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Entrepreneurial Decision-Making Methods: The Evolution and Research Agenda

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Abstract: Entrepreneurial decision-making methods significantly influence the success of new ventures. They have been hot topics of entrepreneurship research. With the booming development of digital technology, entrepreneurial decision-making methods have changed. It is necessary to review the research on entrepreneurial decision-making methods, so as to lay a theoretical foundation for further research. This paper systematically reviews the literature on three entrepreneurial decision-making methods and summarizes their evolutionary patterns. This study clarifies the conceptual connotation and research structure of the three entrepreneurial decision-making methods. Meanwhile, the current research status of the three entrepreneurial decision-methods is summarized systematically. Finally, the future research direction is prospected.

1. Introduction

Entrepreneurial decision-making methods have always been of interest because of their significant impact on the performance of new ventures. At the same time, as the entrepreneurial environment continues to evolve, so does the entrepreneurial decision-making method. Trial-and-error, bricolage, improvisation, experimentation, effectuation, causation, and lean startup are all common methods to entrepreneurial decision-making. It is important to note that there is some overlap between these entrepreneurial decision-making methods, such as effectuation and improvisation, bricolage, and experimentation [1]. Examining them one by one will distract the research focus and constrain further research.

Based on the main ways of human understanding the objective world, experimental verification of "hypothesis + experiment + induction", simulation selection of "sample data + mechanistic model", and big data analysis of "massive data + scientific modeling analysis"), this paper discusses the combination of existing literature on entrepreneurial decision-making methods .It distills three main entrepreneurial decision-making methods: causation, effectuation and lean startup. The paper describes the origin and conceptual model of entrepreneurial decision-making methods, compares the main features of different entrepreneurial decision-making methods, and summarizes the current research status of entrepreneurial decision-making methods. It is important to deepen the research of entrepreneurial decision-making methods.

2. Evolution of Entrepreneurial Decision-Making Methods

The entrepreneurial decision-making method evolves with the changes of the entrepreneurial context. Since the 1950s, the entrepreneurial environment changed from a risky environment with low uncertainty to a fuzziness environment with high uncertainty. And then it turns to a Knightian uncertainty environment [2]. The evolution of the entrepreneurial decision-making methods can thus be divided into three stages.

The first stage: The 1950s to 1980s was an industrial society dominated by manufacturing, and the worldwide entrepreneurial environment was characterized by stability and obvious economies of scale effects. During this period, there was a clear demand and supply in the market, and entrepreneurial resources and entrepreneurial information were known. The overall entrepreneurial environment was a risky entrepreneurial environment, and entrepreneurs use causation to better meet market demand through the reallocation of resources.

Causation is mainly based on the view of rational decision making. It assumes that individuals make decisions by predicting expected returns based on relevant information obtained and making rational choices from the predicted outcomes. Causation asserts the objectivity of opportunities, arguing that most opportunities can be discovered through a targeted search process. The competitive advantage of a new firm also depends largely on the ability to capture and exploit opportunities and the ability to control resources. Underpinned by neoclassical economic assumptions, most scholars believe that entrepreneurs adopt rational, goal-driven behavior while pursuing entrepreneurial opportunities [3,4]. Entrepreneurs who follow causation can evaluate and identify the opportunities in the market. Through sufficient market research and competitive analysis, entrepreneurs avoid unforeseen events as much as possible and select the best combination of resources to achieve their stated goals. However, due to the uncertainty of the environment, it is not very likely that firms will want to maintain their competitive advantage permanently over time [5].

The second stage: In the 1980s and 1990s, due to the rise of the Internet, Western countries, led by the United States, gradually changed from a manufacturing-oriented industrial economy in the past to an Internet economy. At this stage, the supply and demand relationships in the market did not exist simultaneously, and the entrepreneurial risk was known but the probability of the entrepreneurial outcome was unknown [6].The entrepreneurial environment was changing from a risky entrepreneurial environment to a fuzzy entrepreneurial environment. The high level of environmental uncertainty makes it difficult for entrepreneurs to obtain information about their decisions and to predict the future, which calls into question the validity of causal reasoning.

