Using Socioecological Systems Based on a Modified Delphi Method to Explore Entrepreneurship Education

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Abstract

Entrepreneurship can substantially influence a country's economy, not only stimulating economic growth but also encouraging national development during periods of economic recession. As indicated by Schumpete in 1934, entrepreneurship refers to a series of behaviors required for economic resource management and redistribution; the purpose of entrepreneurship is to create economic value. In 1985, Gartner proposed four dimensions of entrepreneurship: individuals, environments, organizations, and new venture processes. Most studies on entrepreneurship education have focused on entrepreneurial spirit, knowledge, and skills. Some basic concepts are crucial for entrepreneurship education and research; if entrepreneurial phenomena can be clarified from a theoretical perspective, then an excellent entrepreneurship education model can be established and various entrepreneurial talents can be cultivated (e.g., the socioecological systems framework developed by Ostrom). In the present study, a modified Delphi method was used to investigate entrepreneurship education; we found that entrepreneurship education was related to society, the economy, policies, and ecological systems. Finally, we hoped that the results of this study could serve as a reference for education authorities to formulate polces on entrepreneurship education.

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1   Introduction

Both entrepreneurs' internal factors and external factors such as social systems influence the development of entrepreneurship education. Baron and Tang [1] indicated that entrepreneurs destroy the existing economic order by introducing new products and services, creating new organizations, or developing new materials. Entrepreneurs are those who undertake entrepreneurial activities. According to Colin and Jack [2] the core of entrepreneurship education includes entrepreneurial knowledge, ability, opportunities, and spirit. According to the socioecological model, entrepreneurship is type of activity where the interaction between people, society, policies, and the ecological environment is crucial.

Entrepreneurial activities are closely related to the economic development of a country. National competitiveness is typically influenced by business operation and management, trade direction, the financial system, and factors that stimulate national economic growth. Currently, three critical factors related to the development of a competitive economy are knowledge, innovation, and entrepreneurial spirit. In the background of the knowledge economy, education is the only method for developing entrepreneurship and enhancing competitiveness and well-being. Popescu and Crenicean [3] stated that entrepreneurship is a type of economic behavior through which individuals, society, and resources are interconnected. "Society" or "community" refers to the environment where people live and undertake a range of activities. Thus, in addition to entrepreneurial spirit, knowledge, and skills, socioecological environments are crucial for understanding entrepreneurship education. According to previous studies, new commercial opportunities are derived from market changes such as technological, political and regulatory, social and demographic, and industrial changes, as described in a socioecological systems framework developed by Ostrom [4]. In the present study, we showed that according to expert opinions, entrepreneurship education can solve entrepreneurial dynamic problems through an analysis of socioecological systems.

2   Literatures Review

2.1 Society ecological theory

In 1992, Bronfenbrenner [5] developed the ecological systems theory to explore the interaction between humans and the environment (including society, systems, geographical environments, and cultural contexts). Bronfenbrenner emphasized that changes in individual behavior are influenced by physical and social environments; in addition, these physical and social environments are mutually influential. Focusing on the influence of a single factor on individual behavior would lead to an underestimation of the influences of other factors. Therefore, multiple factors must be considered when attempting to understand individual behavior. The ecological systems theory provides a complete framework to

understand factors that influence individual behavior and helps researchers understand the influences of environmental factors on behavioral changes.

According to Charles Zastrow [6] socioecological systems can be categorized into three basic types: microsystems, mesosystems, and macrosystems. The microsystem refers to individuals in the socioecological environment; individuals are not only biosocial systems but also psychosocial systems. The mesosystem refers to small groups (e.g., families, occupational groups, or other social groups). The macrosystem refers to large social systems (e.g., cultures, communities, institutions, and organizations).

Ostrom [4] established a socioecological systems framework that provided a platform for understanding the tragedies of the commons and anticommons and overcoming social dilemmas. The socioecological systems framework revealed that socioecological systems include four core systems that are mutually influential and are related to society, the economy, policies, and ecological systems. These systems include resource systems, resource units, management systems, and users. In addition, each core system contains multiple secondary variables (e.g., the size of a resource system, the flexibility of a resource unit, management level, and the knowledge of users about the resource system).

