	**HI**	**SMI**	**EI**	**SLI**	**LI**	**VLI**	**ALI**		
AS1							3	7		**AS2**	**10**
AS1					1	4	5			**AS3**	**10**
AS1							4	6		**AS4**	**10**
AS1							2	8		**AS5**	**10**
AS2					4	6				**AS3**	**10**
AS2				2	8					**AS4**	**10**
AS2						6	4			**AS5**	**10**
AS3			4	5	1					**AS4**	**10**
AS3					3	5	2			**AS5**	**10**
AS4						2	4	4		**AS5**	**10**

Table 4. 19 Initial Comparison Matrices AS sub-criteria

	AS1			**AS2**			**AS3**			**AS4**			**AS5**		
AS1	0.500	0.400	0.400	0.226	0.775	0.131	0.354	0.643	0.260	0.235	0.766	0.141	0.217	0.784	0.121
AS2	0.769	0.235	0.140	0.500	0.400	0.400	0.437	0.535	0.339	0.519	0.400	0.383	0.357	0.645	0.261
AS3	0.622	0.368	0.275	0.510	0.444	0.348	0.500	0.400	0.400	0.627	0.364	0.281	0.404	0.580	0.309
AS4	0.758	0.246	0.150	0.400	0.523	0.381	0.357	0.637	0.271	0.500	0.400	0.400	0.270	0.732	0.182
AS5	0.779	0.224	0.128	0.638	0.364	0.267	0.548	0.418	0.326	0.716	0.292	0.200	0.500	0.400	0.400

Table 4. 20 Integrated Spherical Fuzzy Comparison Matrix AS sub-criteria

	Spherical Fuzzy Weights ($\widetilde{w}^s$)			**Calculations to obtain crisp weights** $S(\widetilde{w}^s)$	**Crisp Weights** ($\widetilde{w}^s$)	**Rank**
AS1	0.331	0.654	0.254	8.621	0.122	**5**
AS2	0.555	0.419	0.310	15.074	0.213	**2**
AS3	0.544	0.425	0.325	14.657	0.208	**3**
AS4	0.513	0.474	0.290	13.940	0.197	**4**
AS5	0.657	0.331	0.265	18.341	0.260	**1**
Consistency Ratio (CR) = **0.0887**						

Table 4. 21 Pairwise comparisons of AS sub-criteria

- **Innovativeness (INNO)** sub-criteria

	Left Criteria Is Greater					Right Criteria Is Greater					Number of Experts
	9	7	5	3	1	1/3	1/5	1/7	1/9		
	AMI	**VHI**	**HI**	**SMI**	**EI**	**SLI**	**LI**	**VLI**	**ALI**		
INNO1				7	3					**INNO2**	**10**
INNO1					6	4				**INNO3**	**10**
INNO1					1	6	3			**INNO4**	**10**
INNO1						6	4			**INNO5**	**10**
INNO1							7	3		**INNO6**	**10**
INNO1						2	7	1		**INNO7**	**10**
INNO1						1	2	7		**INNO8**	**10**
INNO2					4	6				**INNO3**	**10**
INNO2					7	3				**INNO4**	**10**
INNO2						8	2			**INNO5**	**10**
INNO2						8	2			**INNO6**	**10**
INNO2							3	7		**INNO7**	**10**
INNO2							6	4		**INNO8**	**10**
INNO3				6	4					**INNO4**	**10**
INNO3						3	7			**INNO5**	**10**
INNO3							9	1		**INNO6**	**10**
INNO3							8	2		**INNO7**	**10**
INNO3							1	9		**INNO8**	**10**
INNO4					4	6				**INNO5**	**10**
INNO4					3	7				**INNO6**	**10**
INNO4							8	2		**INNO7**	**10**
INNO4							3	7		**INNO8**	**10**
INNO5						8	2			**INNO6**	**10**
INNO5						6	4			**INNO7**	**10**
INNO5						4	6			**INNO8**	**10**
INNO6							2	8		**INNO7**	**10**
INNO6					1	4	5			**INNO8**	**10**
INNO7						8	2			**INNO8**	**10**

Table 4. 22 Initial Comparison Matrices INNO sub-criteria

	INNO1			INNO2			INNO3			INNO4			INNO5			INNO6			INNO7			INNO8		
INNO1	0.500	0.400	0.400	0.568	0.400	0.334	0.457	0.497	0.359	0.375	0.621	0.280	0.357	0.645	0.261	0.266	0.735	0.171	0.305	0.696	0.211	0.232	0.769	0.143
INNO2	0.400	0.573	0.331	0.500	0.400	0.400	0.437	0.535	0.339	0.468	0.475	0.369	0.378	0.623	0.280	0.378	0.623	0.280	0.226	0.775	0.131	0.255	0.746	0.161
INNO3	0.470	0.464	0.368	0.510	0.444	0.348	0.500	0.400	0.400	0.558	0.400	0.345	0.327	0.674	0.231	0.288	0.712	0.190	0.277	0.724	0.181	0.208	0.792	0.111
INNO4	0.603	0.386	0.292	0.452	0.473	0.377	0.400	0.564	0.341	0.500	0.400	0.400	0.437	0.535	0.339	0.428	0.553	0.329	0.277	0.724	0.181	0.226	0.775	0.131
INNO5	0.638	0.364	0.267	0.619	0.383	0.285	0.668	0.334	0.237	0.510	0.444	0.348	0.500	0.400	0.400	0.378	0.623	0.280	0.357	0.645	0.261	0.337	0.664	0.241
INNO6	0.729	0.274	0.177	0.619	0.383	0.285	0.709	0.292	0.193	0.531	0.434	0.338	0.619	0.383	0.285	0.500	0.400	0.400	0.217	0.784	0.121	0.354	0.643	0.260
INNO7	0.688	0.316	0.220	0.769	0.235	0.140	0.719	0.283	0.185	0.719	0.283	0.185	0.638	0.364	0.267	0.779	0.224	0.128	0.500	0.400	0.400	0.378	0.623	0.280
INNO8	0.757	0.251	0.160	0.738	0.265	0.169	0.789	0.212	0.115	0.769	0.235	0.140	0.658	0.344	0.248	0.622	0.368	0.275	0.619	0.383	0.285	0.500	0.400	0.400

Table 4. 23 Integrated Spherical Fuzzy Comparison Matrix INNO sub-criteria

	Spherical Fuzzy Weights ($\widetilde{w}^s$)			Calculations to obtain crisp weights $S(\widetilde{w}^s)$	Crisp Weights ($\widetilde{w}^s$)	Rank
INNO1	0.404	0.578	0.295	10.647	0.095	7
INNO2	0.394	0.582	0.310	10.266	0.091	8
INNO3	0.418	0.556	0.304	11.015	0.098	6
INNO4	0.436	0.536	0.320	11.480	0.102	5
INNO5	0.526	0.466	0.297	14.296	0.127	4
INNO6	0.576	0.423	0.272	15.906	0.141	3
INNO7	0.676	0.324	0.227	19.136	0.170	2
INNO8	0.698	0.299	0.226	19.785	0.176	1
Consistency Ratio (CR) = **0.0984**						

Table 4. 24 Pairwise comparisons of INNO sub-criteria

- **Locus of control (LOC)** sub-criteria

	Left Criteria Is Greater					Right Criteria Is Greater					Number of Experts
	9	7	5	3	1	1/3	1/5	1/7	1/9		
	AMI	**VHI**	**HI**	**SMI**	**EI**	**SLI**	**LI**	**VLI**	**ALI**		
LOC1					8	2				**LOC2**	**10**
LOC1					7	2	1			**LOC3**	**10**
LOC1						8	2			**LOC4**	**10**
LOC1					8	1	1			**LOC5**	**10**
LOC1					1	6	3			**LOC6**	**10**
LOC1							8	2		**LOC7**	**10**
LOC1						2	7	1		**LOC8**	**10**
LOC1							7	3		**LOC9**	**10**
LOC1						2	8			**LOC10**	**10**
LOC2					8	2				**LOC3**	**10**
LOC2					3	7				**LOC4**	**10**
LOC2						8	2			**LOC5**	**10**
LOC2					2	7	1			**LOC6**	**10**
LOC2							7	3		**LOC7**	**10**
LOC2						7	3			**LOC8**	**10**
LOC2						2	2	6		**LOC9**	**10**
LOC2						1	2	7		**LOC10**	**10**
LOC3					6	3	1			**LOC4**	**10**
LOC3					7	2	1			**LOC5**	**10**
LOC3						2	6	2		**LOC6**	**10**
LOC3							7	3		**LOC7**	**10**
LOC3					2	3	5			**LOC8**	**10**