Effectuation, pioneered by Sarasvathy (2001), is mainly based on finite rational decision theory and Knight's uncertainty theory, and incorporates Western pragmatic philosophical ideas [3,7]. Unlike causation, effectuation considers the future as unpredictable, but can control it to some extent. Effectuation starts from a given set of means and focuses on the various possible outcomes created by this set of means. Entrepreneurs can increase access to resources by actively interacting with the people around them and getting their commitment. At the same time, entrepreneurs tend to turn unexpected events encountered in the market into exploited opportunities timely, using the resources available around them to create better results on the basis of affordable losses [8]. Sarasvathy (2001) points out that causation and effectuation are two important methods to entrepreneurial decision-making. There is no one who is more effective than the other, just the process of implementing an appropriate decision-making behavior by the entrepreneur [3].

The third stage: From the end of the 20th century to the present, the world economy began to enter the era of "Internet+", "big data", "artificial intelligence" and other emerging technologies. The overall entrepreneurial environment is changing to a more uncertain entrepreneurial environment. The relationship between market supply and demand is unclear, and the probability of entrepreneurial

risks and outcomes are unknown. Starting a business in such an environment requires not only clarifying the interactive processes and interactions among entrepreneurial influences, but also making scientific decisions in the entrepreneurial process as well as minimizing entrepreneurial risks [9]. Lean startup is widely used because of its emphasis on bringing out products that customers really want faster and at a lower cost, and reducing unnecessary waste.

The term "lean" in lean startup was first derived from the concept of "lean production", which was embodied in the Toyota Production System (TPS) proposed by engineer Krafcik (1988). Based on this, Ries (2011) introduced lean thinking into the entrepreneurship curriculum, forming a prototype for the concept of "lean startup". According to Ries (2011), entrepreneurship is the human activity of creating new products and services under conditions of extreme uncertainty [10]. In the early stages of business establishment, there is a lack of resources, experience, and information, so new businesses must implement simple methods and processes to get rid of these constraints. By formulating hypotheses about the market user profile, Lean startup conducts a "develop-measure-perceive" feedback loop from a basic product prototype to continuous customer feedback. Then, lean startup entrepreneurs continuously test their hypotheses by trial and error and gradually improve their products to eliminate waste and meet user needs, ultimately helping companies find a sustainable business model.

In essence, the lean startup is a framework that supports business model innovation, new products and services [11,12]. It includes an iterative approach to feedback and change [13], such as using customer feedback to develop solutions, create requirements, get suggestions and improve products [14]. Using the lean startup can reduce the time and cost of starting a business, and the company can constantly adapt itself to customer needs at any time during the startup process. Lean startup is initially applied in the IT industry [10] and can now be widely used in all types of startups or any innovation projects [15,16].

3. Conceptual Model of Three Entrepreneurial Decision-Making

3.1. Causation

Causation is a decision-making method that has been much discussed in traditional management theory. The typical path is: the entrepreneur first identifies an opportunity to launch a new product, develop a new business, or explore a potential market. Then, through competitive analysis and market research, the entrepreneur divides the potential market into several separate segments based on target consumer characteristics and identifies the potential purchasing power of each segment. Then they develop a business (or entrepreneurial) plan and implement it by gaining stakeholder's acceptance and securing the resources needed to develop the opportunity. In this process, the entrepreneur needs to adapt to the environment as time progresses and eventually achieve the intended goal [3]. The conceptual model is shown in Figure 1.

