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Sustainable Entrepreneurship Team Scale Development: A Complex Systems Perspective

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Abstract: This paper primarily focuses on two questions: (1) "How is a sustainable entrepreneurship team (SET) formed?"; and (2) "What factors contribute to effective SET?". Based on the model of Baron and Henry (2011), we adopt a process view of SET development and propose a conceptual model of a SET work that includes four key elements: (1) Sustainable entrepreneurial motivation; (2) sustainable entrepreneurial opportunity recognition; (3) knowledge resources acquirement; and (4) sustainable entrepreneurial outcome. Furthermore, based on complex systems theory, we elaborate on how individual entrepreneurs form a SET. We also develop a SET scale and provide some initial empirical support for our conceptual model. Finally, based on our qualitative and quantitative results, we offer suggestions for Research Question 2.

Keywords: sustainable entrepreneurship; team; complex systems; scale

1. Introduction

In recent years, the term "sustainability" is often used to describe developmental visions. Over the past few decades, unsustainable economic development models have brought about harmful social and environmental impacts, despite promoting short-term economic prosperities. Global warming, the shortage of drinking water, population and other sustainability problems all pose severe threats to the survival of mankind. Now, people have realized that substantial changes are needed to improve our ecological and social environment. Primary researches on sustainable entrepreneurship were shown in Table 1. In the past, entrepreneurial activities were believed to lead to these problems [1–3]; however, scholars have recently shown that entrepreneurship can promote the development of sustainability in a society and the protection of the environment [4–6]. Hall and colleagues (2010) regard entrepreneurship as a panacea for addressing social and environmental problems [7]. Moreover, as entrepreneurship is increasingly used to solve social and environmental issues, different types of entrepreneurship, such as social entrepreneurship, green (ecological) entrepreneurship, and sustainable entrepreneurship (SE), come into being. In particular, social entrepreneurship focuses on contributing to public well-being and creating social value [8]. Ecological or green entrepreneurship solves environmental problems. On the other hand, SE is more inclusive, including both social and environmental entrepreneurship [6,9]. The core of SE is to conduct business activities without harming social and ecological environment [5], and to create social, economic and environmental values at the same time [10,11].

Table 1. Primary research on sustainable entrepreneurship.

Authors	Style	Focus
Cohen and Winn (2007)	Qualitative	Four types of market imperfections are discussed: inefficient firms, externalities exist, flawed pricing mechanisms and imperfectly distributed information in the sources of sustainable entrepreneurial opportunities.
Dean and MuMullen (2007)	Qualitative	Based on market theory and environmental economics, they deeply analyzed the relationship between market failure and entrepreneurial opportunity.
Pacheco et al. (2010)	Qualitative	How can entrepreneurs take action to escape "green prisons" to implement sustainable business practices. These include setting norms related to environmental behavior, establishing co-operation, defining property rights and seeking government intervention
Parrish et al. (2010)	Qualitative	The organizational design expertise that sustainable entrepreneurs need to succeed in a competitive market
Patzelt and Shepherd (2011)	Qualitative	Based on personal prior knowledge and motivation, they find that four factors—discover prior knowledge related to natural and public environment, motivation of personal interests (perceived threat), motivation of developing interests for others (altruism) and entrepreneurial knowledge, are related to the identification of sustainable entrepreneurial opportunities.

Over the past decade, a vast amount of scholarly work has examined various aspects of sustainable entrepreneurship, including sustainable entrepreneurs' (SEs') intention and motivation [12–16], SEs' competency [17–19], SEs' values [20], SEs' knowledge [5,21], sustainable entrepreneurial opportunity [1,2,22–24], the context for SE [9,25–28], success factors for SE [29,30], ways to promote SE [31–35], etc. Although prior studies are insightful, they mainly focus on individual- and/or organization-level factors, albeit the fact that most startups are launched with a group of people [36]. In addition, existing research findings are fairly fragmented. Thus, it is necessary to carry out SE research at the team level, and explore how these elements interact and evolve from a holistic perspective so as to guide a sustainable entrepreneurship team (SET) toward ultimate success.

In this study, we mainly focus on two questions: (1) how a SET is formed; and (2) what factors contribute to effective SET. To do so we first identify key elements of SEs by drawing on the established process model of traditional entrepreneurship, which provides a basis for discussing the formation and development of a SET. Secondly, we propose a conceptual model of SET, addressing the first question from a complex systems perspective. Thirdly, based on the conceptual model, we develop and validate a SET scale. Finally, we discuss theoretical and practical implications based on conceptual and empirical work of this paper.

The study is organized as follows. In Section 2, a process model of sustainable entrepreneurship is introduced based on Baron and Henry's (2011) framework. In Sections 3 and 4, the questions regarding the formation and measurement of SET are discussed from a complex systems perspective. In Section 5, the scale items are generated, and reliability and validity of the scale is tested. The method and measures are detailed in Section 6. Finally, Section 7 contains the discussion and our conclusions, including theoretical and practical implications, main contribution, limitations, and future research directions.

2. The Process of Sustainable Entrepreneurship

Researchers of traditional entrepreneurialism [37] have developed a process model of entrepreneurship that contains four key components: (1) Motivation (factors influencing individuals to become entrepreneurs); (2) opportunity recognition (factors affecting whether individuals can perceive opportunities, as well as types of opportunities identified); (3) acquiring resources (factors influencing

an individuals' ability to access entrepreneurial resources); and (4) entrepreneurial performance (factors related to individuals' realizing entrepreneurial outcomes). Adapting this process model, we argue that SE development also requires four key elements: (1) sustainable entrepreneurial motivation (SEM); (2) sustainable entrepreneurial opportunity recognition (SEOR); (3) knowledge resources acquirement (KRA); and (4) sustainable entrepreneurial outcome (SEO). In this section, we will elaborate on these processes in detail.

