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THE EFFECTUAL DESIGN METHOD FOR INTERNATIONALIZING ARCHITECTURAL AND ENGINEERING SERVICES: INSIGHTS FROM SWISS DESIGN ENTREPRENEURS

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Abstract

This research explores the use of effectual and causal design logic in architectural and engineering design internationalization. Specifically, it aims to understand how individual design entrepreneurs act across three international opportunity design problem spaces: (a) formation, (b) evaluation, and (c) exploitation. This qualitative multiple-case study employed phenomenographic, semi-structured interviews with 17 Swiss architectural and engineering design entrepreneurs.

The findings indicate that international opportunity formation is created via the dominant effectual design logic principle; international opportunity evaluation mainly applies causal design logic; and international opportunity exploitation primarily uses actions combining effectual and causal design logic principles. This research contributes to the architectural and engineering design internationalization literature, which focuses only on causal design logic and provides a practical integrative model for successful international architectural and engineering design services.

Keywords: architectural design, engineering design, entrepreneurial method, effectuation, international opportunity

1. INTRODUCTION

According to the World Trade Organization (WTO, 2023), within the General Agreement on Trade in Services (GATS) negotiations, technological advancements such as Building Information Modelling (BIM) and Virtual Reality (VR) have made international architectural and engineering design services part of the global economy (Winch, 2008). Furthermore, the United Nations Sustainable Development Goals (2015) emphasise sustainable cities and communities (SDG 11). For the conceptual design of a sustainable city, investors, and governmental institutions require highly creative, smart-city and urban planners, architects, civil engineers, and landscape architects. Such undertakings can be conducted as an international co-creation of different actors, in the formation of the

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design, creation and construction of a human-made abstract artefact, a sustainable city.

This study combines two literature streams of firm internationalization: the effectual design method in SME internationalization (Chetty et al., 2015; Kalinic et al., 2014; Laine & Galkina, 2017) and spatial research on architectural and engineering design internationalization (Coviello & Martin, 1999; McQuillan et al., 2018; Winch, 2008). Previous studies on architectural and engineering design internationalization have focused mainly on traditional management and marketing perspectives (Coviello & Martin, 1999; McQuillan et al., 2018; Winch, 2008), considering only causal design logic (Sarasvathy, 2001, 2008). However, research has been conducted on the effectual design logic of SME internationalization in the high-tech, software, and manufacturing sectors (Chetty et al., 2015; Kalinic et al., 2014; Laine & Galkina, 2017). The effectual design method in the international opportunity concept is not fully understood, with the current understanding lacking detail and a particularly high need for research, especially within the international architecture and engineering service industry (Valentino et al., 2022). Therefore, to the best of our knowledge, empirical research focused on applying both causal and effectual design logics in architectural and engineering design internationalization remains scarce (Valentino et al., 2022) and deserves greater research attention.

This study builds on Tabares et al.'s (2020) call to explore the international opportunity process under the effectual design method (p. 359) and to comprehend the synergistic use of effectual and causal design logic (Sarasvathy, 2001, 2008). The study investigates how to internationalize architectural and engineering design services by applying the effectual design method through three international opportunity design problem spaces: (a) formation, (b) evaluation, and (c) exploitation. Examining architectural and engineering design practices provides insights from a highly dynamic and creative service sector, in which competition relies on creativity rather than on the development of products and goods.

This study enhances the international entrepreneurship literature by clarifying the international individual-opportunity nexus (Shane, 2003) in response to Tabares et al.'s (2020) call. The study further explores how individual design entrepreneurs operate within the international opportunity process. Finally, it fills the research gap in the effectual design method (Sarasvathy & Venkataraman, 2011; Mansoori & Lackéus, 2020) by applying it to the internationalization of architectural and engineering design.

2. LITERATURE REVIEW

2.1 The Effectual Design Method

Sarasvathy's (2001, 2008) effectual design logic was conceived from a study of the think-aloud protocols of experienced entrepreneurs. Sarasvathy continuously stressed the practical implications of her ideas, contrasting them with the business plan, which she saw as an encapsulation of causal design logic. The effectual design approach involves leveraging the resources at hand, minimising losses, trusting partners more than objectively warranted, and leveraging contingencies to transform surprises into opportunities (Sarasvathy, 2001, 2008).