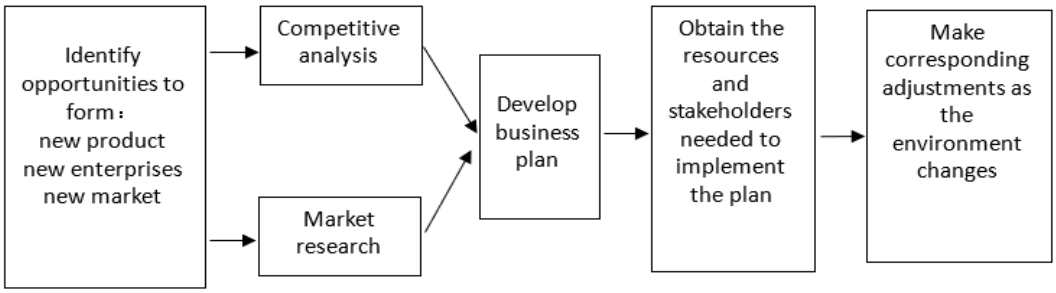

Figure 1: Model of entrepreneurial decision-making method based on causation

3.2. Effectuation

In contexts with unpredictable and ambiguous internal goals, the effectuation entrepreneurs tend to view the future as unpredictable and therefore do not deliberately predict it. They are action-oriented and turn their ideas into reality by leveraging their connections. Entrepreneurs base their ideas on three initial conditions: their unique abilities, their prior experience and their social network to determine their capabilities and what they can do, and then actively interact with the people they know to gain their commitment and support and mobilize as many resources as possible to develop the opportunity. In this process, the market gradually expands and new means and ends are derived. At the same time, the entrepreneurial behavior process is always embedded in a certain environment, so the specific environment plays an important role in the entrepreneurial decision-making process. Environmental changes may bring new means on the one hand, and on the other hand, they may affect the costs and benefits of using entrepreneurial resources, etc., leading to changes in the constraints of entrepreneurship. The emergence of new means and purposes will drive entrepreneurs to make the next series of decisions based on effectuation [17]. The conceptual model is shown in Figure 2.

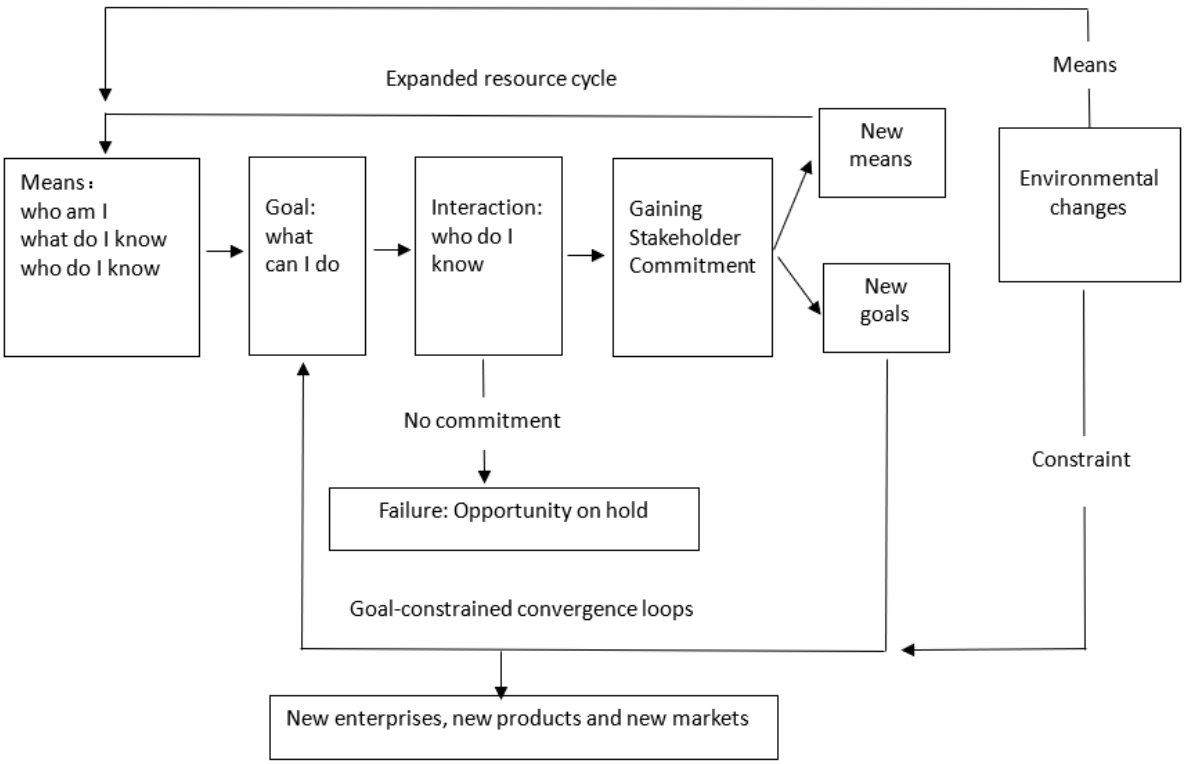

Figure 2: Model of entrepreneurial decision-making method based on effectuation

3.3. Lean Startup

The core view of lean startup is that new business startups should run around customers and deliver value to them. Companies need to efficiently iterate on how to deliver valuable, sustainable products to customers in a timely manner while avoiding startup failure, and identify real user needs in high speed iterations [13]. Faced with an uncertain entrepreneurial environment, companies should define their business models in a limited time. Companies need to keep trying, validating, and aligning with the exact market to avoid unnecessary waste and neutralize risks in a short period of time.