LOC3						1	7	2		**LOC9**	**10**
LOC3							3	7		**LOC10**	**10**
LOC4					5	5				**LOC5**	**10**
LOC4					7	3				**LOC6**	**10**
LOC4					1	7	2			**LOC7**	**10**
LOC4						6	2	2		**LOC8**	**10**
LOC4							6	4		**LOC9**	**10**
LOC4						6	4			**LOC10**	**10**
LOC5						7	3			**LOC6**	**10**
LOC5						5	3	2		**LOC7**	**10**
LOC5							9	1		**LOC8**	**10**
LOC5							8	2		**LOC9**	**10**
LOC5					1	2	7			**LOC10**	**10**
LOC6							6	4		**LOC7**	**10**
LOC6						5	3	2		**LOC8**	**10**
LOC6							7	3		**LOC9**	**10**
LOC6						6	4			**LOC10**	**10**
LOC7					1	3	4	2		**LOC8**	**10**
LOC7						2	7	1		**LOC9**	**10**
LOC7						2	8			**LOC10**	**10**
LOC8					5	3	1	1		**LOC9**	**10**
LOC8				4	1	5				**LOC10**	**10**
LOC9				1	3	6				**LOC10**	**10**

Table 4. 25 Initial Comparison Matrices LOC sub-criteria

	LOC1			LOC2			LOC3			LOC4			LOC5			LOC6			LOC7			LOC8			LOC9			LOC10		
LOC1	0.500	0.400	0.400	0.478	0.452	0.379	0.454	0.493	0.359	0.378	0.623	0.280	0.465	0.472	0.369	0.375	0.621	0.280	0.277	0.724	0.181	0.305	0.696	0.211	0.266	0.735	0.171	0.318	0.683	0.221
LOC2	0.434	0.483	0.385	0.500	0.400	0.400	0.478	0.452	0.379	0.428	0.553	0.329	0.378	0.623	0.280	0.406	0.583	0.309	0.266	0.735	0.171	0.367	0.634	0.271	0.249	0.753	0.163	0.232	0.769	0.143
LOC3	0.459	0.467	0.372	0.434	0.483	0.385	0.500	0.400	0.400	0.444	0.513	0.349	0.454	0.493	0.359	0.293	0.709	0.201	0.266	0.735	0.171	0.362	0.630	0.270	0.285	0.717	0.191	0.226	0.775	0.131
LOC4	0.619	0.383	0.285	0.531	0.434	0.338	0.478	0.457	0.363	0.500	0.400	0.400	0.447	0.517	0.349	0.468	0.475	0.369	0.386	0.610	0.290	0.329	0.674	0.241	0.255	0.746	0.161	0.357	0.645	0.261
LOC5	0.441	0.476	0.381	0.619	0.383	0.285	0.459	0.467	0.372	0.490	0.454	0.358	0.500	0.400	0.400	0.367	0.634	0.271	0.319	0.683	0.231	0.288	0.712	0.190	0.277	0.724	0.181	0.334	0.663	0.240
LOC6	0.603	0.386	0.292	0.562	0.415	0.320	0.697	0.308	0.214	0.452	0.473	0.377	0.628	0.374	0.276	0.500	0.400	0.400	0.255	0.746	0.161	0.319	0.683	0.231	0.266	0.735	0.171	0.357	0.645	0.261
LOC7	0.719	0.283	0.185	0.729	0.274	0.177	0.729	0.274	0.177	0.594	0.395	0.299	0.666	0.341	0.248	0.738	0.265	0.169	0.500	0.400	0.400	0.317	0.682	0.231	0.305	0.696	0.211	0.318	0.683	0.221
LOC8	0.688	0.316	0.220	0.628	0.374	0.276	0.598	0.381	0.291	0.655	0.351	0.258	0.709	0.292	0.193	0.666	0.341	0.248	0.649	0.345	0.257	0.500	0.400	0.400	0.405	0.569	0.318	0.481	0.517	0.312
LOC9	0.729	0.274	0.177	0.735	0.274	0.186	0.708	0.296	0.200	0.738	0.265	0.169	0.719	0.283	0.185	0.729	0.274	0.177	0.688	0.316	0.220	0.512	0.435	0.346	0.500	0.400	0.400	0.445	0.535	0.330
LOC10	0.679	0.323	0.226	0.757	0.251	0.160	0.769	0.235	0.140	0.638	0.364	0.267	0.642	0.349	0.257	0.638	0.364	0.267	0.679	0.323	0.226	0.490	0.505	0.313	0.510	0.458	0.337	0.500	0.400	0.400

Table 4. 26 Integrated Spherical Fuzzy Comparison Matrix LOC sub-criteria

	Spherical Fuzzy Weights ($\widetilde{w}^s$)			Calculations to obtain crisp weights $S(\widetilde{w}^s)$	Crisp Weights ($\widetilde{w}^s$)	Rank
LOC1	0.394	0.577	0.307	10.277	0.074	8
LOC2	0.388	0.585	0.307	10.095	0.073	9
LOC3	0.387	0.578	0.310	10.063	0.073	10
LOC4	0.454	0.521	0.320	12.012	0.087	6
LOC5	0.429	0.544	0.310	11.315	0.082	7
LOC6	0.502	0.493	0.288	13.607	0.098	5
LOC7	0.610	0.398	0.239	17.093	0.123	3
LOC8	0.613	0.381	0.278	16.974	0.123	4
LOC9	0.670	0.326	0.239	18.885	0.136	1
LOC10	0.647	0.348	0.259	18.087	0.131	2
Consistency Ratio (CR) = **0.0836**						

Table 4. 27 Pairwise comparisons of LOC sub-criteria

- **Perceived Relational Support (PRS)** sub-criteria

	Left Criteria Is Greater					Right Criteria Is Greater					Number of Experts
	9	7	5	3	1	1/3	1/5	1/7	1/9		
	AMI	**VHI**	**HI**	**SMI**	**EI**	**SLI**	**LI**	**VLI**	**ALI**		
PRS1		1	5	4						**PRS2**	**10**
PRS1	4	3	3							**PRS3**	**10**
PRS2		2	2	6						**PRS3**	**10**

Table 4. 28 Initial Comparison Matrices PRS sub-criteria

	PRS1			PRS2			PRS3		
PRS1	0.500	0.400	0.400	0.667	0.338	0.243	0.806	0.209	0.126
PRS2	0.323	0.679	0.231	0.500	0.400	0.400	0.655	0.351	0.258
PRS3	0.171	0.831	0.100	0.329	0.674	0.241	0.500	0.400	0.400

Table 4. 29 Integrated Spherical Fuzzy Comparison Matrix PRS sub-criteria

	Spherical Fuzzy Weights ($\widetilde{w}^s$)			Calculations to obtain crisp weights $S(\widetilde{w}^s)$	Crisp Weights ($\widetilde{w}^s$)	Rank
PRS1	0.688	0.304	0.256	19.332	0.450	1
PRS2	0.523	0.457	0.310	14.122	0.329	2
PRS3	0.366	0.607	0.295	9.508	0.221	3
Consistency Ratio (CR) = **0.073**						

Table 4. 30 Pairwise comparisons of PRS sub-criteria

- **Perceived University Support (PUS)** sub-criteria

	Left Criteria Is Greater					**Right Criteria Is Greater**					**Number of Experts**
	9	7	5	3	1	1/3	1/5	1/7	1/9		
	AMI	**VHI**	**HI**	**SMI**	**EI**	**SLI**	**LI**	**VLI**	**ALI**		
PUS1					3	7				**PUS2**	**10**
PUS1					2	5	3			**PUS3**	**10**
PUS1						1	5	4		**PUS4**	**10**
PUS1							8	2		**PUS5**	**10**
PUS1							7	3		**PUS6**	**10**
PUS1							2	8		**PUS7**	**10**
PUS2				5	3	2				**PUS3**	**10**
PUS2					4	5	1			**PUS4**	**10**
PUS2						2	2	6		**PUS5**	**10**
PUS2						1	2	7		**PUS6**	**10**
PUS2						1	2	7		**PUS7**	**10**
PUS3					6	4				**PUS4**	**10**
PUS3						3	7			**PUS5**	**10**
PUS3							1	9		**PUS6**	**10**
PUS3							2	8		**PUS7**	**10**
PUS4					3	5	2			**PUS5**	**10**
PUS4					3	5	2			**PUS6**	**10**
PUS4					2	3	5			**PUS7**	**10**
PUS5							2	8		**PUS6**	**10**
PUS5						1	2	7		**PUS7**	**10**
PUS6					7	3				**PUS7**	**10**