2.2 Entrepreneurship education

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), entrepreneurship education in a broad sense is the cultivation of entrepreneurs; it involves educational activities that help learners develop innovative behavior in social, economic, cultural, and political fields, expand development into new spaces, and explore opportunities. In the United States, the first center for entrepreneurship was founded at Babson College in 1978, leading research in and the development of entrepreneurship education.

UNESCO proposed three educational passports in an international conference on education in the 21st century: entrepreneurship, academic, and vocational education. Therefore, entrepreneurship education was considered to be as crucial as academic and vocational education because it was argued to enhance a country's entrepreneurship level and innovation ability, encourage schools to cooperate with enterprises, and solve university students' employment problems.[24]

Solomon [7] indicated that the core values and objectives of entrepreneurship education are to obtain various commercial opportunities and ideas and to create benefits and value for society. After years of implementing entrepreneurship education, the United States developed an excellent systematic entrepreneurship education program that covered four major areas: entrepreneurial awareness, entrepreneurial knowledge, entrepreneurial skills, and entrepreneurial practices.

Regarding entrepreneurship problems, Gartner [8] proposed four dimensions: 1) individuals—entrepreneurs, 2) environments—conditions that influence new organizations, 3) organizations—the founding of new organizations, 4) new venture processes—initiatives spearheaded by individuals.

2.3 The relationship between ecological systems and entrepreneurship education

As indicated by Liu [9] entrepreneurship education was first implemented and became prevalent in the United States. Entrepreneurship education was crucial for stimulating the economic and social development of the United States. Liu analyzed entrepreneurship education in U.S. universities from an ecological systems perspective and indicated that entrepreneurship education can continue to develop.

As indicated by Yagoub [10] Developing Knowledge based Entrepreneurship requires building a Knowledge-Based Entrepreneurship ecosystem that include all actors and factors which contribute developing Knowledge based Entrepreneurship.

Fuerlinger &. Funke [11] indicated that Germany already features a dynamic entrepreneurship ecosystem and has a distinct political agenda to promote entrepreneurship. Improvements have been made in the regulatory environment and in entrepreneurship education, especially tertiary education, and publicly funded programs support the early stages of new ventures.

3   Research Model

The world is currently threatened by climate change and the loss of natural resources including fisheries, forests, and lakes. The use of natural resources to start an undertaking occurs in a complex socioecological system (e.g., a resource system such as offshore fisheries, a resource unit such as lobsters, users such as fishermen, and government actors such as fishery agencies and regulations). Although these secondary systems are separate, they interact with one another and influence other socioecological systems.

In the present study, we adopted the socioecological systems framework proposed by Ostrom[4], consulted with experts and scholars, and developed an entrepreneurship archetype to explore the development of entrepreneurship education (Fig. 1). According to the socioecological systems framework, the development of entrepreneurship education involves four systems that are mutually influential and are related to policies and social, economic, and ecological systems. The four systems are a resource system (e.g., an entrepreneurial environment), a resource unit (e.g., an entrepreneurial education unit), users (e.g., entrepreneurs), and a management system (e.g., agencies and regulations that govern entrepreneurship education units).