Lean startup is based on the two main goals of creating customer value and eliminating waste,

with the main emphasis on the "develop-measure-cognize" feedback loop. This cycle is developed as "concept - development - product - measurement - data - Cognition" [10]. The lean startup process starts with a concept, proposes relevant hypotheses, develops a minimized product and advances it to market, obtains user feedback data through measurement, validates the proposed hypothesis to gain new knowledge, and decides whether to proceed to the next round of iterations. As a result, the business forms a complete cycle of logic. In the process, lean startup firms advocate efficiency and agility, seeking to reduce costs, minimize waste and ease resource constraints. Also, new ventures will have a much lower failure rate when using the lean startup in their portfolios compared to the traditional causation and effectuation [1]. The conceptual model is shown in Figure 3.

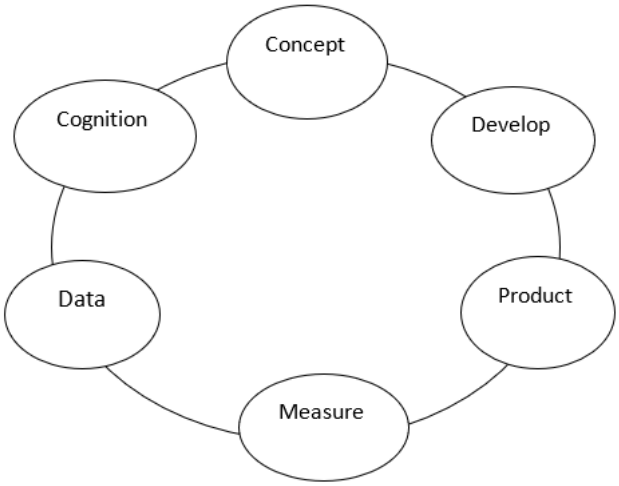

Figure 3: Model of entrepreneurial decision making approach based on lean startup

4. Comparison of Three Entrepreneurial Decision-Making Methods

First, compared to causation, both lean startup and effectuation exhibit a high degree of tolerance for ambiguity and an emphasis on not needing to predict the environment. In the Knight uncertainty entrepreneurial environment, entrepreneurial opportunities are more often created or discovered by chance [18]. Lean startup and effectuation deal with problem spaces that are both naive uncertainty and unpredictability. Both methods use a "first-activate-then-analyze" experimental paradigm to more rationally identify entrepreneurial opportunities and address resource constraints and information deficiencies in entrepreneurship.

Second, there are significant differences between the lean startup and effectuation at three levels: logic, model, and strategy. The lean startup emphasizes "lean". The logic of lean startups lies in the fact that the possibility of startup success is improved by constantly testing theories to validate upfront judgments about new products or services [10]. At the model and strategy level, the entrepreneur interacts closely and continuously with the customer, gathering information that is used to validate or disprove key assumptions up front. At the operational level, the lean startup has the following steps: converting a business idea into a testable product, analyzing of the completed test results objectively, validating or falsifying key assumptions, learning the results and designing the next round of experiments [14]. These processes are designed to reduce uncertainty by accumulating detailed and accurate information. At a lower strategic level, the lean startup relies on a set of tools from other domains, such as rapid prototyping and agile software development principles to quickly gather feedback and drive the process. Both effectuation and lean startup include circular models. At a logical level, the lean startup uses a systematic and scientific approach to guessing, testing the effectiveness of business plans and reducing uncertainty. The difference is that effectuation assumes

that the future is largely unpredictable and that the core of all activities is control, not prediction [1].