Table 4. 31 Initial Comparison Matrices PUS sub-criteria

	PUS1			PUS2			PUS3			PUS4			PUS5			PUS6			PUS7		
PUS1	0.500	0.400	0.400	0.428	0.553	0.329	0.384	0.607	0.290	0.263	0.739	0.172	0.277	0.724	0.181	0.266	0.735	0.171	0.217	0.784	0.121
PUS2	0.531	0.434	0.338	0.500	0.400	0.400	0.524	0.452	0.333	0.425	0.550	0.329	0.249	0.753	0.163	0.232	0.769	0.143	0.232	0.769	0.143
PUS3	0.579	0.399	0.306	0.434	0.540	0.333	0.500	0.400	0.400	0.457	0.497	0.359	0.327	0.674	0.231	0.208	0.792	0.111	0.217	0.784	0.121
PUS4	0.727	0.279	0.185	0.518	0.437	0.343	0.470	0.464	0.368	0.500	0.400	0.400	0.404	0.580	0.309	0.404	0.580	0.309	0.362	0.630	0.270
PUS5	0.719	0.283	0.185	0.735	0.274	0.186	0.668	0.334	0.237	0.548	0.418	0.326	0.500	0.400	0.400	0.217	0.784	0.121	0.232	0.769	0.143
PUS6	0.729	0.274	0.177	0.757	0.251	0.160	0.789	0.212	0.115	0.548	0.418	0.326	0.779	0.224	0.128	0.500	0.400	0.400	0.468	0.475	0.369
PUS7	0.779	0.224	0.128	0.757	0.251	0.160	0.779	0.224	0.128	0.598	0.381	0.291	0.757	0.251	0.160	0.452	0.473	0.377	0.500	0.400	0.400

Table 4. 32 Integrated Spherical Fuzzy Comparison Matrix PUS sub-criteria

	Spherical Fuzzy Weights $(\widetilde{w}^s)$			**Calculations to obtain crisp weights** $S\,(\widetilde{w}^s)$	**Crisp Weights** $(\widetilde{w}^s)$	**Rank**
PUS1	0.351	0.634	0.269	9.179	0.092	7
PUS2	0.414	0.569	0.298	10.922	0.110	6
PUS3	0.418	0.563	0.300	11.045	0.111	5
PUS4	0.509	0.466	0.316	13.667	0.137	4
PUS5	0.578	0.428	0.252	16.076	0.161	3
PUS6	0.684	0.308	0.241	19.284	0.193	2
PUS7	0.690	0.302	0.236	19.502	0.196	1
Consistency Ratio (CR) = **0.0904**						

Table 4. 33 Pairwise comparisons of PUS sub-criteria

- **Perceived Government Support (PGS)** sub-criteria

	Left Criteria Is Greater					Right Criteria Is Greater					Number of Experts
	9	7	5	3	1	1/3	1/5	1/7	1/9		
	AMI	**VHI**	**HI**	**SMI**	**EI**	**SLI**	**LI**	**VLI**	**ALI**		
PGS1						2	8			**PGS2**	**10**
PGS1					4	6				**PGS3**	**10**
PGS1						6	4			**PGS4**	**10**
PGS1							7	3		**PGS5**	**10**
PGS2					4	6				**PGS3**	**10**
PGS2					7	3				**PGS4**	**10**
PGS2						3	7			**PGS5**	**10**
PGS3			1	9						**PGS4**	**10**
PGS3						8	2			**PGS5**	**10**
PGS4							8	2		**PGS5**	**10**

Table 4. 34 Initial Comparison Matrices PGS sub-criteria

	PGS1			PGS2			PGS3			PGS4			PGS5		
PGS1	0.500	0.400	0.400	0.318	0.683	0.221	0.437	0.535	0.339	0.357	0.645	0.261	0.266	0.735	0.171
PGS2	0.679	0.323	0.226	0.500	0.400	0.400	0.437	0.535	0.339	0.468	0.475	0.369	0.327	0.674	0.231
PGS3	0.510	0.444	0.348	0.510	0.444	0.348	0.500	0.400	0.400	0.609	0.391	0.292	0.378	0.623	0.280
PGS4	0.638	0.364	0.267	0.452	0.473	0.377	0.389	0.612	0.290	0.500	0.400	0.400	0.277	0.724	0.181
PGS5	0.729	0.274	0.177	0.668	0.334	0.237	0.619	0.383	0.285	0.719	0.283	0.185	0.500	0.400	0.400

Table 4. 35 Integrated Spherical Fuzzy Comparison Matrix PGS sub-criteria

	Spherical Fuzzy Weights ($\widetilde{w}^s$)			Calculations to obtain crisp weights $S(\widetilde{w}^s)$	Crisp Weights ($\widetilde{w}^s$)	Rank
PGS1	0.388	0.586	0.300	10.136	0.148	**5**
PGS2	0.506	0.467	0.321	13.540	0.198	**3**
PGS3	0.510	0.454	0.338	13.573	0.199	**2**
PGS4	0.476	0.498	0.319	12.654	0.185	**4**
PGS5	0.659	0.331	0.259	18.447	0.270	**1**
Consistency Ratio (CR) = **0.0999**						

Table 4. 36 Pairwise comparisons of PGS sub-criteria

- **Perceived Environmental Support (PES)** sub-criteria

	Left Criteria Is Greater					**Right Criteria Is Greater**					**Number of Experts**
	9	7	5	3	1	1/3	1/5	1/7	1/9		
	AMI	**VHI**	**HI**	**SMI**	**EI**	**SLI**	**LI**	**VLI**	**ALI**		
PES1						5	5			**PES2**	**10**
PES1					2	8				**PES3**	**10**
PES1						6	4			**PES4**	**10**
PES1							5	5		**PES5**	**10**
PES2					3	7				**PES3**	**10**
PES2					6	4				**PES4**	**10**
PES2						3	7			**PES5**	**10**
PES3			4	6						**PES4**	**10**
PES3						5	5			**PES5**	**10**
PES4						2	8			**PES5**	**10**

Table 4. 37 Initial Comparison Matrices PES sub-criteria

	PES1			**PES2**			**PES3**			**PES4**			**PES5**		
PES1	0.500	0.400	0.400	0.346	0.655	0.251	0.418	0.569	0.319	0.357	0.645	0.261	0.245	0.756	0.151
PES2	0.648	0.355	0.258	0.500	0.400	0.400	0.428	0.553	0.329	0.457	0.497	0.359	0.327	0.674	0.231
PES3	0.553	0.423	0.326	0.531	0.434	0.338	0.500	0.400	0.400	0.638	0.364	0.267	0.346	0.655	0.251
PES4	0.638	0.364	0.267	0.470	0.464	0.368	0.357	0.645	0.261	0.500	0.400	0.400	0.318	0.683	0.221
PES5	0.748	0.256	0.160	0.668	0.334	0.237	0.648	0.355	0.258	0.679	0.323	0.226	0.500	0.400	0.400

Table 4. 38 Integrated Spherical Fuzzy Comparison Matrix PES sub-criteria

	Spherical Fuzzy Weights ($\widetilde{w}^s$)			**Calculations to obtain crisp weights** $S(\widetilde{w}^s)$	**Crisp Weights** ($\widetilde{w}^s$)	**Rank**
PES1	0.386	0.592	0.298	10.082	0.147	**5**
PES2	0.491	0.483	0.324	13.099	0.191	**3**
PES3	0.528	0.445	0.323	14.195	0.207	**2**
PES4	0.479	0.495	0.316	12.769	0.186	**4**
PES5	0.660	0.330	0.258	18.493	0.269	**1**
Consistency Ratio (CR) = **0.0944**						