2.1. Sustainable Entrepreneurial Motivation

A key antecedent to entrepreneurial behavior is entrepreneurial motivation [12], which is regarded as the entrepreneurs' consciousness and belief in starting a business and planning for future actions [38,39]. Previous research on entrepreneurial motivation has illustrated the complex nature of entrepreneurial motivation from multiple aspects [37]. Most research divided the motivation into intrinsic motivation and extrinsic motivation, of which we adopt this classification in this study. Extrinsic motivation refers to a person's desires to achieve money, prestige, or status through work [40]. For example, economic benefits are not only a goal of sustainable entrepreneurship, but also a means to achieve social and environmental goals [10]. As mentioned by Fischer et al. (2018), entrepreneurs believe that "they cannot help others without maintaining at least a partly profitable business" [14]. Thus, it can be seen that economic profits are an important driver of sustainable entrepreneurship [12]. On the other hand, intrinsic motivation can be seen as the intrinsic value that an individual finds in their efforts, such as personal interests, happiness in work, and self-challenge, and so on [40]. Scholars have linked the two types of motivation to sustainable entrepreneurship, such as attitude toward sustainability [13,16], pro-social motivations [41,42], pro-environmental values [43,44], etc. Individuals who are positive about sustainability will focus on social and/or environmental issues [16], and be more likely to solve these problems by becoming entrepreneurs [13]. Different values determine different entrepreneurial behavior [11]. For example, pro-social behavior is seen as generally beneficial to others [45]. Further, Miller et al., (2012) regard compassion as attending to others' suffering, which is related to launch of social entrepreneurship. Yitshaki and Kropp (2016) suggest that social entrepreneurship motivation is hope "to improve the well-being of a specific group or society at large" [42]. In addition, some researchers show that the inner desire to be your own boss works in the context of sustainable entrepreneurship [22,44]. Based on these research findings, both intrinsic and extrinsic motivation have been identified as drivers of sustainability entrepreneurship. However, social and environmental problems are complex, difficult to be easily and quickly solved [46]. It means that sustainability-oriented entrepreneurship is likely to be unprofitable or even unsuccessful in the early stages. Sustainable entrepreneurs are less motivated to achieve financial success than traditional entrepreneurs [44], and they may even engage in entrepreneurship with economic loss [35]. Thus, from the above arguments, sustainable entrepreneurs' intrinsic motivation may play a more important role than extrinsic motivation.

2.2. Sustainable Entrepreneurial Opportunity Recognition

Identifying and pursuing opportunity is among the essence of entrepreneurship [47,48]. Opportunity recognition is an early step of the entrepreneurial process [49]. Many previous studies on the definition of opportunity suggested that there are three central characteristics: (a) Potential economic value (i.e., the potential to generate profit), (b) newness (i.e., some product, service, technology, and so forth that did not exist previously), and (c) perceived desirability (e.g., moral and legal acceptability of the new product or service in the society in which it is introduced) [37]. For sustainable entrepreneurial opportunities, this includes not only potential economic value, but also social and environmental values. The origin of the opportunities, however, may lie in market failure [1]. Market failure has brought many opportunities that could create economic benefits. Opportunities are associated with sustainability when a market failure is related to the environment. Market failure being relevant to the environment not only undermines the economic sustainability, but also causes

environmental degradation. Hence, identifying, evaluating and developing sustainable entrepreneurial opportunities can improve the ecological and social environment and obtain economic returns while eliminating market failure related to ecological and social problems. Beyond that, market failure related to the environment brings huge negative externalities, such as reduction in forest area, degradation of water quality, acid deposition and ozone depletion, which has led the unsustainable development of the global market. However, sustainable entrepreneurs promote sustainable development of society, economy and environment while recognizing and creating opportunities (e.g., 3D printing, electric vehicles, wind turbines) to acquire profits from market failures [1,2].

In conclusion, sustainable entrepreneurial opportunities differ from traditional ones. The latter only focuses on economic profit. A sustainable entrepreneurial opportunity is defined as "one that enables the pursuit of new combinations in order to simultaneously address economic, environmental and social outcomes" [50]. Examples of environmental outcomes includes water improvement, reductions in emissions and soil purification, etc. Examples of social outcomes includes education, care for employees and society, etc. [21,51]. Table 1 illustrates research on opportunity recognition for sustainable entrepreneurship.

2.3. Knowledge Resources Acquirement

Besides sustainable entrepreneurial opportunity recognition, resources acquirement is also important. After identifying opportunities, sustainable entrepreneurs need to evaluate and exploit them. In other words, entrepreneurs need to identify and configure the various entrepreneurial resources [37]. Resources can be divided into property-based resources and knowledge-based resources [52], they can help entrepreneurs to adapt quickly to external environmental changes and promote the survival and growth of the venture [53]. Knowledge-based resources refer to skill, professional knowledge or talents that are difficult for competitors to imitate [54]. It can provide support to launch a new organization, to obtain development and competitive advantage, to develop new technology and production [55], and to help firms achieve long-term performance and deal with the uncertain environment [52]. Sustainable entrepreneurship is future-oriented, its ultimate goal is to achieve social, economic and environmentally sustainable development [10]. This means that enterprises need to constantly and steadily achieve social, economic and environmental value creation. In addition, knowledge can promote technological breakthroughs [56]. In the process of solving complex social and environmental problems, it usually involves the research and development of new technology. Meanwhile, start-ups are more likely to engage in sustainable entrepreneurship and bring innovative solutions to the market [4]. Knowledge-based resources can contribute to their competitive advantage and sustainability [57]. On the other hand, prior knowledge has been demonstrated to enhance entrepreneurial opportunity recognition [58,59]. For example, Patzelt and Shepherd (2011) propose prior knowledge about nature and public environment and entrepreneurial knowledge may influence sustainable entrepreneurial opportunity recognition, which was supported in subsequent empirical studies [22]. Entrepreneurs with rich knowledge resources often pay more attention to learning, keep a watchful eye on market changes and make timely responses; In contrast, entrepreneurs with poor knowledge resources have lower ability to recognize and exploit opportunities [57]. Furthermore, knowledge resources used to identify and exploit opportunities, such as technical knowledge and market knowledge, are positively related to firm performance [55]. Therefore, this study is focused on knowledge resources acquirement in sustainable entrepreneurship.

In conclusion, knowledge resources play a key role in sustainable entrepreneurship. Prior knowledge about society and environment enables individuals to identify sustainable entrepreneurial opportunities. Other types of knowledge, such as technical knowledge and market knowledge, not only enhance their abilities to recognize opportunities, but more importantly, help develop and exploit opportunities to produce and promote new technologies, products and services that bring social and environmental value. However, given that it is difficult to solve social and environmental problems, failures can happen frequently. This may require us to

re-seek new knowledge resources and even return to the second stage—identifying new sustainable entrepreneurial opportunities.