3.1 Entrepreneurship archetype

Social, economic and policy measures

Resource

Management System

Entrepreneurship

Education

Development

Resource unit

entrepreneur
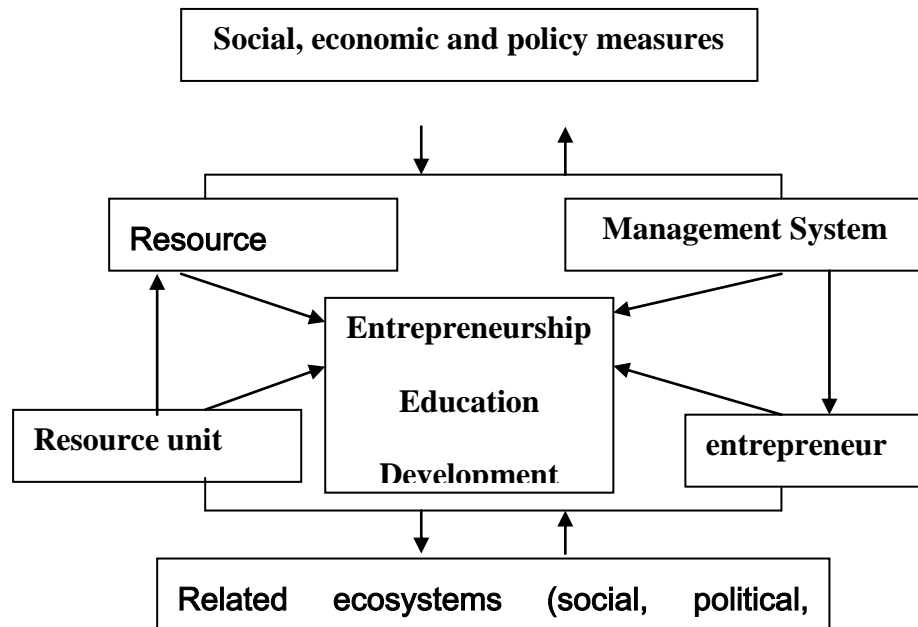
Related   ecosystems   (social,   political,

Figure 1: Entrepreneurship archetype

The society, economy, and policies; a resource system; a management system; the development of entrepreneurship education; a resources unit; entrepreneurs; related ecological systems (society, politics, and education)

3.2 Model validation

The Delphi involves iterative rounds of structured group communication. Round 1 consists of an idea-generating exercise which typically involves participants independently producing a list of ideas or statements. In this study however, the lead author conducted in-depth qualitative interviews with each participant. This is a modification of the Delphi method which has been successfully carried out in previous studies and which in our view would maximize participant involvement.

Interviews were conducted using a semi-structured inter-view guide which included open non-leading questions. Interviews were audio-recorded and transcribed verbatim by the lead author or an independent transcription service. All transcriptions were checked by the lead author. Additional field notes were taken and considered during analysis. Analysis was based on principles of thematic and framework analysis and conducted by coding in Microsoft Word 2010 using the 'Comments' function and charting in Microsoft Excel 2010. Framework analysis features a number of stages, involving familiarizing self with the data, developing a thematic framework and charting and mapping to identify

patterns within the data. This enabled a list of statements regarding clinical practice to be prepared for the next Delphi round.

In round 2, these statements were distributed back to the group using Survey Monkey, a web-based questionnaire. Participants were asked to indicate their level of agreement with each statement using a 3-point Likert scale.

Statistical analysis was conducted using Microsoft Exce2010. Group consensus was defined a priori as a median group rating or more as used in previous Delphi studies. Following the Delphi method, items achieving consensus were accepted. Items not achieving consensus were circulated back to the participants for reconsideration in round 3. These were presented with the participant's original rating, the group rating and an invitation to re-consider their rating which they could accept or decline. Where a new rating was offered, this was used to reanalysis the group rating. Free-text comments from round 2 were analyzed qualitatively and which could lead to the generation of new statements to be distributed in round 3. We planned for each statement to be circulated a maximum of two times, and a maximum of four Delphi rounds to be conducted.

3.3 Steps

On the basis of the aforementioned research methods, we conducted three surveys among experts to understand entrepreneurship education from the perspective of socioecological systems. An adequate number of experts must be selected according to the topics involved. As indicated by Dalkey and Helmer [12], a reliable Delphi group should consist of at least 10 people to ensure they reach a consensus with minimal errors. Therefore, 28 homogeneous experts were recruited to participate in this study.