Sarasvathy and Venkataraman (2011) compared scientific and entrepreneurial methods, suggesting that the entrepreneurial method is as useful as the scientific method in practice. This idea is also supported by Mises (1949), who argued that the entrepreneurial method is a universal aspect of human action. Effectual design may be the dominant logic of the entrepreneurial method, similar to experimentation within the scientific method. Sarasvathy and Venkataraman (2011) developed the idea that entrepreneurial methods are teachable and learnable. They remove entrepreneurship from the corners of economics and management by suggesting it to be a general method of human action. In essence, stating that it "aims to generate and refine design principles" by using mechanisms that "involve action, interaction, reaction, trans-

formation and co-creation" (Sarasvathy & Venkataraman, 2011, p. 115).

In Nelson Goodman's terms, the architect or engineer is a creative designer, a world-maker (Goodman, 1978; Schön, 1992), who constructs reality at the interface between the actual and virtual worlds to create a newly designed world. The interface is the reality of the world in which the architect and engineer design a constructed human-made artefact such as a sustainable city. Design worlds are socially constructed by the action, interaction, and co-creation of multiple highly creative designers, such as smart city and urban planners, architects, civil engineers, and landscape architects. Architectural and engineering professions are integral to the design and construction of artificial structures such as buildings, bridges, and landscapes. Architects design a space to meet client needs and the aesthetic appearance of the interior and exterior of a building. A civil engineer's main responsibility is to ensure that the design of a structure is safe and meets all appropriate building codes. One way that architects and engineers communicate their ideas to each other is through design methods that create artefacts, such as blueprints or technical drawings. Design methods are often referred to as activity models, while actions must be taken to obtain a solution for a design problem. Until it is finally built, such action is a problem-solving as well as a design process (Heath, 1984; Schön, 1992). Therefore, what is for the architect and engineer the design method to initiate changes in man-made objects (Jones, 1972) is for the entrepreneur the entrepreneurial method of effectual design (Mansoori, 2017, Sarasvathy & Venkataraman, 2011; Sarasvathy, 2021). Therefore, the effectual design method is a combination of effectual and causal design actions to create human-made artefacts, such as international opportunities for architects and engineers.

2.2 The International Opportunity Process

Simon (1988) conceptualised design as the creation of an interface between inner and outer systems, thus embodying the ability to connect the two by iteratively developing artefacts (Simon, 1996). Building on this notion of design, an emerging literature stream has begun recognising entrepreneurship as a design activity (Berglund et al., 2020; Klenner et al., 2021). Additionally, studies recognise that creativity and critical reflexivity are necessary to transform insights into opportunities (Dimov, 2021) and that artefacts are central to conceptualising and understanding entrepreneurial opportunities (Ding, 2019).

Combining design and entrepreneurial methods with effectual design, uses human actions, interaction, and co-creation (Sarasvathy & Venkataraman, 2011) in the international opportunity process (Mainela et al., 2013, 2018, Tabares et al., 2020). In international entrepreneurship (IE), an international opportunity process is "the socially constructed behavioral process associated with the creation, discovery, evaluation, and exploitation of opportunities across national borders to create new businesses…" (Tabares, et al., 2020, p. 357). This study investigates the international opportunity process of architectural and engineering services from an entrepreneurial design process perspective. This situation is seen as a human-designed artefact by the effectual design method along three international opportunity design problem spaces: (a) formation, (b) evaluation, and (c) exploitation.

How have international opportunities come to be? Scholarly literature has proposed two contrasting behavioral ontological views (Tabares et al., 2020). The positivistic view assumes that opportunities are hidden in the market, but can be discovered (Alvarez & Barney, 2007, 2010; Chandra, 2017; Kalinic et al., 2014). Alternatively, some scholars argue that opportunities result from entrepreneurial creation and co-creation (Chandra, 2017; Kalinic et al., 2014).