2.4. Sustainable Entrepreneurial Outcome

The outcome is the ultimate key element in sustainable entrepreneurship process, which determines the extent to which the final goals (social, economic and environmental value creation) are achieved. Previous research on sustainable entrepreneurial outcome primarily concentrated on two streams: value creation and strategic returns [50]. Value creation refers to the integration of sustainable development and wealth accumulation, while strategic returns focus on how to improve performance by implementing the strategy of sustainable development. A company pursuing sustainable development can also be seen as a business opportunity [60,61], which helps the company to reduce costs, bring new revenue, and fulfill corporate social responsibility. Numerous studies have examined the relationship between sustainability and business performance [50]. Nonetheless, the core of sustainable entrepreneurship is not to achieve profit growth; instead, profit is treated as a means to realize social and environmental value creation [10]. Moreover, the ultimate goal of sustainable entrepreneurship is to make a contribution to the sustainable development of the entire society. Sustainable entrepreneurship pursues the improvement of environmental quality and social well-being and creates new things to solve complex social and environmental problems. The sustainable entrepreneurial outcomes tend to be revolutionary and pioneering, which will take the future market-share leadership in diverse industries and promote social change. The foregoing section has shown that scholars have dismantled the goals of sustainable entrepreneurship in three dimensions—social, economic and environmental—based on the principle of sustainability (society, economy, and environment). This framework may overemphasize the need to balance among society, economy and environment [50]. Consequently, it may have ignored the sustainable entrepreneurial outcome as a whole to promote sustainable development and produce a profound influence on the future.

Although our framework draws on Baron and Henry's (2011) process model of entrepreneurship, there is a significant extension in features when the model is used in the domain of sustainable entrepreneurship. For motivation, sustainable entrepreneurs are dedicated to sustainable development and even changing the world while making money [62]. It is significantly different from the traditional entrepreneurs who only pursue economic benefits. Furthermore, market failure related to social and environmental problems generates many sustainable entrepreneurship opportunities. Sustainable entrepreneurs have a successful entrepreneurship by identifying, evaluating and exploiting these opportunities. In a word, sustainable entrepreneurship can be regarded as a unique entrepreneurial type. Thus, we define sustainable entrepreneurship as a process through which sustainable entrepreneurs produce new products or services by recognizing opportunities, acquiring knowledge resources, and exploring opportunities, so that to improve social well-being and environmental quality. Given the above, we can conclude that sustainable entrepreneurship includes four key components: sustainable entrepreneurial motivation, sustainable entrepreneurial opportunity recognition, knowledge resources acquirement, and sustainable entrepreneurial outcome. Sustainable entrepreneurship revolves around these elements. Specifically, prosocial and pro-environmental values make some individuals become a sustainable entrepreneur, who creates and builds profitable enterprises, while pursuing social and environmentally-focused causes [63]. At the team level, we argue that a SET also includes these four key elements. Based on the discussion above, we propose a model of SET (Figure 1). In the next section, we introduce complex systems theory to illustrate how individual sustainable entrepreneurs form SET.

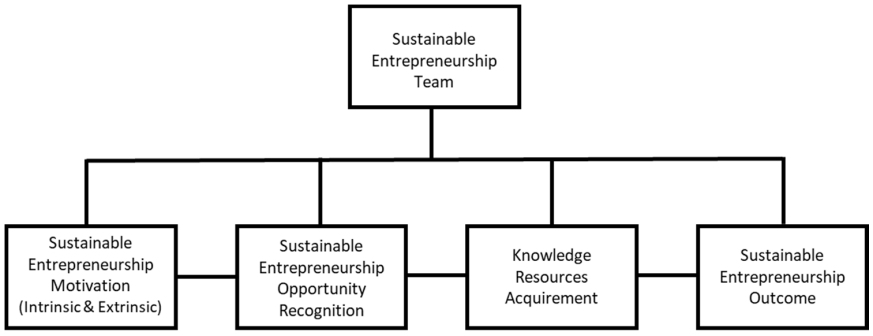

Figure 1. A conceptual model of a sustainable entrepreneurship team.

3. A Complex Systems Perspective on Sustainable Entrepreneurship Team

Entrepreneurship plays an important role in modern social and economic development [64]. People must embrace sustainability for a healthy economic development, sound ecological environment, and comfortable life. However, social and environmental problems are often too complex and in large scales for individual sustainable entrepreneurs to solve them. Thus, a team of entrepreneurs are seen as a powerful means for achieving their goals [65,66]. To explicate how a set collaborates and achieves its objectives synergistically, we introduce complex systems theory that employs a holistic approach to system analysis. It states that all systems are complex systems, which comprise various elements that are interconnected with each other. It holds the characteristics of non-linearity, emergence, hierarchy, and so on. Despite complex systems theory being derived from social psychology, as a common research method and thinking logic, it has been applied to studies of multiple disciplines including entrepreneurship. SET, viewed as a complex system (see Figure 2), must have the following essential characteristics.

First, elements are interconnected and interact with each other. The relevance of the SET system is reflected at two levels: individual level and part level. Specifically, individuals are influenced by factors, such as gender, educational level, external rewards, and values in the formation of sustainable entrepreneurial motivation. Further, social networks, cognitive styles, prior experiences, and social skills all influence the process of sustainable entrepreneurial opportunity recognition and knowledge resources acquirement. Moreover, the outcomes of sustainable entrepreneurship are the product of the collaborative efforts of each team member. Additionally, the valuable resources obtained in the process of team knowledge resources acquirement contribute to the identification of high quality opportunities. On the other hand, the exploitation of sustainable entrepreneurship opportunities needs knowledge resources at the part level. The team's sustainable entrepreneurial motivation and outcomes are enhanced through constant interactions in the process of sustainable entrepreneurial opportunity recognition and knowledge resources acquirement, and sustainable entrepreneurial outcomes, in turn, will bring more knowledge resources to the entrepreneurship team, which further improves the quality of sustainable entrepreneurship opportunity. Finally, sustainable entrepreneurial outcomes with great values will enhance the team's sustainable entrepreneurial motivation.