(1) Selection of interviewees

In this survey, four groups of experts were interviewed: government officials, professors, managers, and enterprisers. Each group consisted of 7 experts, for a total of 28 experts. These experts specialized in entrepreneurial planning, entrepreneurial counseling, or entrepreneurship education. All of the experts were considered representative of their fields (Table 1).

(2) Interview outline

In this study, we developed an interview outline according to the socioecological systems framework proposed by Ostrom.

(3) Expert review and content revision

The interview outline was reviewed by experts on the basis of the research framework. Following expert review, a pretest was administered; finally, a formal interview outline was completed.

(4) Questionnaire

We first telephoned or emailed interviewees to confirm the time and location of each interview. We provided the interviewees with an outline to ensure interviewees were aware of the interview content in advance. We recorded each interview after obtaining the interviewee's consent. The interview content was analyzed at a later point.

(5) First expert interview

The content of the first expert interview was analyzed statistically. The items with inconsistent answers were used for a second expert interview. The conclusions drawn from other experts served as references; the interviewees could then modify their opinions or preserve their original opinions. If a consistent conclusion was reached, further analysis was performed; otherwise, a third expert interview was conducted, wherein more explanations were provided and the conclusions drawn from other experts served as a reference, enabling the interviewees to modify their opinions again.

(6) Questionnaire assessment

A 3-point Likert scale was employed to rate questionnaire items (1 = disagree, 3 = neither agree nor disagree, 5 = agree). Microsoft Excel 2010 was used for statistical analysis.

(7) Determination of consistency

High consistency: The total rating score provided by seven experts was equal to or greater than 29 points (i.e., a high rating score from four experts and a medium rating score from three experts).

Medium consistency: The total rating score provided by seven experts was greater than 21 points and lower than 29 points.

Low consistency: The total rating score provided by seven experts was lower than 21 points.

Table 1: Experts who participated in the present study

Expert code	Education Level	Employment years	Type
A ~ A7	4 PhDs, 2 master's degrees 1 bachelor'sdegree	10–20 years	**Government officials** 2 government officials from the Small and Medium Enterprise Administration, Ministry of Economic Affairs; 1government official from the Taichung Changhua Nantou Regional Branch, the Ministry of Labor; 2 government officials from the Local Tax Bureau, Changhua County; 1 government official from the Local Tax Bureau, Taichung City; 1 government official from the Construction Bureau, Taichung City

B1 ~ B7	Seven PhDs	10–20 years	**Professors** 2 professors from Tunghai University; 1 professor from Overseas Chinese University; 1 professor from Ling Tung University; 1 professor from Chung Shan Medical University; 1 professor from Providence University; 1 professor from Ming Chuan University
C1 ~ C7	7 master's degrees	5–12 years	**Incubation center** 1 expert from Feng Chia University; 2 experts from Tunghai University; 1 expert from National Chinyi University of Technology; 1 expert from Chaoyang University of Technology; 1 expert from China Medical University; 1 expert from National Taiwan University of Arts
D ~ D7	Five Masters Two Bachelors	5–35 years	**Enterprisers** 1 enterpriser from the financial industry; 1 enterpriser from the consultants businesses; 1 enterpriser from the hotel industry; 1 enterpriser from the biotech industry; 1 enterpriser from the technology industry; 1 enterpriser from the building industry; 1 enterpriser from the cultural and creative industry

4   Data Analysis

The questionnaire process was composed of eight parts. Three surveys were conducted, and the mode was used as the basis of data analysis. Following the three surveys, medium or high consensus was reached. Low consensus was reached on four questions among professors and one question among experts from

the incubation center. The third set of survey results was used as the consistency criteria for consensus (Table 5).

4.1 Round 1

The first survey lasted 5 weeks and 28 experts participated. A total of 47 questions were used in the first questionnaire; a 3-point Likert scale was employed to understand the agreement or consensus level of the experts (Table 2).

Among the 47 questions on the first questionnaire, high consensus was achieved on 40 questions among government officials, 30 questions among professors, 37 questions among enterprisers, and 24 questions among experts from the incubation center; low consensus was achieved on 6 questions among professors and 2 questions among experts from the incubation center; medium consensus was achieved on all other questions. According to the aforementioned results, a second survey was conducted.