Dimov (2021) explains that entrepreneurship literature has recognised that these two epistemological stances on opportunities often coexist (Berglund et al., 2020; Ding, 2019). A systematic literature review conducted in the IE literature (Mainela et al.,

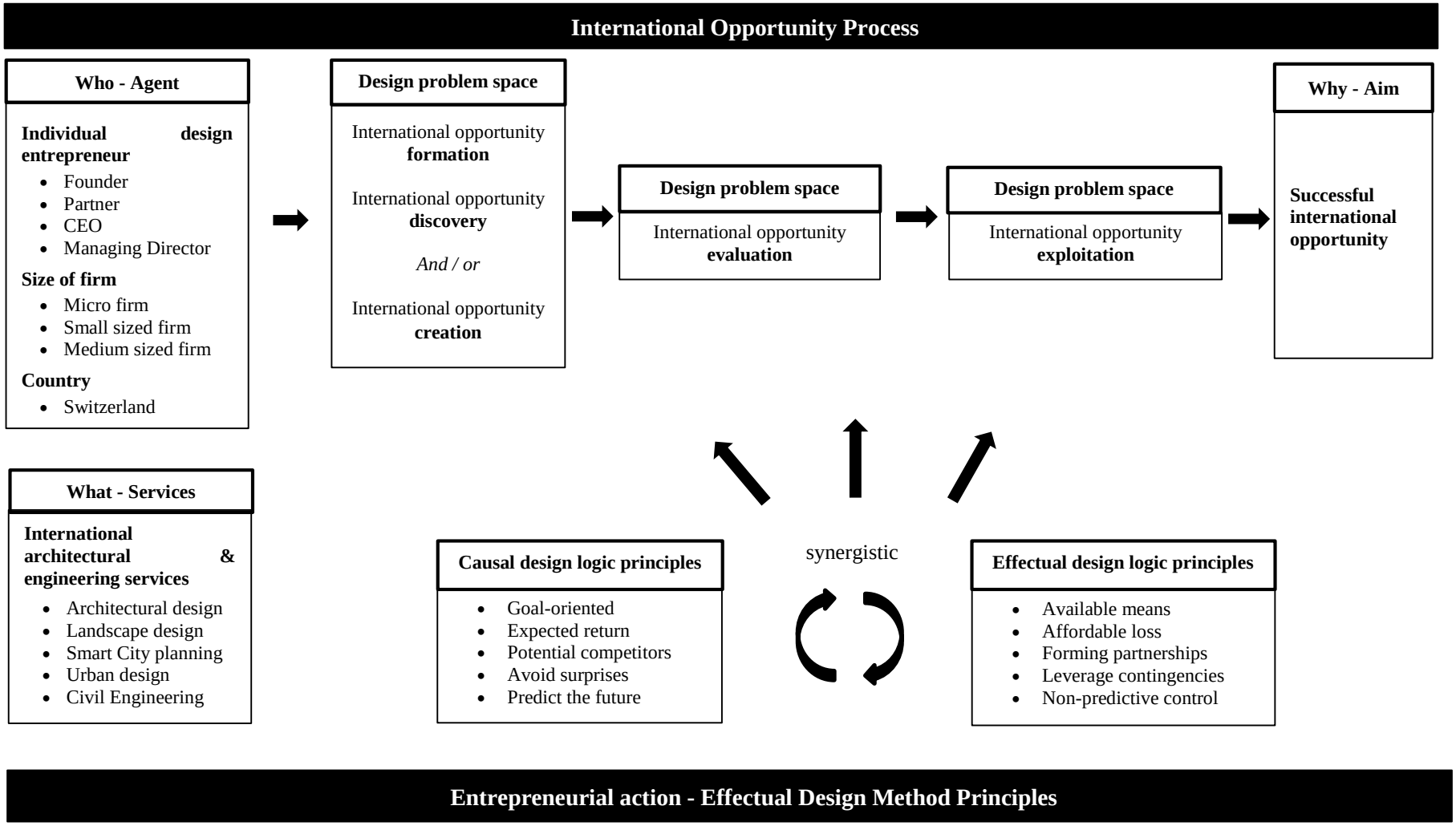

Figure 1 Conceptual Framework (by the Authors)

2018; Tabares et al., 2021) indicates that opportunity discovery, serendipity or active search, or creation/co-creation in social processes form a continuum of action logics that are intertwined, and which complement each other (Berglund, 2007).