Second, there is a hierarchy of the SET system. Hierarchy refers to dividing the complex system into different levels according to the differences among various system elements. Higher-level systems comprise lower-level subsystems. Meanwhile, higher-level systems are also subsystems of next higher-level systems. In fact, there is not a highest-level system. In Figure 2, from the individual level to the team level, a team's sustainable entrepreneurial motivation, opportunity recognition, knowledge resources acquirement, and sustainable entrepreneurial outcome are formed by the effective integration of individuals' sustainable entrepreneurial motivation, individual opportunity recognition, individual knowledge resources acquirement, and individual sustainable entrepreneurial outcome. Four key elements at the team level are subsystems of SET. From the part level to the whole level, team sustainable entrepreneurial motivation, opportunity recognition, knowledge resources acquirement, and sustainable entrepreneurial outcome constitute the SET system.

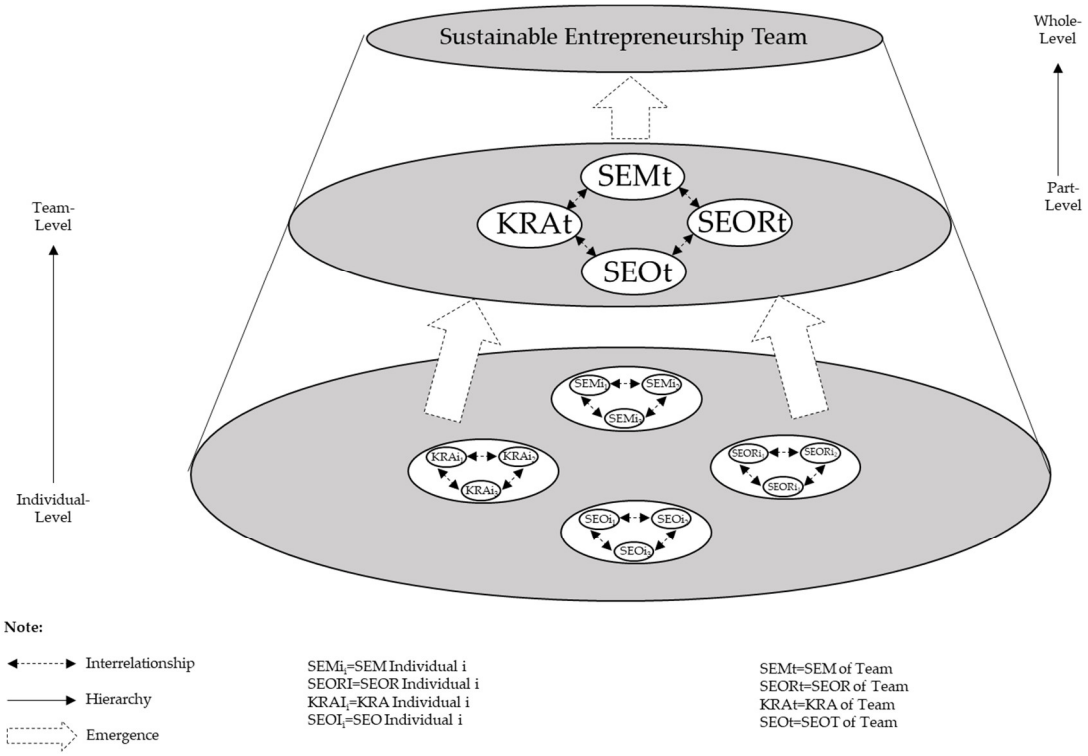

Figure 2. Complex systems model of a sustainable entrepreneurship team.

The third characteristic is emergence, which is considered as the properties of the whole hardly being able to be inferred from the properties of the parts. The SET presents a dual emergence feature in Figure 2. Above all is functional emergence. For instance, from the individual level to the team level, although team sustainable entrepreneurial motivation is a high-level system, it comprises individual sustainable entrepreneurial motivation as a lower-level system. Meanwhile, from the part level to the whole level, SET is formed by the integration of all properties of team sustainable entrepreneurial motivation, opportunity recognition, knowledge resources acquirement, and sustainable entrepreneurial outcome. New features also emerge. For example, from individual to team, team sustainable entrepreneurial motivation produces a shared vision, and a sense of collective mission. In addition, the interaction among team members in the process of opportunity recognition can overcome constraints of prior experience and identify various opportunity. From the part to the whole, constant interactions among team opportunity recognition and knowledge resources acquirement make it possible to achieve revolutionary and pioneering technologies or products that are unlikely to be developed by individual entrepreneurs.

In conclusion, SET involves comprehensive competences that emerge from the part level to the whole level by integrating interrelated and interactive elements—team sustainable entrepreneurial motivation, team sustainable entrepreneurial opportunity recognition, team knowledge resources acquirement, and team sustainable entrepreneurial outcome. Meanwhile, motivation, opportunity recognition, knowledge resources acquirement, and outcomes make up a set of competencies that emerge from individuals to the team by integrating interrelated and interactive elements.

4. Sustainable Entrepreneurship Team Measurement

Little research has paid attention to the competence needed for ET. An exception is Lans and colleagues (2014), who established an integrative competence framework for sustainable entrepreneurship to identify key competencies for effective sustainable entrepreneurship [17]. The authors developed a scale for entrepreneurial competence (five items) and sustainable development competencies (seven items). Three groups of competencies are identified through empirical analysis:

opportunity-action competence and foresighted thinking, business and strategic management competence, and social and interpersonal competence. The results of empirical analysis show that opportunity competence is a key factor for entrepreneurial performance. Thongpoon et al. (2012) confirmed that some entrepreneurial competencies (opportunity, organization, strategy) are significantly related to the long-term sustainable performance of SMEs [67]. They also emphasized the important role of opportunity competence. These results provide support for some components (e.g., sustainable entrepreneurial opportunity recognition and knowledge resources acquirement) of SET. Therefore, based on the conceptual model in Figure 1, a scale can be developed to measure SET work process and outcome. Next, we build on complex systems theory to explore how to measure the SET work. Figure 3 shows the connection between the main characteristics of the SET work and three fundamental principles of complex systems: integrity, dynamic and nonlinear [68].