Table 4. 39 Pairwise comparisons of PES sub-criteria

- **Risk-taking (RT)** sub-criteria

	Left Criteria Is Greater					Right Criteria Is Greater					No. Experts
	AMI	**VHI**	**HI**	**SMI**	**EI**	**SLI**	**LI**	**VLI**	**ALI**		
RT1				2	8					**RT2**	**10**
RT1					3	7				**RT3**	**10**
RT1						1	5	4		**RT4**	**10**
RT1							2	8		**RT5**	**10**
RT1						1	3	6		**RT6**	**10**
RT2					8	2				**RT3**	**10**
RT2					7	3				**RT4**	**10**
RT2						5	5			**RT5**	**10**
RT2							3	7		**RT6**	**10**
RT3					7	3				**RT4**	**10**
RT3							3	7		**RT5**	**10**
RT3						7	3			**RT6**	**10**
RT4					7	3				**RT5**	**10**
RT4						3	7			**RT6**	**10**
RT5							7	3		**RT6**	**10**

Table 4. 40 Initial Comparison Matrices RT sub-criteria

	RT1			**RT2**			**RT3**			**RT4**			**RT5**			**RT6**		
RT1	0.500	0.400	0.400	0.519	0.400	0.383	0.428	0.553	0.329	0.263	0.739	0.172	0.217	0.784	0.121	0.242	0.759	0.153
RT2	0.400	0.523	0.381	0.500	0.400	0.400	0.478	0.452	0.379	0.478	0.452	0.379	0.346	0.655	0.251	0.226	0.775	0.131
RT3	0.531	0.434	0.338	0.434	0.483	0.385	0.500	0.400	0.400	0.468	0.475	0.369	0.226	0.775	0.131	0.367	0.634	0.271
RT4	0.727	0.279	0.185	0.452	0.473	0.377	0.452	0.473	0.377	0.500	0.400	0.400	0.468	0.475	0.369	0.327	0.674	0.231
RT5	0.779	0.224	0.128	0.648	0.355	0.258	0.769	0.235	0.140	0.452	0.473	0.377	0.500	0.400	0.400	0.266	0.735	0.171
RT6	0.747	0.260	0.169	0.769	0.235	0.140	0.628	0.374	0.276	0.668	0.334	0.237	0.729	0.274	0.177	0.500	0.400	0.400

Table 4. 41 Integrated Spherical Fuzzy Comparison Matrix RT sub-criteria

	Spherical Fuzzy Weights ($\widetilde{w}^s$)			**Calculations to obtain crisp weights** S $(\widetilde{w}^s)$	**Crisp Weights** $(\widetilde{w}^s)$	**Rank**
RT1	0.389	0.582	0.301	10.155	0.122	6
RT2	0.420	0.528	0.345	10.832	0.130	5
RT3	0.437	0.519	0.338	11.394	0.137	4
RT4	0.516	0.447	0.330	13.787	0.166	3
RT5	0.624	0.371	0.256	17.428	0.210	2
RT6	0.688	0.307	0.235	19.447	0.234	1
Consistency Ratio (CR) = **0.0962**						

Table 4. 42 Pairwise comparisons of RT sub-criteria

Criteria	Weights Concept	Rank Concept	Sub-criteria	Weights Local	Rank Local	Weights Global	Rank Global
PDSE	0.073	10	**PDSE1**	0.124	6	0.00903	60
			PDSE2	0.128	4	0.00926	58
			PDSE3	0.125	5	0.00908	59
			PDSE4	0.130	3	0.00943	55
			PDSE5	0.111	8	0.00804	69
			PDSE6	0.118	7	0.00858	65
			PDSE7	0.131	2	0.00951	54
			PDSE8	0.133	1	0.00968	51
PA	0.068	13	**PA1**	0.179	5	0.01213	36
			PA2	0.195	3	0.01324	32
			PA3	0.184	4	0.01248	34
			PA4	0.204	2	0.01384	27
			PA5	0.239	1	0.01623	12
MOT	0.082	4	**MOT1**	0.109	6	0.00898	61
			MOT2	0.116	5	0.00957	53
			MOT3	0.108	7	0.00893	63
			MOT4	0.140	4	0.01149	40
			MOT5	0.153	3	0.01258	33
			MOT6	0.178	2	0.01469	22
			MOT7	0.195	1	0.01609	13
ESE	0.079	5	**ESE1**	0.093	8	0.00737	75
			ESE2	0.095	7	0.00756	73
			ESE3	0.097	6	0.00772	72
			ESE4	0.108	5	0.00855	66
			ESE5	0.131	4	0.01043	46
			ESE6	0.150	3	0.01188	38
			ESE7	0.152	2	0.01210	37
			ESE8	0.174	1	0.01382	28
SN	0.083	3	**SN1**	0.319	1	0.02650	2
			SN2	0.220	3	0.01830	8
			SN3	0.295	2	0.02452	3
			SN4	0.165	4	0.01370	29
AS	0.071	11	**AS1**	0.122	5	0.00866	64
			AS2	0.213	2	0.01515	17
			AS3	0.208	3	0.01473	21
			AS4	0.197	4	0.01401	25
			AS5	0.260	1	0.01843	7
INNO	0.079	6	**INNO1**	0.095	7	0.00748	74
			INNO2	0.091	8	0.00722	77
			INNO3	0.098	6	0.00774	71

			INNO4	0.102	5	0.00807	68
			INNO5	0.127	4	0.01005	50
			INNO6	0.141	3	0.01118	44
			INNO7	0.170	2	0.01345	31
			INNO8	0.176	1	0.01391	26
LOC	0.084	2	**LOC1**	0.074	8	0.00623	79
			LOC2	0.073	9	0.00612	80
			LOC3	0.073	10	0.00610	81
			LOC4	0.087	6	0.00728	76
			LOC5	0.082	7	0.00686	78
			LOC6	0.098	5	0.00825	67
			LOC7	0.123	3	0.01036	47
			LOC8	0.123	4	0.01029	48
			LOC9	0.136	1	0.01144	41
			LOC10	0.131	2	0.01096	45
PRS	0.069	12	**PRS1**	0.450	1	0.03099	1
			PRS2	0.329	2	0.02264	4
			PRS3	0.221	3	0.01524	16
PUS	0.085	1	**PUS1**	0.092	7	0.00780	70
			PUS2	0.110	6	0.00928	57
			PUS3	0.111	5	0.00938	56
			PUS4	0.137	4	0.01161	39
			PUS5	0.161	3	0.01366	30
			PUS6	0.193	2	0.01638	11
			PUS7	0.196	1	0.01657	10
PGS	0.076	8	**PGS1**	0.148	5	0.01128	43
			PGS2	0.198	3	0.01507	19
			PGS3	0.199	2	0.01511	18
			PGS4	0.185	4	0.01408	24
			PGS5	0.270	1	0.02053	6
PES	0.078	7	**PES1**	0.147	5	0.01141	42
			PES2	0.191	3	0.01482	20
			PES3	0.207	2	0.01606	14
			PES4	0.186	4	0.01445	23
			PES5	0.269	1	0.02092	5
RT	0.073	9	**RT1**	0.122	6	0.00898	62
			RT2	0.130	5	0.00958	52
			RT3	0.137	4	0.01008	49
			RT4	0.166	3	0.01220	35
			RT5	0.210	2	0.01542	15
			RT6	0.234	1	0.01720	9

Table 4. 43 Weighting and Ranking Results of SFAHP

This research shown criteria of 13 main criteria include Perceived Desirability of Self-employment (PDSE), Personal Attitude (PA), Motivation (MOT), Entrepreneurial Self-efficacy (ESE), Social Norms (SN), Achievement Striving (AS), Innovativeness (INNO), Locus of Control (LOC), Perceived Relational Support (PRS), Perceived University Support (PUS), Perceived Government Support (PGS), Perceived Environmental Support (PES), Risk-taking (RT). Table 4.43 demonstrate the main criteria, sub-criteria and their final ranks based on their weights. According to this table, the following results are obtained:

- **Sub criteria**
  - **Perceived desirability of self- employment (PDSE)**

The proposed mathematical model is solved results are obtained. After solving the model, the results are PDSE1=0.124; PDSE2=0.128; PDSE3=0.125; PDSE4=0.130; PDSE5=0.111; PDSE6=0.118; PDSE7=0.131; PDSE8=0.133.