As soon as an international opportunity is created or discovered, design entrepreneurs move to a developmental stage in which the opportunity is evaluated to determine whether it is valid and substantial enough to be exploited (Mainela et al., 2018; Tabares et al., 2020). How do individual design entrepreneurs view created and discovered international opportunities favourably, and reject others to act appropriately (Alvarez & Barney, 2007; Shane & Venkataraman, 2000)? Tabares et al. (2020) explains that the nature of decision-making or mode of reasoning involved in opportunity evaluation is not absolute but varies among individuals (Chandra, 2017). Some studies argue that decision rules for evaluating opportunities can be the result of causal design logic, in which an opportunity is assessed with more precise criteria and cost analysis, seeking to select more attractive opportunities (Chandra, 2017; Williams & Wood, 2015). Other studies have revealed that decision rules can be the result of effectual design logic (Chandra, 2017; Mainela & Puhakka, 2013). Not all opportunity ideas survive this evaluation process (Oyson & Whittaker, 2015), as only some will be exploited, while others are likely to be abandoned due to insufficient resource support (Bingham et al., 2007). Some studies claim that institutional and cultural factors also affect how different actors evaluate opportunities and whether the opportunities are deemed valuable for exploitation (Mainela et al., 2018). For instance, financial systems can directly influence the evaluation process through the cost and availability of capital (Baker et al., 2005). Furthermore, company- and individual-level experiences influence international opportunity evaluations (Zahra et al., 2005).

Finally, international opportunity exploitation occurs after a design entrepreneur has created and/or discovered an international opportunity and decides whether it is worth pursuing. Moreover, how, and where resources are acquired and mobilized in pursuit of that opportunity (Alvarez & Barney, 2007; Shane & Venkataraman, 2000) must also be determined in order to act accordingly. Zahra et al. (2005) emphasize that only during the process of exploiting an opportunity, is the opportunity created. Figure 1 illustrates the conceptual framework.

3. METHODOLOGY

3.1 Research Design

This study investigates the actions of individual design entrepreneurs during the international opportunity process (Mainela et al., 2013; Tabares et al., 2020) using Swiss architectural and engineering design firms as an example. This study applies a constructivist research approach (Lincoln & Guba, 2013) and effectual design method to existing architectural and engineering design firms.

An exploratory research strategy consisting of multiple cases was utilized (Welch et al., 2011), which is particularly useful in the context of applied effectual and causal design logic throughout the international opportunity process of architectural and engineering design, given that this phenomenon remains scarcely examined (Valentino et al., 2022).

3.2 Data sample and collection

For the qualitative case study, purposeful and comparison-focused sampling (Bell et al., 2022; Patton, 2015) was used to select design entrepreneurs for interviews. Individual design entrepreneurs, employing between five and 249 employees, and providing international design in at least two foreign markets, were selected for the data collection. The individual design entrepreneurs were required to be owners, founders, partners, CEOs, or managing directors who were directly involved in the design service internationalization decision-making.

Most of the interview participants identi fied were in Basel, Geneva, and Zurich, the

main hubs of Swiss architectural and engineering design. These entrepreneurial designers were contacted via e-mail, telephone, or face-to-face at architectural and engineering exhibitions, for the purpose of requesting their participation in the research. After obtaining approval, a participant consent form was distributed to the potential interviewees. Most informants were design entrepreneurs from medium-sized firms (eight out of 17), with 85% of their total turnover from foreign projects. All identities were kept confidential, and the data were used for academic research only. Table 1 provides the pseudonymous profiles of the Swiss architectural and engineering design firms.

The interviews were conducted in English. Phenomenographic semi-structured interviews were conducted to capture variations in individual perceptions, experiences, and enactments (Marton, 1981). Data were collected during three COVID-19 pandemic periods (fall 2020, spring 2021, and summer 2022). All interviews were recorded and transcribed verbatim and guided by a set of guidelines based on prior research on causal and effectual design logic (Brettel et al., 2012; Chandler et al., 2011; Sarasvathy, 2008). Two pilot interviews (CHE_01 and CHE_02) were conducted to validate the interview approach and test the usability of the guidelines. Pilot interviews evaluated the respondents' understanding of the questions. The data were used to refine the interview guidelines and are included in the results.