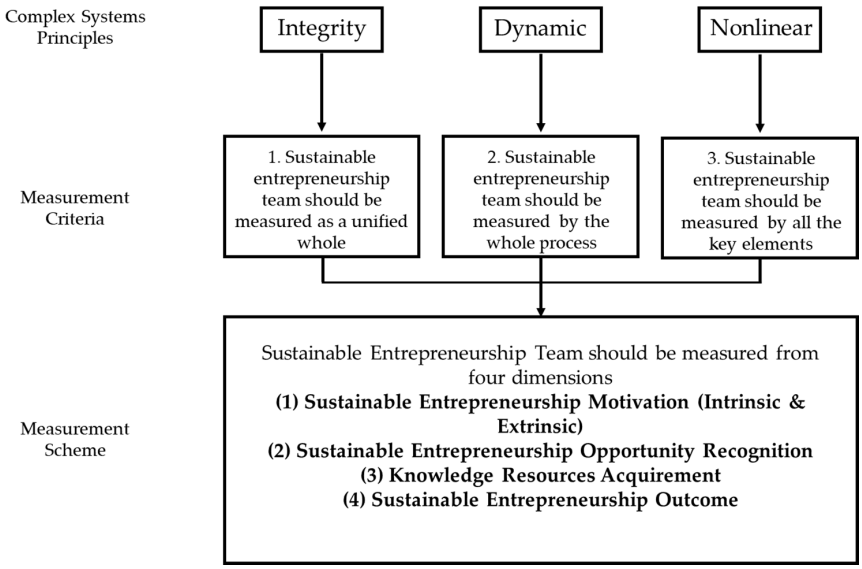

Figure 3. Main characteristics of a sustainable entrepreneurship team.

First, the integrity of complex systems requires treating the system as a unified whole. Because a SET is deemed as a complex system, it cannot be measured as individual components. Therefore, based on the integrity principle, we can conclude that the SET should be measured as a unified whole. As SET is a comprehensive property that emerges from part level to whole level by integrating team sustainable entrepreneurial motivation, opportunity recognition, knowledge resources acquirement, and sustainable entrepreneurial outcome. Hence, it is desirable to measure the SET in the four dimensions of sustainable entrepreneurial motivation, sustainable entrepreneurial opportunity recognition, knowledge resources acquirement, and sustainable entrepreneurial outcome and then integrate them into a composite measure.

Second, the dynamic principle of complex systems suggests that the system is constantly developing [69]. In the process of sustainable entrepreneurship, whatever is the formation of motivation, opportunity recognition, acquiring resources or innovation, an entrepreneurial team needs to constantly exchange information with each other and across team boundary. Thus, based on the dynamic principle, criteria to include for the measurement of SET should consider the entire sustainable entrepreneurship process from beginning to end. For example, driven by sustainable entrepreneurial motivation, the team identifies and exploits entrepreneurship opportunities. It also acquires needed knowledge resources, such as expertise and information for new product development, and converts these ideas and resources into actual operation and performance [37]. Hence, the dynamic principle points to interconnected nature of the four components of SET.

Finally, the nonlinear principle of complex systems suggests that the relationship of input-output is uncertain [70]. Complex interactions among elements make it literally impossible to predict which

one, or ones, play a key role in complex systems. For instance, an entrepreneurial team may still fail even if they recognize high quality opportunities, possess required knowledge resources, and get motivated to launch a new business. Thus, another measurement criterion for SET is nonlinearity, namely, considering all key elements in measurement. Sustainable entrepreneurial motivation may be enhanced with a successful outcome or discovery of new opportunity in the process of knowledge resources acquirement. Therefore, SET should be measured from the four dimensions of motivation, opportunity, knowledge resources, and outcome.

In conclusion, in light of the three characteristics of complex systems theory, the four dimensions comprising SET work are proposed. The next two sections report scale development and validation of SET work.

5. Scale Development of Sustainable Entrepreneurship Team

5.1. The Qualitative Research

Qualitative interviews were used to generate initial items. We selected founding teams of four start-ups in China, whose business goal is to make money while promoting social and environmental sustainability (Table 2). A total of 24 members in those teams were interviewed. Since our interviews were conducted during working hours, to save time and not to disturb their normal work, panel interviews with multiple members were conducted, which facilitated consensus making among them.

Before each interview, we introduced our research and asked the interviewee to simply describe their team composition, entrepreneurial goals and business operation. Each interview was semi-structured and lasted about 40 to 60 min. The structured part has four questions, ensuring the conversations revolving around a central theme. In addition, based on responses from the interviewees, we asked follow-up questions to ensure the quality and comprehensiveness of information (Table 3). All interviews were transcribed, and the content was analyzed. The content analysis consists of four steps [71]: (a) Screening qualitative data to remove content unrelated to the research theme; (b) developing a coding and classification system (In our case the conceptual model of sustainable entrepreneurship serves as a classification standard); (c) coding data using sentences with complete meaning as the unit of analysis; and (d) analyzing coded data. In this study, we generated items based on this procedure.

Table 2. The founding teams for interviews.

Team	Business	Number of Members	Code
A	Sustainable agriculture	9	A1–A9
B	Sustainable agriculture	4	B1–B4
C	Sustainable education	6	C1–C6
D	Sustainable investment	5	D1–D5

Note: The number start with the primary founder.

Table 3. The question list.

Structured Part	Unstructured Part
SQ1. What motivates you start an entrepreneurship?	FQ1: What do you think about starting a business to make money?
SQ2. What kind of entrepreneurial opportunity are you interested in? Why?	
SQ3. What resources are important or necessary in your entrepreneurial process?	FQ2: what knowledge resources do you think are important in your entrepreneurial process?
SQ4. What have you achieved so far? How do you evaluate the value of these achievements?	

Note: SQ = Structured question, FQ = Unstructured question.