Third, causation, effectuation, and lean startup differ in three areas: uncertainty management, resource management, and continuous learning. In causation, uncertainty is lowest [17]. In effectuation, uncertainty is ontological, that is, the future is in principle unknowable. The future is co-constructed by those unpredictable ways, but entrepreneurs can control to minimize the impact of uncertainty [17]. Uncertainty in lean startup is based on epistemology, and the entrepreneurial process is prone to misjudgment and risk. But entrepreneurs can reduce uncertainty by gathering information to anticipate the future [19].

Resource management focuses on how to use existing resources and acquire new resources through various strategies. The central issue in causation is what resources are needed to achieve the intended goal. The entrepreneur avoids contingencies as much as possible through adequate market research and competitive analysis to achieve the stated goal [17].Effectuation emphasizes the dynamic nature of resources and focuses on two issues: first, the resources that the entrepreneur is willing to lose; and second, the committed resources acquired through interaction with stakeholders [17].In lean startup, entrepreneurs must test feasibility and conserve resources to identify critical resources needed and make early predictions based on the idea of resource scarcity [20].

Continuous learning focuses on the role of feedback and how it provides learning opportunities for entrepreneurs. Causation emphasizes prior predictions and a goal-oriented entrepreneurial decision-making process that pays little attention to external feedback. Effectuation is less about continuous learning as an inherent strategy and more as an adjunct to the entrepreneurial decision-making process [17]. Lean startup views the receipt of feedback and effective learning as the core of decision making. The continuous learning often revisits and modifies the short-term assumptions held in the face of newly acquired information [10].

In summary, although there are many differences between the three entrepreneurial decision-making methods in terms of decision-making goals and decision-making thinking. There is no situation in which they are superior, but rather the primary decision-making method in a given context. The decision-making methods used by entrepreneurs change over time and with the context [21]. In the early stages of entrepreneurship, the level of uncertainty is high and entrepreneurs prefer to use effectuation and lean startup. As the new venture grows, uncertainty decreases and causation is used more frequently. At the same time, the three entrepreneurial decision-making methods are not opposing, either/or relationships, and they can exist simultaneously. The findings of scholars such as Szambelan and Jiang (2020) and Furlotti et al. (2020) show that entrepreneurs do not use only one entrepreneurial method in their entrepreneurial decision making [22]. They use different dimensions of several entrepreneurial decision-making methods to improve entrepreneurial performance depending on the decision goal, entrepreneurial context.

5. The Status of Research on Entrepreneurship Decision-Making Methods

Due to the length of development time, there are significant differences in the accumulation of research results for several entrepreneurial decision-making methods. Causation and effectuation have been developed for more than two decades and have led to a series of research results. However, as a new entrepreneurship theory, the lean startup is still in its infancy and the amount of literature is relatively small. Scholars focus on theoretical analysis and case studies on lean startup. On the one hand, scholars theoretically derive models, concepts of lean startup. On the other hand, case studies are used to explore the application of lean startup in areas such as business model innovation and opportunity creation. Existing research on entrepreneurial decision-making methods revolves around the following aspects: research on the differences of different entrepreneurial decision-making methods, research on the antecedents of entrepreneurial decision-making methods, and research on

the impact of entrepreneurial decision-making methods on the performance of entrepreneurial firms.

5.1. The Differences of Different Entrepreneurial Decision-Making Methods

The literature on the comparative analysis of effectuation and causation is richer and more established. Scholars analyze the difference between the two mainly based on the difference in decision-making environment. For example, a study by Brettel et al. (2012) find that effectuation will play a greater role in the development process of highly innovative projects [23]. Reymen et al. (2015) find that as the level and form of environmental uncertainty changes, entrepreneurs switch between the use of two decision methods, causation and effectuation, or use a combination of both to create better results [24].

Since the introduction of lean startup, scholars have begun to explore the differences between lean startup and causation and effectuation. From the perspective of entrepreneurial method, Mansoori and Lackeus (2020) argue that lean startup is a systematic entrepreneurial method with lean thinking and effectuation [1]. It can clarify the way to match the resources at hand with customer needs, deepen the knowledge of the resources at hand, and thus promote entrepreneurship. Yang et al. (2019) argue that lean startup is a search and execution process based on effectuation and causation, and it can help startups identify entrepreneurial resources and create new opportunities to gain sustainable competitive advantage [25]. Ghezzi (2019) also states that lean startup is mainly expressed as a business strategy based on lean thinking and an execution approach based on effectuation [14]. The fundamental difference between lean startup and traditional entrepreneurial decision-making methods lies in the emphasis on lean thinking as the core, which can more effectively solve uncertainty, entrepreneurial resource constraints and other issues.