The optimal ranking order of the 8 sub-criterion of perceived desirability of self-employment is PDSE8 > PDSE7 > PDSE4 > PDSE2 > PDSE3 > PDSE1 > PDSE 6 > PDSE5. Based on Table 4.43, good income (PDSE8) is the essential sub-criterion of perceived desirability of self-employment. That means it has the most substantial influence on the perceived desirability of self-employment.

- **Personal Attitude (PA)**

The defuzzified values of the Personal Attitude (PA) crisp weights in Table 4.43 using Eq. (28) are 0.179, 0.195, 0.184, 0.204 and 0.239, respectively. Thus, PA5 > PA4 > PA2 > PA3 > PA1.

- **Motivation (MOT)**

From Table 4.43, the weighted sum scores of the sub-criterion in Motivation (MOT) are as follows. MOT1=0.109, MOT2=0.116, MOT3=0.108, MOT4=0.140, MOT5=0.153, MOT6=0.178, MOT7=0.195. The ranking is MOT7 > MOT6 > MOT5 > MOT 4 > MOT2 > MOT1 > MOT3. The best sub-criterion in Motivation (MOT) is MOT7. Unemployment is the main reason that motivates students to start a business.

- **Entrepreneurial self-efficacy (ESE)**

Table 4.43 displays the rankings that indicate the ESE8 (experience) as the best one and ESE1 (knowledge) as the last one in ranking. ESE8 (0.174) > ESE7 (0.152) > ESE6 (0.150) > ESE5 (0.131) > ESE4 (0.108) > ESE3 (0.097) > ESE2 (0.095) > ESE1 (0.093).

- **Social Norms (SN)**

The sub-criterion of Social Norms (SN) are evaluated based on the criteria weights. This sub-criterion, their SN1, SN2, SN3 and SN4 values and ranking orders are indicated in Table 4.43. According to SN1, SN2, SN3 and SN4 values are ranked as SN1 > SN3 > SN2 > SN4. In Vietnam, continuing the family tradition is considered the most influential social norm for students to start a business.

- **Achievement striving (AS)**

Determine the essential sub-criterion of Achievement striving (AS) factors that affect the entrepreneurial intention using Eq. (28). The results show that the crisp weight of the highest individual achievement level in the Achievement striving factor has the most significant influence on shaping students' entrepreneurial intentions. Thus, the ranking order of five sub-criterion is obtained as follows: AS5 > AS2 > AS3 > AS4 > AS1, 0.260 > 0.213 > 0.208 > 0.197 > 0.122, respectively.

- **Innovativeness (INNO)**

By using comparative analysis, we use the same data and have solved this problem by crisp weights (Eq. 28) and get results: INNO8 > INNO7 > INNO6 > INNO5 > INNO4 > INNO3 > INNO1 > INNO2 (0.176 > 0.170 > 0.141 > 0.127 > 0.102 > 0.098 > 0.095 > 0.091). We defined that sub-criteria INNO8 (experiment with various ways of doing the same thing) is the best one and INNO2 (people often ask for help in creative activities) is the worst one in terms of the Innovativeness (INNO) factor.

- **Locus of control (LOC)**

The sub-criteria weights of Locus of control (LOC) main criteria were obtained in Table 4.43. With the help of the rules which are used when comparing two rough number, the weights of sub-criteria were compared with respect to each other. The gained sequence of criteria is given as follows: LOC9 > LOC10 > LOC7 = LOC8 > LOC6 > LOC5 > LOC1 > LOC2 = LOC3, 0.136, 0.131, 0.123, 0.123, 0.098, 0.087, 0.082, 0.074, 0.073, 0.073, respectively.

- **Perceived Relational Support (PRS)**

Family members' support (PRS1), which has 0.450 crisp weight, is essential for Perceived Relational Support (PRS) in entrepreneurial intention, as seen in Table 5. Additionally, two criteria are determined as friends support and close network support, 0.329 and 0.221, respectively.

- **Perceived University Support (PUS)**

As a result of the application, the crisp weights of sub-criteria in Perceived University Support (PUS) are calculated as follows: PUS1=0.092, PUS2=0.110, PUS3=0.111, PUS4=0.137, PUS5=0.161, PUS6=0.193, PUS7=0.196 The ranking is given as PUS7 > PUS6 > PUS5 > PUS4 > PUS3 > PUS2 > PUS1. Workshops, seminars and training regarding entrepreneurship be prepared University/school (PUS7) is selected as the most affect factor.

- **Perceived Government Support (PGS)**

The data are presented in Table 4.43 presents numerical calculations and the final weights of the sub-criteria in Perceived Government Support (PGS). The government provides financial incentives for startups (PGS5) is the most important criterion. Then, procedures to start a business (PGS3), the government supports the creation of new business (PGS2), the government provides tax facilities for start-ups (PGS4), and government supports youth entrepreneurship (PGS1) follow. The weights are 0.270, 0.199, 0.198, 0.185 and 0.148 respectively.

- **Perceived Environmental Support (PES)**

Table 4.43 lists the weights and ranks for the criteria. The results indicate that PES5 (Politics in Vietnam) is the most important with a weight of '0.269'; closely followed by PES3 (loans in Vietnam), PES2 (opportunities for entrepreneurs in Vietnamese economy provides) and PES4 (Infrastructure in Vietnam) with weights of '0.207', '0.191' and '0.186', respectively. Finally, the last preferred alternative is PES1 which is the advantage of owning a business and being employed in Vietnam society (0.147).

- **Risk-taking (RT)**

Table 4.43 displays the rankings that RT6 (work for a small business or a large business) as the best one and RT1 (trust own judgment) as the last one in the ranking (RT6 > RT5 > RT4 > RT3 > RT2 > RT1).

- **Main criteria**

The weights of these criteria were calculated by the SF-AHP method. According to the evaluation results, as it is expected, Perceived University Support (PUS) and Locus of Control (LOC) are found as the most important criteria. It is good to see that the weight of Social Norms (SN) criteria is very close to these criteria. In addition to MOT (Motivation), ESE (Entrepreneurial Self-efficacy), INNO (Innovativeness), PES (Perceived Environmental Support) and PGS (Perceived Government Support) as the following five

criteria that affect the entrepreneurial intention of students FPT. Furthermore, the factor that has the most negligible influence on entrepreneurial intention is PA (Personal Attitude), and this is followed by PRS (Perceived Relational Support), AS (Achievement Striving), PDSE (Perceived Desirability of Self-employment) and RT (Risk-taking). Base in Table 4.43, the rank of the main criteria is PUS > LOC > SN > MOT > ESE = INNO > PES > PGS > RT = PDSE > AS > PRS > PA, with crisp weights is 0.085, 0.084, 0.083, 0.082, 0.079, 0.079 0.078, 0.073, 0.073, 0.071, 0.069, 0.068 respectively.

- **81 sub-criteria**

Weight coefficients of the sub-criteria are determined using step 6 to obtain the relative weight coefficients. This final weight coefficient indicates the importance of one criterion relative to other criteria. The final relative weight coefficients of the criteria are shown in Table 4.43. It is also surprising that although Perceived Relational Support (PRS) criteria are one in criteria the least important (the rank is 12/13), its subcriterion titled 'family's support' (PRS1) has the highest importance among all sub-criteria. In other words, ‘family's support’ is the most influential sub-criteria to students' entrepreneurial intention, followed by ‘continue family traditions’ (SN1). The least influential sub-criteria is ‘INNO3’ (compare between skill and new idea).

4.3. Discussions

- **Perceived Desirability of Self-employment**

Firstly, these findings are in line with the results of (Yousaf *et al.*, 2015), which states that the greater the Perceived Desirability of Self-employment, the greater is the intention to become entrepreneurs. Similarly, Shepherd and Douglas (2000) indicated that all employees would be incentivized to be self-employed. Also, the greater their managerial and entrepreneurial ability, the greater their incentive to be self-employed, other things being equal. Next, they showed that a more positive attitude to work (i.e., a lesser aversion to work effort required) provides a greater incentive to be self-employed. The individual's degree of risk aversion also influences the choice to be an entrepreneur. The more tolerant one is of risk-bearing, the greater the incentive to be self-employed.