5.2. Results of Qualitative Research

Sustainable entrepreneurial motivation. Respondents from four start-ups mentioned that entrepreneurial ideas stemmed from concerns about social and environmental problems. For example:

> *[. . .]. The idea of starting a business came early, when I was a farmhouse operator, working mostly in the countryside. You know, our farmers burn their crop stalks after harvest, and I'm against that because it's going to cause serious air pollution. [. . .] At that time, although the government issued relevant policies on banning incineration, they were not implemented properly. [. . .] I have time, and I will talk to some farmers and tell them the harm of this matter.* (Respondent A1)

> *I also worked in a bank when I had the idea of starting a business. I was responsible for rural credit and had more contact with rural areas. In this process, I noticed the education problem of left-behind children. I came from the countryside myself, and I know the importance of education to them. At that time, I thought that I would do something in the future to improve the education problem of left-behind children.* (Respondent C1)

Respondents from both A and B also mentioned that entrepreneurship was related to personal characteristics, such as taking risks, doing something challenging and solving problems with new ideas. Respondent A3, in charge of new business development, thought himself as a person who likes taking risks and trying new things. B1, the main founder, enjoyed challenging work while he was in college. For example:

> *He (A1) came to me and wanted me to do it with him. [. . .] I think this is a challenging thing. I like taking risks. I study business administration. I would often take part in various entrepreneurship competitions and focus on some thorny issues in the current society. [. . .] Every time a new technology or idea comes along, I wonder if it can be used to solve some problem.* (Respondent A3)

> *It's not easy to do ecological fertilizer. It takes a lot of technical research. Day to day research is not necessarily successful. But we enjoy the process because doing something challenging gives you a sense of accomplishment, even if it's just doing it. [. . .] When I was in college, I was always stuck in the lab for four days. [. . .]* (Respondent B1)

In the course of interviews, we had a question about their view of starting a business to make money? They all believed that making money is not the first goal, although they need profits to sustain the business and meet the interests of shareholders. For example:

> *[. . .] Making money is still necessary for maintaining the survival and developing enterprises. But this is secondary. We still hope to solve some problems. [. . .] Using straw to produce biogas can bring benefit to villagers. For example, many communities in cities have a heating system, but it is still difficult to achieve in rural areas. [. . .] Using straw for biogas can not only serve as natural gas, but also provide heating for residents after technical treatment, which is also what I have always wanted to do.* (Respondent A1)

> *Making money is not my original intention. [. . .] When I was in college, I began to pay attention to the problem of farmland degradation. At that time, I wanted to be able to make ecological fertilizers, which could reduce soil pollution and increase crop yield. [. . .] However, if you want to start a business, it involves the problem of survival and development. Besides, the research and development of new technology requires a large amount of capital investment. Therefore, making money is also necessary.* (Respondent B1)

Respondent A3 and respondent B2 also mentioned that they hope their work can be known more, because it makes more people attention to social and environmental issues. For example:

> *[. . .] We have developed some businesses, not only in biogas, but also in eco-tourism and green aquaculture. For example, by taking advantage of the excellent natural environment in some poor mountainous areas, ecological tourist attractions can be built to increase local visibility and bring income to villagers. [. . .] We certainly hope that our work will be noticed by others. Now the country calls for poverty alleviation, and our program provides a good reference, which brings social and environmental values while poverty alleviation and enrichment.* (Respondent A3)

> *We are going to hold a national public service campaign in Xi'an recently to call attention to the issue of farmland. And hopefully more people will pay attention to what we're doing. Because if people pay attention and recognize you, then you're doing something valuable, something that deserves encouragement. This can draw more attention to the environmental problems we face.* (Respondent B2)

Sustainable entrepreneurial opportunity recognition. Respondents from all four start-ups cited concerns about future-oriented issues and ideas to solve social and environmental problems. For example:

> *Currently, the burning of straw has been completely banned in Hubei province, but the production of straw will not stop. After all, farmers must grow food. [. . .] This is certainly a big market in the future. Our farmers used to burn the straw, but now they can't burn it, and they don't have a better way to deal with it. [. . .] At present, the method to deal with straw is ecological and environmental-friendly, which is also what we pursue in the future. It not only solves the problem of environmental pollution, but also brings benefits to the lives of villagers.* (Respondent A1)

> *We're interested in entrepreneurs who come up with ideas for the future, like electric cars, eco-agriculture, green buildings, who are committed to improving people's life experience, their living environment, and creating social value.* (Respondent D1)

Knowledge resources acquirement. Respondents all stressed the importance of money. But that's not the focus of this study. Therefore, we asked a supplementary question: what knowledge resources do you think are important in the entrepreneurial process? Respondents from four start-ups indicated that knowledge related to market development is very important. For example:

> *[. . .] Although our idea is good, if we can't get a foothold in the market, we can't achieve it. [. . .] Education is already a very mature market, so we need to find the gap in the market and find the market segments that are not or rarely covered. [. . .] Marketing is also very important in the education market, which determines whether people can recognize the uniqueness of our products.* (Respondent C1)

Knowledge about daily management and operation of enterprises were also very important. Respondent D2, who was in charge of finance, mentioned that they also had some cases about investment failures. But the main reason was that the entrepreneurs lacked relevant management knowledge, such as human resource management, motivation and corporate culture building, which led to the company's poor management and eventual failure. In addition, they also emphasize the importance of technical knowledge. For example:

[. . .] We have a problem, if we want to turn the straw into biogas, and we are going to be involved in the field of bioelectricity in the future, all of which involve knowledge of biology, physics, chemistry, etc. So we have to find experienced professionals, otherwise we just have ideas, nothing will happen. (Respondent A2)

[. . .] In our case of investment failure, in addition to those caused by poor management, there is also a lack of key technical knowledge, [. . .] (Respondent D2)

Sustainable entrepreneurial outcome. It is important to focus on output for future markets. Respondents stated that sustainable development was advocated by countries around the world, and many products and technologies in the future must be green and environmentally friendly, which can bring people a comfortable life experience and living environment. For example:

[. . .] Clean energy is an inevitable choice for the future, and this is a big market [. . .] (Respondent A1)

Ecological fertilizer is the trend of future agricultural development. [. . .] Now the deterioration of farmland is a serious problem, soil pollution makes people worry about the quality of food. [. . .] People are also paying more and more attention to their health. They hope that the food they eat is pollution-free and green. [. . .] People began to pursue the concept of green life. (Respondent B1)

Respondent C1 also mentioned that they hope to bring some changes to society through their work. Respondents from other start-ups expressed similar views. They hoped their products to bring the real social and environmental value, which is also a measure of their success. For example:

During their study tour, in addition to visiting universities and learning some scientific knowledge, we also arrange teachers to guide them to establish a positive outlook on life and values and learn to make contributions to the society, which are interspersed in our classroom and extracurricular games. [. . .] We want more people in this society who are willing to help others and contribute to society. (Respondent C1)

We have launched many organic fertilizers that contain less harmful soil and have been successful on the market. But we are not satisfied with that now. We are developing new ecological compound fertilizer, which is integrated with traditional Chinese medicine, not only won't bring pollution to the soil, but also will repair and improve the soil that has been damaged. [. . .] We hope our products can help hundreds of millions of farmers realize their dreams of harvest, safeguard national food security and create more wealth for society. (Respondent B1)

To be clear, in each of our interviews, we found that the interviewees who spoke the most and shared most insightful information were the primary founders of the start-ups, especially the founder of Team C. Further inquiries about this revealed that other members thought the primary founder knew more details and could give better answers than they did. The founders thought they can answer more clearly.