5.2. The Antecedents of Entrepreneurial Decision-Making Methods

For the antecedent variables of the entrepreneurial decision-making method, existing studies analyze them at three levels: individual, corporate and external environment. Gabrielsson et al. (2011) find that individuals with previous entrepreneurial experience and small business work experience are more likely to use effectuation when making entrepreneurial decisions, while individuals with large business work experience are more likely to use causation [26]. Later, scholars begin to focus on deeper cognitive characteristics of individuals as well as corporate-level factors. Costa et al. (2011) explore the effects of individual-level motivation, resilience, sources of internal control, and corporate-level job discretion, time availability, and management support on entrepreneurial decision-making method [27]. Smolka et al. (2018) argue that causation and effectuation can not only coexist but also have complementary effects [28]. They also find that using both entrepreneurial decision-making methods together will improve firm performance. Through analysis of data from 17 semi-structured interviews, Abbas and Liu (2021) find that firm dynamic capabilities can help startups in emerging economies to engage in lean startup, thus helping entrepreneurs to build more competitive business models and further improving the sustainability of startups [29]. Using a random questionnaire survey of all managers in small and medium-sized enterprises in the food industry, Molla et al. (2021) find that "employee empowerment" has the most direct effect on lean startup. Companies with a high level of employee empowerment are more likely to use lean startup [30]. Na et al. (2022) explore the role of female entrepreneurs' age on the use of lean startup through a quantitative research approach [31]. The results show that younger entrepreneurs have lower levels of anxiety and are more willing to implement business innovation behaviors through lean startup.

5.3. The Impact of Entrepreneurial Decision-Making Methods on the Performance of Entrepreneurial Firms

As research on entrepreneurial decision-making methods has intensified, scholars shift their research interest to its impact on the performance of entrepreneurial ventures. Scholars use case studies and empirical research to develop two main perspectives. One is to fully acknowledge the contribution of effectuation, causation, and lean startup to the performance of new ventures. For example, Guo et al. (2016) conduct an empirical study on Chinese network firms and find that both effectuation and causation positively affect the growth of new network firms through resource bundling behavior [32]. Yang et al. (2019) propose a two-stage process model to better describe the growth trajectory of new ventures. The lean startup provides the theoretical basis for both search and execution activities in a business [25]. In practice, entrepreneurs can use effectuation in search activities and causation in execution activities to improve new venture performance. At the same time, some scholars point out that the benefits of the lean startup have been proven and have received positive feedback in many companies. By implementing lean startup, entrepreneurs reduce risk and uncertainty and promote new business performance [15].In addition, lean startup facilitates the reduction of product development time and time to market. New business performance is significantly improved due to a greater focus on the voice of the customer in the implementation of the lean startup, making the product more likely to succeed [14].

Second, the study emphasizes the context of application of entrepreneurial decision-making methods. While recognizing the importance of entrepreneurial decision-making methods, scholars suggest that the role of entrepreneurial decision-making methods cannot be examined in isolation from the context. Based on data from the CAUSEE (Comprehensive Study of New Venture Entrepreneurship) project, Garonne et al. (2010) use a stratified research approach to examine the mechanisms of effectuation on new venture creation [33]. They find that effectuation has a significant contribution to new venture growth performance. And new ventures using effectuation have significantly higher entrepreneurial performance than causation in highly uncertain environments.

For example, using a meta-analytic approach on a 41 independent sample of 40 domestic and international empirical studies, Garonne et al. (2019) find that both causation and effectuation are significantly and positively related to firm performance, but that effectuation is more effective in emerging market contexts. The study by Cheng et al. (2014) use the stage of social development and the economic environment as contextual factors to argue that the new goal of entrepreneurship is to improve economic and environmental efficiency simultaneously [34]. Lean startup reduces ecological hazards, pollution and other adverse impacts of the resources used, including energy use, using our unique production methods, products, management or services, and business models. From this perspective, lean startup is more applicable to the current stage of social development and economic environment than other entrepreneurial decision-making methods.