Similarly, the greater the preference for independence, or decision-making control, the greater the incentive to be self-employed. Conversely, Burchell and Coutts (2019) used the International Labour Organization’s 2012 School-to-Work Transition Survey from 28 developing countries to provide new evidence of young people’s experience of job quality and associated working conditions in self-employment. They found that self-employment is

not necessarily favorable for young people's economic and social benefits. They also found little evidence that young people are making utility-maximizing decisions concerning their employment status. Furthermore, they argue that if youth employment policies overlook the importance and role of kinship networks in the uptake of self-employment, they are likely to be even less effective than other programs to promote entrepreneurship.

- **Personal Attitude**

Tshikovhi and Shambare (2015) investigated how action-based entrepreneurship training influences entrepreneurial knowledge and personal attitudes, which in turn reportedly develop individuals' entrepreneurship intentions. A cohort of students who had undergone social entrepreneurship training under the auspices of Enactus South Africa was studied to determine the relationship between these three key variables associated with entrepreneurship tendencies. The study, in particular, addresses the question of whether practical entrepreneurship training bears any consequences on developing students' attitudes, entrepreneurship knowledge, and entrepreneurship intentions. While findings of the study indicated that entrepreneurial knowledge and personal attitudes significantly influence entrepreneurship intentions, personal attitudes were observed as having a more significant influence on the former. Rosique-Blasco et al. (2018) found that personal abilities play an important role in understanding the theory of planned behavior and could promote entrepreneurship through several approaches.

- **Motivation**

The components of entrepreneurial motivation affecting career entrepreneurship intention are behavioral control, subjective norm, and attitude towards entrepreneurship. The level of behavioral control is excellent; subjective norms and attitudes towards entrepreneurship are good. Subjective norms and attitudes of self-employment are significantly related to both student's immediate and future entrepreneurship intentions. However, behavioral control entrepreneurial motivation is significantly related to students' immediate career intention but not entrepreneurship career intention. (Kim-Soon *et al.*, 2016)**.** Herdjiono *et al.* (2018) implied that individual factors such as self-concept, motivation, risk-taking propensity, social factors, and family environment affect entrepreneurial intention.

- **Entrepreneurial Self-efficacy**

Purwana and Suhud (2018) showed that taking motivation affected giving motivation and giving motivation affected intention significantly. Omar *et al.* (2019), self-efficacy, independence, and motivation significantly influenced the students' intention to become entrepreneurs, explaining 52% of the variance in intention to become entrepreneurs. Additionally, the findings indicate that motivation is the critical factor in the entrepreneurial intent of the students. These findings contribute to a better understanding of students' intention to become entrepreneurs, which is necessary to increase more university students to become job creators rather than job seekers.

- **Social Norms**

Social Norm looks at the influence of an external environment that may nurture the desire to start a business. Consistent with earlier research, we found that social norms are positively associated with entrepreneurial intention. For instance, Moriano et al. (2012) confirm that social norms significantly predict entrepreneurial intention. In addition, Van Gelderen et al. (2008) also found that social norm was significant in explaining intention towards entrepreneurship; they further discussed that students having entrepreneur family members and friends had positive social norms regarding entrepreneurship. Nonetheless, on the contrary, do Paço et al. (2011) conclude that social norm has traditionally played a weak role in predicting entrepreneurial intention and is insignificant in influencing entrepreneurial intention. Similarly, Shook & Bratianu (2010) also assert that social norm is not positively related to entrepreneurial intention.

- **Achievement Striving**

Achievement Striving is similar to McClelland's (1961) "need for achievement" concept, which is based on classical theories of need as a motivator of human behavior (e.g., Maslow, 1970) and is closely related to Murray's (1938) theory of psychogenic needs; also called "press-needs" (which pressure a person to act in ways that satisfy those needs). McClelland suggested that individuals with a strong achievement motive often find their way to entrepreneurship and succeed better than others at such endeavors. McClelland (1985) also argued that individuals who strive to achieve gravitate toward situations where they can attain results through their efforts, pursue moderately tricky goals, and receive prompt feedback on how they are doing. Research has shown that the desire to achieve has been a powerful predictor of entrepreneurship (Collins *et al.*, 2004). Although the desire to achieve is high for the Chinese in general (see Lau & Busenitz, 2001), Koh (1996) did not

find a difference in achievement needs between Chinese MBA students who were and were not entrepreneurially inclined. Moreover, it is similar to our study results.

- **Innovativeness**

Next, our study found that Innovativeness mediated the relationship between entrepreneurial passion and entrepreneurial intentions. This is consistent with prior research showing entrepreneurial enthusiasm for creativity and innovation (e.g., (Oxman Ryan, 2015; Anonymous., 2016) and entrepreneurial innovation (e.g., Ghaleb, 2010).

- **Locus of Control**

The Locus of Control factor ranks second in the total factors affecting the intention to start a business. Similarly, based on (Ayodele 2013) research, the findings revealed that locus of control had a significant correlation with the adolescents' entrepreneurial intentions. Data collected was analyzed Hierarchical Multiple Regression Analysis. Moreover, it is confirmed by (Kundu *et al.*, 2008) work, Robinson and King (1991), who discovered that "perspective person (locus of management) of company performance is concerned with the perceptions of control and influence of individuals over their businesses. Internal person control leads to a positive entrepreneurial attitude". Also, adolescents' entrepreneurial intention was positively correlated with the locus of control. This outcome is supported by the findings of Strauss (2005).

Furthermore, according to research by Tentama & Abdussalam, 2020 used product moment analysis techniques, it showed a significant positive relationship between internal locus of control with entrepreneurial intention, with a significance level (p) of 0.030. Internal locus of control contributed 2.1 percent to entrepreneurial intention so that other variables influenced the remaining 97.9 percent. This study could conclude that students' internal locus of control can predict students' entrepreneurship intention.

- **Perceived Relational Support**

These findings align with Ambad and Damit's (2016) results, which showed perceived relational support is the predictor of entrepreneurial intention. In addition, the study conducted among young Australians concluded that friends significantly influence their decision to start a business (Nanda & Sorensen, 2009; Sergeant & Crawford, 2001). It is also found that the support from family, friends and close network among 425 Turkish university students was positively influenced their decision to become an entrepreneur (Yurtkoru *et al.*, 2014). Similarly, Altinay et al. (2012), in a study of university hospitality

students in the UK, found that family entrepreneurial background positively related to entrepreneurial intention. Supporting these, Zapkau et al. (2015) also found that parental role models positively influence entrepreneurial intention.

- **Perceived University Support**

In our research, Perceived University Support is the most critical factor affecting entrepreneurial intention. These are consistent with the opinion of (Audretsch 2014; Guerrero & Urbano, 2012), who wrote that there had been a growing recognition of the importance of entrepreneurial universities to society. Besides, the study of Lu et al. (2021) utilized 13,954 recent college graduates from Chinese higher education institutions, and findings also indicate that university entrepreneurship support positively impacts students' entrepreneurial intentions. However, it is not a very strong relationship. Moreover, university entrepreneurship support positively affects entrepreneurial attitude, subjective norms, and entrepreneurial self-efficacy, determining entrepreneurial intention. Broadly, supportive university environments can increase student's interest in entrepreneurship as a career choice through increasing their knowledge, confidence and promoting self-efficacy.

- **Perceived Government Support**

(Sivarajah and Achchuthan, 2013) Agropreneurship refers to producing, processing, and selling various agricultural products. Essentially, the Sabah Agriculture Blueprint 2021-2030 aims to attract more public involvement, particularly among graduates in the agriculture and fisheries sector, while lessening such imported goods. The Sabahan youth could benefit from this blueprint. Despite this significance, youth participation in the agricultural industry remains low. Therefore, this study examined the effect of the perceived government support on the attitude towards solopreneurship and PBC.