5.3. Item Generation and Scale Development

Based on initial interviews, we developed a SET work scale (Table 4). After consolidating with existing literature, 15 items were retained in the final analysis, tapping into four dimensions of SET, namely, motivation, opportunity recognition, knowledge resources acquirement, and entrepreneurship outcome.

Table 4. Constructs and items.

Construct	Item	Source
Sustainable Entrepreneurship Intrinsic Motivation(SEIM)	Q1: We are motivated by help others and the surrounding society, as well as care for the environment	Author developed
	Q2: We are willing to engage in challenging work	
	Q3: We are passionate about solving problems creatively	
Sustainable Entrepreneurship Extrinsic Motivation(SEEM)	Q4: We hope to make a good profit by entrepreneurship	Author developed
	Q5: We hope to solve social or environment problems by entrepreneurship	
	Q6: We hope that our work achievement can be recognized by the public	
Sustainable Entrepreneurship Opportunity Recognition(SEOR)	Q7: We can identify products or services which people want in the future	Adapted from Chandler and Jansen (1992)
	Q8: We can perceive unmet consumer needs from social or environment problem	
	Q9: We can look for products or services that provide real social or environmental benefit	
Knowledge Resources Acquirement	Q10: We can acquire knowledge and information for Research & Development of new products or services	Author developed
	Q11: We can acquire knowledge and information for new market development	
	Q12: We can acquire knowledge and information for production and operation	
Sustainable Entrepreneurship Outcome(SEO)	Q13: Our outcome has social, economic, and environmental value	Author developed
	Q14: Our outcome can gain major market share in the future	
	Q15: Our outcome can promote social change to some extent	

Except that items of one dimension were drawn from existing scales: SEOR [72], the other four dimensions—SEIM, SEEM, KRA, and SEO—are all from our qualitative research and literature review. Three items from Chandler and Jansen (1992) were used to measure the ability to recognize opportunity. Table 4 provides details of each item in four dimensions.

6. Scale Validation of Sustainable Entrepreneurship Team

6.1. Data Collection

Our data came from two parts. One is founders of start-ups, the other is entrepreneurial team members. The latter came from business incubators, and their business goal is also to achieve social, economic and environmental value creation. Eighteen items with a seven-point Likert scale (ranging from 1: "strongly disagree" to 7: "strongly agree") were collected via a survey. The data collection lasted for three months, 340 questionnaires were issued, and 252 were returned. Four were excluded due to invalid responses. Therefore, the final sample was 248 (response rate = 72.94 percent). There were 184 males and 64 females, their average age was 29.15 years, and average tenure was 2.1 years. In addition, of the 248 respondents, 5 had a PhD, 48 had a master's degree, 175 had a bachelor's degree, and 20 had an associate degree.

6.2. Measures

6.2.1. Reliability Measures

Reliability indices of constructs were calculated respectively based on the Cronbach's alphas. In Table 5, all alphas were above the criterion of 0.70 [73], demonstrating good reliability of the scales.

Table 5. Reliability scores of the constructs.

Construct	Cronbach's Alpha	Number of Items
Sustainable Entrepreneurial Intrinsic Motivation (SEIM)	0.774	3
Sustainable Entrepreneurial Extrinsic Motivation (SEEM)	0.805	3
Sustainable Entrepreneurial Opportunity Recognition (SEOR)	0.883	3
Knowledge Resources Acquirement (KRA)	0.789	3
Sustainable Entrepreneurial Outcome (SEO)	0.798	3

6.2.2. Confirmatory Factor Analysis

The data supported the structure of SET work in initial exploratory factor analysis. Thus, the further confirmatory factor analyses (CFA) were performed. We tested whether the measurement model of sustainable entrepreneurship could fit the sample data. IBM SPSS AMOS 24.0 was used to test the model, and the acceptable fit indices of model output, as shown in Table 6. The results of CFA indicated that the measurement model of the SET Scale had a good fit with the sample data.

Table 6. Model fit indices.

Test Statistic	Model	Acceptable Values
χ^2/df	1.541	<3
Goodness of Fit Index (GFI)	0.939	≥0.90
Adjusted Goodness of Fit Index (AGFI)	0.908	≥0.80
Root Mean Square Residuals (RMR)	0.044	≤0.05
Standardized Root Mean Square Residual (SRMR)	0.042	≤0.10
Root Mean Square Error of Approximation (RMSEA)	0.047	≤0.08
Comparative Fit Index (CFI)	0.971	≥0.90

6.2.3. Convergent and Divergent Validity

As model fit measures demonstrated excellent fit between measurement model and sample data, we tested the convergent and divergent validity of SET Scale. The convergent validity was examined by factor loadings, average variance extracted (AVE) and composite reliability. In Table 7, all the results of factor loadings were significant ($p < 0.001$) and reached the minimum value of 0.5 (ideal value > 0.7). Meanwhile, the AVE of the six constructs was all greater than the standard value of 0.5. Furthermore, each construct's composite reliability meets the requirement (ideal value > 0.7). Therefore, the above results indicate that the measurement model of SET had a good convergent validity in this paper.

To assess divergent validity, the correlation coefficients between two constructs were compared with their respective average variance extracted. The AVE would be greater than the squared correlation coefficient if divergent validity is satisfactory. In Table 8, the values on the diagonal line were the AVE of each construct and the lower triangular values were the correlation coefficient square. Table 5 shows that all the correlation coefficients square are significantly less than the corresponding values of AVE. These results supported divergent validity.