Table 2: Consistency or consensus level of experts according to the results of the first survey

Consistency level	The number of questions(%) (government officials)	The number of questions (%) (professors)	The number of questions (%) (incubation center)	The number of questions (%) (enterprisers)
High consistency	40(85%)	30(64%)	24(51%)	37(79%)
Medium consistency	0(0%)	11(24%)	21(45%)	10(21%)
Low consistency	7(15%)	6(12%)	2(4%)	0(0%)
Total	47(100%)	47(100%)	47(100%)	47(100%)

4.2 Round 2

In the present study, the second survey lasted 3 weeks and 28 experts participated. A total of 47 questions were used for the second questionnaire; a 3-point Likert scale was employed to understand the agreement or consensus level of the experts (Table 3). Among the 47 questions on the second questionnaire, high consensus was achieved on 44 questions among government officials (compared with 40 questions previously), 32 questions among professors (compared with 30 questions previously), 40 questions among enterprisers (compared with 37 questions previously), and 31 questions among experts from the incubation center (compared with 24 questions previously); low consensus was achieved on 5 questions among professors and 1 question among experts from the incubation center; medium consensus was achieved on all other questions. The results of the second survey showed that the 28 experts achieved high consensus on certain

questions on which the experts previously held varying opinions.

Table 3: Consistency or consensus level of experts according to the results of the second survey

Consistency level	The number of questions (%) (government officials)	The number of questions (%) (professors)	The number of questions (%) (incubation center)	The number of questions (%) (enterprisers)
High consistency	44(94%)	32(68%)	31(66%)	40(85%)
Medium consistency	3(6%)	10(21%)	15(32%)	7(15%)
Low consistency	0(0%)	5(11%)	1(2%)	0(0%)
Total	47(100%)	47(100%)	47(100%)	47(100%)

4.3 Round 3

The third survey lasted 2 weeks and 28 experts participated. A total of 47 questions were used for the third questionnaire; a 3-point Likert scale was employed to understand the agreement or consensus level of the experts (Table 4). Among the 47 questions on the third questionnaire, high consensus was achieved on 44 questions among government officials, 32 questions among professors, 40 questions among enterprisers, and 31 questions among experts from the incubation center; low consensus was achieved on 4 questions among professors and 1 question among experts from the incubation center; medium consensus was achieved on other questions. According to the results of the third survey, the 28 experts achieved consensus on most questions. Finally, through in-depth interviews, the experts provided valuable suggestions regarding this study.

Table 4: Consistency or consensus level of experts according to the results of the third survey

Consistency level	The number of questions (%) (government officials)	The number of questions (%) (professors)	The number of questions (%) (incubation center)	The number of questions (%) (enterprisers)
High consistency	44(94%)	32(68%)	31(66%)	40(85%)
Medium consistency	3(6%)	10(21%)	15(32%)	7(15%)
Low consistency	0(0%)	5(11%)	1(2%)	0(0%)
Total	47(100%)	47(100%)	47(100%)	47(100%)

Table 5: Consistency or consensus level of experts according to the results of the third survey

Consistency level	The number of questions (%) (government officials)	The number of questions (%) (professors)	The number of questions (%) (incubation center)	The number of questions (%) (enterprisers)
High consistency	40(85%) (Round 1)	30(64%) (Round 1)	24(51%) (Round 1)	37(79%) (Round 1)
High consistency	44(94%) (Round 2)	32(68%) (Round 2)	31(66%) (Round 2)	40(85%) (Round 2)
High consistency	44(94%) (Round 3)	32(68%) (Round 3)	31(66%) (Round 3)	40(85%) (Round 3)
Medium consistency	0(0%) (Round 1)	11(24%) (Round 1)	21(45%) (Round 1)	10(21%) (Round 1)
Medium consistency	3(6%) (Round 2)	10(21%) (Round 2)	15(32%) (Round 2)	7(15%) (Round 2)
Medium consistency	3(6%) (Round 3)	11(23%) (Round 3)	15(32%) (Round 3)	7(15%) (Round 3)
Low consistency	7(15%) (Round 1)	6(12%) (Round 1)	2(4%) (Round 1)	0(0%) (Round 1)
Low consistency	0(0%) (Round 2)	5(11%) (Round 2)	1(2%) (Round 2)	0(0%) (Round 2)
Low consistency	0(0%) (Round 3)	4(9%) (Round 3)	1(2%) (Round 3)	0(0%) (Round 3)
Total	47(100%)	47(100%)	47(100%)	47(100%)