On top of that, this study investigated the effect of Perceived Government Support, the attitude towards solopreneurship, PBC, and Social Norms (SN) on the solopreneurship intention of Sabahan youth. In this study, 353 Sabahan youth participated, analyzed using Partial Least Squares-Structural Equation Modelling. The results revealed that all hypotheses were significant, except for social norms and solopreneurship intention. In sum, this study could contribute to formulating policies and relevant programs, especially in increasing youth participation in solopreneurship. (Ambad *et al.*, 2020)

- **Perceived Environmental Support**

Entrepreneurial Intention is a vital part of entrepreneurship. This paper aims to explore internal and external impact factors on the entrepreneurial intention from the

perspective of information transfer (Schwarz *et al.*, 2009). It examines how cultural differences, environmental factors, and environmental education affect entrepreneurial intention. A questionnaire-based survey on Chinese and American college students is conducted to verify three hypotheses. The results show no significant difference in the level of entrepreneurial intention among students of universities in China and American (American-born Chinese) college students that the perceived environmental support of individuals is in good relation with their business intent (Ao and Liu, 2014).

- **Risk-taking**

The personal characteristics of entrepreneurs can be significantly related to entrepreneurial startup intentions and behaviors. This study conceptually developed and empirically tested a country-moderated hypothesis, including the relationship between an individual's risk-taking propensity and entrepreneurship (behaviors or intentions) (Antoncic *et al.*, 2018). The data collection was performed through a structured questionnaire. Multinominal logistic regression was used for analyzing data obtained from 1,414 students in six countries. The crucial contribution of this research is the clarification of the character of risk-taking propensity in entrepreneurship and the indication that the risk-taking propensity entrepreneurship relationship can be moderated contingent on power distance.

Lu et al.'s (2021) study investigates the impact of risk-taking propensity on social entrepreneurial intention and examines the mediating effects of perceived feasibility and desirability. The results were obtained from a survey of 795 final semester students. Four steps suggested by Baron and Kenny (1986) were followed to test the mediation effects of perceived desirability and perceived feasibility in the relationship between risk-taking propensity and social entrepreneurial intention. There is no direct relationship between risk-taking propensity and entrepreneurial intention. The results showed that perceived feasibility fully mediated the effects of risk-taking propensity to social entrepreneurial intention. These results are expected to trigger a change in education about social entrepreneurship by developing programs for individuals who have different perceived risks. In addition, knowledge and skills to reduce individuals' perceived risk also need to be more concerned.

CHAPTER 5: CONCLUSIONS AND IMPLICATIONS

5.1. Conclusions

Entrepreneurs are considered as one of the essential factors in the dynamism of the economy. Therefore, it is necessary to understand which initiatives can improve the creation of new companies. In this project, we studied the impact on students' entrepreneurial intention.

The aim and objectives of this thesis have been identified in Chapter 1. The research analyzes the intention and trend of student entrepreneurship globally and Vietnam in particular. In addition, it shows how entrepreneurship elements connect to business purposes (i.e., Perceived Desirability of Self-employment, Personal Attitude, Motivation, Entrepreneurial Self-efficacy, Social Norms, Achievement Striving, Innovativeness, Locus of Control, etc.). This thesis requires an objective approach using the Spherical Fuzzy Analytic Hierarchy Process that highlights the relationship between variables. Based on the findings, the objectives of this thesis are achieved. The objectives are explored by analyzing the data collected using the Spherical Fuzzy Analytic Hierarchy calculation formulas, which underpins the relationship between the variables.

The study results show that these factors that have the most significant influence on business intention are perceived university support followed by locus of control. This shows that college support has a significant influence on students' entrepreneurial intentions. Besides, students also focus on the locus of control. The social norm criterion ranks third, but the weight is close to the two criteria mentioned above. Factors such as motivation, entrepreneurial self-efficacy, innovativeness, perceived environmental support, and perceived government support have medium influence. The factors that have less influence on students' business intention are personal attitude, perceived relational support, achievement, perceived desirability of self-employment, and finally, risk-taking factor.

Thus, this research contributes to the development of entrepreneurship education in Vietnam universities. Plus, the study also influences the introduction of government policies to support start-ups to suit the needs of students.

5.2. Limitation

This research was based on an extensive review of previous empirical research of students’ entrepreneurship intention and influencing factors. The research was implemented based on the quantitative method, gathered through direct interviews and then analyzed by

SF-AHP. However, every research has some limitations (Saunders et al., 2009), this research reveals some specific limitations that should be highlighted.

The first limitation is that various personally specified weights of the performance measurement produce changeable decision outcomes, which generate inconsistent results. Therefore, study outcomes might mislead the generalization of results.

Second, it is generally challenging for decision-makers to quantify their evaluations. Moreover, weight assignment is problematic when the number of criteria and alternatives increases.

Third, this study did not focus on entrepreneurial intention stability over time, and the focus was on the antecedents of students' entrepreneurial intention.

Despite the stated limitations, this research provides valuable knowledge for academics, practitioners, and government regarding the current system. It provides insight into required changes to encourage mind-sets shifts between students.

5.3. Implication

In terms of practical implications, this study measures the entrepreneurial intention of FPT University. Results imply a better understanding of Students' qualities, of how the support offered by the university, the environment and government towards business, of attitudes towards behavior, social standards and perceived controls of behavior and of an intention to become entrepreneurship are perceived in policymakers, universities, practitioners and other concerned parties. The findings should assist the Vietnamese government in better addressing the central problem of unemployment and underemployment by establishing policies and programs that encourage university students to seek a career in entrepreneurship. A national policy that promotes entrepreneurship and development is necessary (Don Y. and Erick W., 2001). A national entrepreneurship plan is suggested to be implemented to achieve a business-friendly environment that creates a conducive ecosystem. Such measures may inspire students to carefully consider entrepreneurship as a career option and encourage students who have already graduated to start their innovative firm in Vietnam. The small firms may grow by receiving finance and business development services, which will expose them to new markets and networks, especially during their early years. To create a better climate for Vietnamese entrepreneurs, we propose that the Vietnamese government give tax advantages and low-interest loans and minimize the cost and time required for business registration procedures.

Moreover, entrepreneurship awareness and open days should be held to provide basic information on registration, finance, and marketing to new businesses (local, national and international). The plan must include the Ministry of Higher Education due to its role in supervising the universities and schools in the country. The ministry should promote the value of entrepreneurship education in colleges and schools and endeavor to ensure a high-quality entrepreneurship program.

In this study, table 4.3, pairwise comparisons of main criteria show that Perceived University Support has the most significant influence on a student's intention to start a business. Such findings may motivate the institution to reconsider its curriculum, extracurricular activities, and new initiatives to encourage students to become entrepreneurs. There is a room for improving the university position towards entrepreneurship and taking advantage of the high proportion of students answered that they would like to attend entrepreneurship course and training. It emphasizes the need to modernize the university environment in Vietnam, and this environment should be more dynamic and rich in experiences that increase students' self-esteem and confidence. Another important implication relates to the pedagogical solutions which motivate students to innovation and creative behavior (Fayolle, 2018; Joensuu-Salo *et al.*, 2015; Jones and Iredale, 2010). Universities should concentrate on developing successful entrepreneurship courses, and they may learn from the experiences of other universities and apply worldwide best practices to boost Vietnam's entrepreneurial ambitions. This type, of course, should focus on the development of student's abilities and knowledge in the areas of start-ups, idea generation, creativity, problem-solving, and critical thinking. The course content must be based on applicable and objective information regarding Vietnam. Workshops, guest lecturers, entrepreneurial role models are critical for building student's minds towards entrepreneurship. Besides, universities should invest in entrepreneurship and business advising centers and incubators that give students appropriate market knowledge, finance sources, legal guidance, and other critical services.

An entrepreneurial-oriented culture should be emphasized and created in order to promote students' attitudes toward entrepreneurship. In this study, the relation between social norms and entrepreneurial intentions was ranked 3rd out of thirteen main factors, suggesting an urgent need to recognize and prefer entrepreneurship as a career in society. Simultaneously, an individual's perception regarding their ability to engage with entrepreneurship could be boosted by lifting confidence by teaching the required

entrepreneurial skills. It was also felt that some entrepreneurship components could be inculcated at an early stage of education, thereby encouraging an entrepreneurial culture in Vietnam. Students should be encouraged to become entrepreneurs and be job creators rather than depending on government and other private organizations.