Table 7. Results of convergent validity test.

Construct	Item	Factor Loading	Average Variance Extracted	Composite Reliability
Sustainable Entrepreneurial Intrinsic Motivation	$SEIM_1$	0.699	0.544	0.780
	$SEIM_2$	0.836		
	$SEIM_3$	0.666		
Sustainable Entrepreneurial Extrinsic Motivation	$SEIM_1$	0.770	0.549	0.784
	$SEIM_2$	0.752		
	$SEIM_3$	0.698		
Sustainable Entrepreneurial Opportunity Recognition	$SEOR_1$	0.811	0.705	0.877
	$SEOR_2$	0.906		
	$SEOR_3$	0.798		
Knowledge Resources Acquirement	KRA_1	0.721	0.557	0.789
	KRA_2	0.840		
	KRA_3	0.667 #		
Sustainable Entrepreneurial Outcome	SEO_1	0.785	0.575	0.802
	SEO_2	0.799		
	SEO_3	0.686 #		

Note: # Factor Loading < 0.7.

Table 8. Results of divergent validity test.

Construct	SEIM	SEEM	SEOR	KRA	SEO
SEIM	**0.544**				
SEEM	0.197	**0.549**			
SEOR	0.169	0.181	**0.705**		
KRA	0.056	0.023	0.243	**0.557**	
SEO	0.033	0.052	0.240	0.226	**0.575**

6.3. Second-Order Confirmatory Factor Analysis

We have proven that the sample data fits well in the first-order CFA. We further assumed that the latent constructs in the previous measurement model collectively reflect a higher order latent factor—the SET work, comprising sustainable entrepreneurial intrinsic motivation, extrinsic motivation, opportunity recognition, knowledge resources acquirement, and sustainable entrepreneurial outcome. The results of the second-order model fit suggest acceptable fit (Table 9). Meanwhile, as could be seen from Table 9, all the standardized path coefficients were significant. In other words, there were significant correlations between the latent variable SET and five first-order latent variables.

Table 9. Results of second-order confirmatory factor analysis.

Path	Standardized Path Coefficient	Fit Index
SET → SEIM	0.483 ***	$\chi^2/df = 1.721$
SET → SEEM	0.486 ***	GFI = 0.927
SET → SEOR	0.850 ***	CFI = 0.958
SET → KRA	0.583 ***	RMSEA = 0.054
SET → SEO	0.583 ***	

Note: *** $p < 0.001$.

7. Discussion and Conclusions

Based on Baron and Henry's (2011) entrepreneurship process model, we described the process of sustainable entrepreneurship and argue it be considered at the team level. Also, we proposed a conceptual model of SET, and identified four key elements: sustainable entrepreneurial motivation (intrinsic and extrinsic), sustainable entrepreneurial opportunity recognition, knowledge resources acquirement, and sustainable entrepreneurial outcome. We examined the development of SET work

by elaborating on how individual entrepreneurs form a sustainable entrepreneurial team from the complex systems perspective. Emergence plays a key role. Further, we developed a SET scale through qualitative interviews, supplemented with literature review. Confirmatory factor analysis provided evidence of reliability and validity of the scale.

7.1. Theoretical and Practical Implications

Our research has important theoretical implications. On the one hand, it complements the literature of sustainable entrepreneurship at the team level. Previous studies mainly focused on the sustainable entrepreneurship of individuals and small and SMEs, but the essence of sustainable entrepreneurship is team entrepreneurship. Furthermore, we propose a conceptual model of SET and confirm that a sustainable team entrepreneurship consists of four key elements. On the other hand, our research introduces a new research avenue to the field of sustainable entrepreneurship. The introduction of complex systems theory provides explanations for how sustainable entrepreneurial teams are formed and how to solve complex social and environmental problems.

Our research also has some practical implications for understanding drivers to the success of SET. First, for motivation, sustainable entrepreneurial motivation is related to their concerns about social and environmental issues. When individual sustainable entrepreneurs want to find partners, they should choose people who are prosocial and pro-environmental. Moreover, sustainable entrepreneurs often like to challenge and solve problems in creative ways. They are also people who are adventurous and good at using new methods to solve problems, being more dexterous and creative when dealing with complex social and environmental problems. Second, individuals, teams or organizations that want to engage in sustainable entrepreneurship should look for business opportunities from the phenomena that can improve people's well-being and environmental quality, such as rural early education, micro-credit, low-income women groups, water pollution and so on. Third, our research results show that knowledge about market development, marketing and Research & Development are crucial for sustainable entrepreneurship outcomes. As a result, sustainable entrepreneurs need to keep an eye on emerging things, because they can mean new markets and opportunities. At the same time, to be a sustainable entrepreneurial success, the first thing is to make your products occupy the market. In the start-up phase, the primary founders should actively seek partners who are proficient in marketing and establish their own marketing capability. This will help people better understand the purpose of your product and let more people know about your product. The importance of research and development knowledge shows that when we design technical solutions, we must ensure that the technical knowledge involved is accessible. We should not only pursue the application of new technology, but also the feasibility of the technology. In addition, as a complex system, SET involves continuous communication and interaction between individuals. To some extent, it is also a process of knowledge acquisition and exchange. This will help improve the team's overall opportunity recognition and knowledge acquirement level, identify business opportunities that can create more social, economic and environmental value, and enhance the team's R&D, management and operation capabilities. Therefore, leaders should encourage communication among members and create a supportive atmosphere of knowledge sharing to promote the success of the team. Fourth, our findings suggest that a sustainable entrepreneurial outcome can promote social, economic and environmental sustainability, and ultimately drives social change. Thus, the measure of outcome eligibility is whether social, economic and environmental values are created at the same time. Furthermore, sustainable entrepreneurs should constantly launch new businesses and expand market share, only this way can they occupy the future market and promote social changes.

7.2. Limitations and Future Research Directions

First, our data show that some respondents joined the entrepreneurial team for a short time. The respondents may not be able to accurately understand the issues and items. In future research, we can obtain SETs with greater tenure. Second, there are few empirical studies related to the SET,

which precludes us from comparing our findings. Thus, we need to replicate our model and add predictive validity test in our future study.

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