The case firms' websites were studied to learn about their internationalization, projects, and social media sites, to confirm their expertise and experience (e.g., LinkedIn, arch-daily.com). Furthermore, secondary documents from the firm, such as interviewee CVs, international project reference portfolios, 2021 annual reports, and client presentations were also examined, while key sources were also asked to verify the findings. This enabled triangulation of the data. Interviews lasted 35-70 minutes, with notes and reflections recorded in writing and through voice memos. Follow-ups and validation were performed via e-mail or phone, if required. Table 2 summarises key information regarding the interviewees and the data collected.

3.3 Data Analysis

Seventeen interviews were digitally recorded, transcribed, and coded for systematic categorisation (Saldaña, 2021). Content analysis was conducted to categorise, sort, and compare similarities, differences, recurring themes, and discrepancies. High-validity measurement indicators have been used to analyze effectual and causal design logic principles (Brettel et al., 2012; Chandler et al., 2011; Sarasvathy, 2008). Memo writing, a key part of data analysis and theory building, was used throughout the content analysis to aid in the development of ideas regarding the data and codes. This process allows for the extraction of hidden meanings from the data and outlines the researcher's interpretation (Charmaz, 2006). Figure 2 shows the applied coding scheme related to the constructivist grounded theory analysis (Charmaz, 2006).

Table 3 presents the final 21 building blocks and the 52 codes of the created integrative model (see Figure 3).

4. FINDINGS AND DISCUSSION

This study builds on Tabares et al.'s (2020) call to investigate the international opportunity process through the effectual design method and comprehend the synergistic use of effectual and causal design logic (Sarasvarthy, 2001, 2008) in the "how-to" internationalize question of Swiss architectural and engineering design across three international opportunity design problem spaces: (a) formation, (b) evaluation, and (c) exploitation. A summary of these findings is discussed in relation to the current literature, and an integrative model is presented for design entrepreneurs to internationalize their services successfully (see Figure 3).

Table 1 Swiss Data Sample

Firm ID	Architectural and Engineering Services	Founded	Ssize	Headcount	Year of Initital Internationalisation & 1st Foreign Market(s)	Number of Foreign Markets	International Revenues	International Opportunity
CHE_01	Civil Engineering	2008	Medium	65	2009 UK and Germany	4	85%	Subsidiary Projects
CHE_02	Architecture	2009	Small	12	2009 Finland and Sweden	5	30%	Subsidiary Projects
CHE_03	Civil Engineering	1964	Micro	6	2002 USA and Canada	14	50%	Subsidiary Projects
CHE_04	Civil Engineering	1926	Medium	200	1926 Turkey	7	70%	Subsidiary Projects
CHE_05	Civil Engineering	2015	Small	35	2015 Israel	5	10%	Subsidiary Projects
CHE_06	Civil Engineering	1963	Small	40	1980 Germany	4	30%	Projects
CHE_07	Architectural & Urban Design	1999	Small	35	2013 Singapore	2	70%	Subsidiary Projects
CHE_08	Architecture	1997	Medium	80	2005 Czech Republic	2	20%	Subsidiary Projects
CHE_09	Architecture	2008	Medium	240	2008 Germany	3	60%	Subsidiary Projects
CHE_10	Civil Engineering	2009	Small	12	2008 Germany	5	5%	Subsidiary Projects
CHE_11	Civil Engineering	1987	Medium	75	1995 Germany	8	65%	Subsidiary Projects
CHE_12	Civil Engineering	1978	Medium	88	2007 France	7	10%	Subsidiary Projects
CHE_13	Architectural & Urban Design	2007	Medium	125	2008 The Netherlands	4	25%	Subsidiary Projects
CHE_14	Architecture	2002	Medium	50	2002 Germany	5	10%	Subsidiary Projects
CHE_15	Architecture	1994	Small	33	2010 Spain	2	30%	Subsidiary Projects
CHE_16	Architectural & Urban Design	2011	Micro	6	2013 Australia	3	5%	Projects
CHE_17	Landscape Architecture	2008	Small	14	2017 China	5	10%	Projects