A priority is to create a favorable macroeconomic environment and investment climate for increased private sector growth. Facilitate market access to help the private sector develop and create employment. Promote entrepreneurship as a realistic means of escaping poverty and unemployment. In particular, campaigns aimed at the unemployed youth will encourage an entrepreneurial culture beneficial to private sector growth.

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APPENDIX

Questionnaires

For Example

Concerning the overall 13 main criteria

Q1: How important is the **Perceived desirability of self-employment (PDSE)** compared with **Personal Attitude (PA)**?

Q2: How important is the **Perceived desirability of self-employment (PDSE)** when it is compared with **Motivation (MOT)**?

Q3: How important is the **Perceived desirability of self-employment (PDSE)** compared with **Entrepreneurial self-efficacy (ESE)**?

Q4: How important is the **Perceived desirability of self-employment (PDSE)** when it is compared with **Social Norms (SN)**?

Q5: How important is the **Perceived desirability of self-employment (PDSE)** compared with **Achievement striving (AS)**?

Q6: How important is the **Perceived desirability of self-employment (PDSE)** compared with **Innovativeness (INNO)**?

Q7: How important is **Perceived desirability of self-employment (PDSE)** compared with **Locus of Control (LOC)**?

Q8: How important is the **Perceived desirability of self-employment (PDSE)** when it is compared with **Perceived Relational Support (PRS)**?

Q9: How important is **Perceived desirability of self-employment (PDSE)** compared with **Perceived University Support (PUS)**?

Q10: How important is the **Perceived desirability of self-employment (PDSE)** when it is compared with **Perceived Government Support (PGS)**?

Q11: How important is the **Perceived desirability of self-employment (PDSE)** when it is compared with **Perceived Environmental Support (PES)**?

Q12: How important is the **Perceived desirability of self-employment (PDSE)** when it is compared with **Risk-taking (RT)**?

Q13: How important is **Personal Attitude (PA)** compared with **Motivation (MOT)**?

Q14: How important is **Personal Attitude (PA)** compared with **Entrepreneurial self-efficacy (ESE)**?

Q15: How important is **Personal Attitude (PA)** compared with **Social Norms (SN)**?

Q16: How important is **Personal Attitude (PA)** compared with **Achievement striving (AS)**?

Q17: How important is **Personal Attitude (PA)** compared with **Innovativeness (INNO)**?

Q18: How important is **Personal Attitude (PA)** compared with **Locus of Control (LOC)**?

Q19: How important is **Personal Attitude (PA)** compared with **Perceived Relational Support (PRS)**?

Q20: How important is **Personal Attitude (PA)** compared with **Perceived University Support (PUS)**?

Q21: How important is **Personal Attitude (PA)** compared with **Perceived Government Support (PGS)**?

Q22: How important is **Personal Attitude (PA)** compared with **Perceived Environmental Support (PES)**?

Q23: How important is **Personal Attitude (PA)** compared with **Risk-taking (RT)**?

Q24: How important is **Motivation (MOT)** compared with **Entrepreneurial self-efficacy (ESE)**?

Q25: How important is **Motivation (MOT)** compared with **Social Norms (SN)**?

Q26: How important is **Motivation (MOT)** compared with **Achievement striving (AS)**?

Q27: How important is **Motivation (MOT)** when it is compared with **Innovativeness (INNO)**?

Q28: How important is **Motivation (MOT)** compared with **Locus of Control (LOC)**?

Q29: How important is **Motivation (MOT)** compared with **Perceived Relational Support (PRS)**?

Q30: How important is **Motivation (MOT)** compared with **Perceived University Support (PUS)**?

Q31: How important is **Motivation (MOT)** compared with **Perceived Government Support (PGS)**?

Q32: How important is **Motivation (MOT)** compared with **Perceived Environmental Support (PES)**?

Q33: How important is **Motivation (MOT)** when it is compared with **Risk-taking (RT)**?

Q34: How important is **Entrepreneurial self-efficacy (ESE)** compared with **Social Norms (SN)**?

Q35: How important is **Entrepreneurial self-efficacy (ESE)** compared with **Achievement striving (AS)**?

Q36: How important is **Entrepreneurial self-efficacy (ESE)** compared with **Innovativeness (INNO)**?

Q37: How important is **Entrepreneurial self-efficacy (ESE)** compared with **Locus of Control (LOC)**?

Q38: How important is **Entrepreneurial self-efficacy (ESE)** compared with **Perceived Relational Support (PRS)**?

Q39: How important is **Entrepreneurial self-efficacy (ESE)** compared with **Perceived University Support (PUS)**?

Q40: How important is **Entrepreneurial self-efficacy (ESE)** compared with **Perceived Government Support (PGS)**?

Q41: How important is **Entrepreneurial self-efficacy (ESE)** compared with **Perceived Environmental Support (PES)**?

Q42: How important is **Entrepreneurial self-efficacy (ESE)** compared with **Risk-taking (RT)**?

Q43: How important is **Social Norms (SN)** compared with **Achievement striving (AS)**?

Q44: How important is **Social Norms (SN)** compared with **Innovativeness (INNO)**?

Q45: How important is **Social Norms (SN)** compared with **Locus of Control (LOC)**?

Q46: How important is **Social Norms (SN)** compared with **Perceived Relational Support (PRS)**?

Q47: How important is **Social Norms (SN)** compared with **Perceived University Support (PUS)**?

Q48: How important is **Social Norms (SN)** compared with **Perceived Government Support (PGS)**?

Q49: How important is **Social Norms (SN)** compared with **Perceived Environmental Support (PES)**?

Q50: How important is **Social Norms (SN)** compared with **Risk-taking (RT)**?

Q51: How important is **Achievement striving (AS)** compared with **Innovativeness (INNO)**?

Q52: How important is **Achievement striving (AS)** compared with **Locus of Control (LOC)**?

Q53: How important is **Achievement striving (AS)** compared with **Perceived Relational Support (PRS)**?

Q54: How important is **Achievement striving (AS)** compared with **Perceived University Support (PUS)**?

Q55: How important is **Achievement striving (AS)** compared with **Perceived Government Support (PGS)**?

Q56: How important is **Achievement striving (AS)** compared with **Perceived Environmental Support (PES)**?

Q57: How important is **Achievement striving (AS)** compared with **Risk-taking (RT)**?

Q58: How important is **Innovativeness (INNO)** compared with **Locus of Control (LOC)**?

Q59: How important is **Innovativeness (INNO)** compared with **Perceived Relational Support (PRS)**?

Q60: How important is **Innovativeness (INNO)** compared with **Perceived University Support (PUS)**?

Q61: How important is **Innovativeness (INNO)** compared with **Perceived Government Support (PGS)**?

Q62: How important is **Innovativeness (INNO)** compared with **Perceived Environmental Support (PES)**?

Q63: How important is **Innovativeness (INNO)** compared with **Risk-taking (RT)**?

Q64: How important is **Locus of Control (LOC)** compared with **Perceived Relational Support (PRS)**?

Q65: How important is **Locus of Control (LOC)** compared with **Perceived University Support (PUS)**?

Q66: How important is **Locus of Control (LOC)** compared with **Perceived Government Support (PGS)**?

Q67: How important is **Locus of Control (LOC)** compared with **Perceived Environmental Support (PES)**?

Q68: How important is **Locus of Control (LOC)** compared with **Risk-taking (RT)**?

Q69: How important is **Perceived Relational Support (PRS)** compared with **Perceived University Support (PUS)**?

Q70: How important is **Perceived Relational Support (PRS)** compared with **Perceived Government Support (PGS)**?

Q71: How important is **Perceived Relational Support (PRS)** compared with **Perceived Environmental Support (PES)**?

Q72: How important is **Perceived Relational Support (PRS)** compared with **Risk-taking (RT)**?

Q73: How important is **Perceived University Support (PUS)** compared with **Perceived Government Support (PGS)**?

Q74: How important is **Perceived University Support (PUS)** compared with **Perceived Environmental Support (PES)**?

Q75: How important is **Perceived University Support (PUS)** compared with **Risk-taking (RT)**?

Q76: How important is **Perceived Government Support (PGS)** compared with **Perceived Environmental Support (PES)**?

Q77: How important is **Perceived Government Support (PGS)** compared with **Risk-taking (RT)**?

Q78: How important is **Perceived Environmental Support (PES)** compared with **Risk-taking (RT)**?