5 Conclusion

According to previous studies, starting an undertaking is a nonlinear, complex, chaotic, and dynamic process. At present, we cannot clearly define the scope and theoretical foundation of research on this topic. Conducting a cross-sectional or retrospective analysis at a specific time point cannot enable us to fully understand entrepreneurial behavior and processes and the interactive relationships between various activities.

5.1 Main findings
This study found that socioecological systems could be used to analyze entrepreneurship education; the socioecological systems included resource systems, resource units, management systems, and entrepreneurs. The four systems mutually influenced one another and were related to society, the economy, policies, and ecological systems. According to the results of the first survey, the government officials and enterprisers achieved high consensus; in addition, professors and experts from incubation center expressed consistent opinions. Through in-depth interviews, the experts provided valuable suggestions regarding this study. By the end of the three surveys, all 28 experts had achieved high consensus. Finally, this study showed that in addition to entrepreneurial spirit, knowledge, and skills, other factors influenced the development of entrepreneurship education. Some basic concepts were crucial for entrepreneurship education. Complex entrepreneurial phenomena should be clarified from theoretical viewpoints, and entrepreneurial talents should be cultivated using an excellent entrepreneurship education model. We hope that the results of this study can serve as a reference for education authorities to develop entrepreneurship education.

5.2 Comparison with other initiatives
In this study, we used socioecological systems to develop an entrepreneurial model. The socioecological systems were a resources system (e.g., an entrepreneurial environment), resources units (e.g., an entrepreneurship education unit), users (e.g., entrepreneurs), and management systems (e.g., agencies and regulations for governing entrepreneurship education units); the four systems were mutually influential. This study provided empirical evidence by investigating the entrepreneurial topics proposed by Gartner[8], namely: individuals, environments, organizations, and new venture processes. Details are provided as follows.

5.2.1 A resource system (an entrepreneurial environment): environments
In this study, the experts stated that the resource system highly influenced entrepreneurship education; in addition, environmental factors also considerably influenced entrepreneurship.

5.2.2 Resource units (entrepreneurship education units): organizations
In this study, the experts stated that the mobility and interactivity of resource units highly influenced entrepreneurship education; in addition, the mobility and interactivity of entrepreneurs in organizations considerably influenced entrepreneurship education.

5.2.3 Management systems (agencies and regulations for governing entrepreneurship education units): new venture processes
In this study, the experts stated that the management system highly influenced entrepreneurship education; in addition, management, supervision, and

punishment mechanisms were crucial in new venture processes. However, for entrepreneurs, management and supervision mechanisms in new venture processes should be simple.

5.2.4 Entrepreneurs: individuals
In this study, the experts agreed with Solomon that entrepreneurship education should emphasize the importance of entrepreneurial awareness, knowledge, skills, and practices. The experts also considered entrepreneurial motivation and environments to be crucial for entrepreneurs.

5.3 Suggestions for future studies
Entrepreneurship education can complement entrepreneurial experiences and help people systematically develop entrepreneurial skills. In practice, numerous factors influence entrepreneurial environments and one another. Therefore, the concept of socioecological systems can be used to explain entrepreneurial phenomena. Finally, we propose some suggestions for future studies on entrepreneurship education: (1) exploring the research methodology of entrepreneurship education; (2) integrating different disciplines to investigate entrepreneurship education.

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