6. Future Directions

A synthesis of the above literature reveals that research related to entrepreneurial decision-making methods is gradually deepening, and the following research questions need to be further addressed:

First, what is the conceptual system of entrepreneurial decision-making methods? Existing research generally recognizes the important role of entrepreneurial decision-making methods in entrepreneurship and has made effective explorations [35]. However, the following problems also exist: First, most studies are not grounded in digital contexts to analyze the uniqueness of entrepreneurial decision-making methods empowered by digital technologies. Second, most of the research studies one or two entrepreneurial decision-making methods in isolation from a static perspective, without systematically constructing a conceptual system of entrepreneurial decision-

making methods, which restricts the establishment of a research map of entrepreneurial decision-making methods. The core questions of "what entrepreneurial decision methods are available to entrepreneurs/teams and what are their uniqueness and applicability in the context" need to be explored in depth. This is conducive to promoting the construction of the conceptual system of entrepreneurial decision-making methods and deepening the understanding of the inner laws of entrepreneurial decision-making methods at the theoretical level.

Second, what factors influence the choice of entrepreneurial decision-making methods? Scholars analyze which factors influence the choice of entrepreneurial decision-making methods from different perspectives, such as experience, relational networks, and cognitive styles [36]. However, the following problems remain in existing studies. For one, research is often based on one theoretical perspective to analyze the impact of a single or a few factors, ignoring the synergistic impact of multiple factors under different theoretical perspectives [37]. In particular, the choice of entrepreneurial decision-making methods is a combined effect of multiple influencing factors rather than being influenced by a single factor [38]. Secondly, the existing studies mainly focus on the entrepreneurial decision-making methods in general contexts and fail to explore the entrepreneurial decision-making laws in digital contexts. Digital technology-enabled entrepreneurial decision making is more prevalent in entrepreneurial practice, and theoretical research is significantly lagging behind entrepreneurial practice. Scholars generally recognize the important impact of digital technologies on entrepreneurial activities and analyze the impact of digital technologies on behavioral activities such as opportunity identification and development, resource identification, acquisition, and allocation [39], but the central question of "how digital technologies affect entrepreneurial decisions" is still unknown. Therefore, to clarify the scientific rules of entrepreneurial decision-making method selection in digital context, it is necessary to construct the mutual matching relationship between digital technology and entrepreneurial elements. Analyzing how digital entrepreneurs/entrepreneurial teams effectively select entrepreneurial decision-making methods under different matching relationships between digital technology and entrepreneurial elements [40].

7. Conclusion

In this paper, we systematically review the research results of three major entrepreneurial decision-making methods: causation, effectuation, and lean startup, in the context of existing literature. The origins and conceptual models of the three entrepreneurial decision-making methods are summarized and described: causation emerged in early stable industrial societies, effectuation emerged with the Internet economy, and lean startup emerged inextricably with the development of the digital economy. Compared with causation and effectuation, lean startup has significant differences in three aspects: logic, model, and strategy. At the same time, the three entrepreneurial decision-making methods differ in three aspects: uncertainty management, resource management, and continuous learning. Although there are many differences among the three entrepreneurial decision-making methods in terms of decision goals and decision thinking, they are not antagonistic and either/or relationships, but can exist simultaneously. In addition, the research status of the three entrepreneurial decision-making methods is summarized: the research on the differences of the three different entrepreneurial decision-making methods, the research on the antecedents of the entrepreneurial decision-making methods, and the research on the impact of the entrepreneurial decision-making methods on the performance of entrepreneurial enterprises. On this basis, future research prospects in the field of entrepreneurial decision-making methods research are proposed. In summary, this paper systematically sorts out the research on the three entrepreneurial decision methods from a theoretical point of view, which is important for deepening the research on entrepreneurial decision methods in the future. However, this paper lacks empirical research supported by enterprise data, and future research can be based on

numerical background to empirically study the impact of entrepreneurial decision-making methods on the performance of entrepreneurial enterprises, which is beneficial to further promote related research.

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