Table 2 Data Collection

Firm ID	Interview Date	Interview Participant(s)	Interviewee(s) Educational Background	Interview Duration in Min	Communication	Secondary Data
CHE_01	14.08.2020	COO Germany / Sweden, & Sales Director Europe	Master Civil Engineering FH N/A	55	Face-to-face on site	- Firm homepage, foreign project reference overview - Email communication - S-GE success story - Social media profile
CHE_02	28.08.2020	Founder & Principal partner	Master Urban design & planning Master Architecture	68	Online via Microsoft Teams	- Firm homepage, foreign project reference overview - Email communication - https://www.archdaily.com - Social media profile
CHE_03	02.10.2020	Manging Director	Master Civil Engineering ETH	64	Online via Microsoft Teams	- Firm homepage, foreign project reference overview - Email communication - https://www.archdaily.com - Social media profile
CHE_04	21.05.2021	CEO & International Project Manager	PhD Geology ETH Master Civil Engineering ETH	55	Online via Microsoft Teams	- Firm homepage, foreign project reference overview - Email communication - https://www.archdaily.com - Social media profile
CHE_05	04.06.2021	Partner	Executive MBA	45	Online via LINE	- Firm homepage, foreign project reference Overview - Email communication - https://www.archdaily.com - Social media profile
CHE_06	06.05.2022	Partner	Master Civil Engineering ETH	33	Face-to-face on site	- Firm homepage, firm presentations, foreign projects overview - Email communication - https://www.archdaily.com

Table 2 (Continued)

Firm ID	Interview Date	Interview Participant(s)	Interviewee(s) Educational Background	Interview Duration in Min	Communication	Secondary Data
CHE_07	20.05.2022	two Partners	Master of Architecture EPFL Geneva Institute of Architecture	52	Online via Microsoft Teams	- Social media profile - Firm homepage, firm presentations, foreign projects overview - Email communication - https://www.archdaily.com
CHE_08	03.06.2022	two Partners	Master of Architecture ETH SIA Master of Architecture ETH SIA	48	Online via Microsoft Teams	- Social media profile - Firm homepage, foreign project reference overview - Email communication - https://www.archdaily.com
CHE_09	08.06.2022	Partner & International Project Manager	Master of Science Real Estate Dipl Ing. Civil Engineering	50	Online via Microsoft Teams	- Social media profile - Firm homepage, foreign project reference overview - Annual report 2021 - https://www.archdaily.com
CHE_10	17.06.2022	Partner	Prof of Structural Design FH	46	Face-to-face on site	- Social media profile - Firm homepage, foreign project reference overview - Email communication - https://www.archdaily.com
CHE_11	30.06.2022	CEO	Master of Science Civil Engineering EPFL & Executive MBA	62	Online via Microsoft Teams	- Social media profile - Firm homepage, foreign project reference overview - Annual Report 2021 - Email communication
CHE_12	08.07.2022	Founder & Managing Director	Master Civil Engineering ETH FH & Executive MBA	35	Online via Microsoft Teams	- Social media profile - Firm homepage, foreign project reference overview - Email communication

Table 2 (Continued)

Firm ID	Interview Date	Interview Participant(s)	Interviewee(s) Educational Background	Interview Duration in Min	Communication	Secondary Data
CHE_13	15.07.2022		Prof for Architecture & urban planning ETH Master of Architecture ETH	57	Online via Microsoft Teams	- https://www.archdaily.com - Social media profile - Firm homepage, foreign project reference overview - Executive descision-making minutes - https://www.archdaily.com - Social media profile
CHE_14	19.07.2022	Owner	Master of Architecture ETH	48	Face-to-face on site	- Firm homepage, foreign project reference overview - Executive descision-making minutes - https://www.archdaily.com - Social media profile
CHE_15	08.08.2022	Founder	Master of Arts in Architecture	56	Online via Microsoft Teams	- Firm homepage, foreign project reference overview - Email communication - https://www.archdaily.com - Social media profile
CHE_16	12.08.2022	Founder & CEO	Master of Architecture FH	65	Face-to-face on site	- Firm homepage, foreign project reference overview - Email communication - https://www.archdaily.com - Social media profile
CHE_17	26.08.2022	Founder	HTL Rapperswil (FH)	44	Face-to-face on site	- Firm homepage, firm presentations, foreign projects overview - Email communication - Executive decision-making minutes - Social media profile

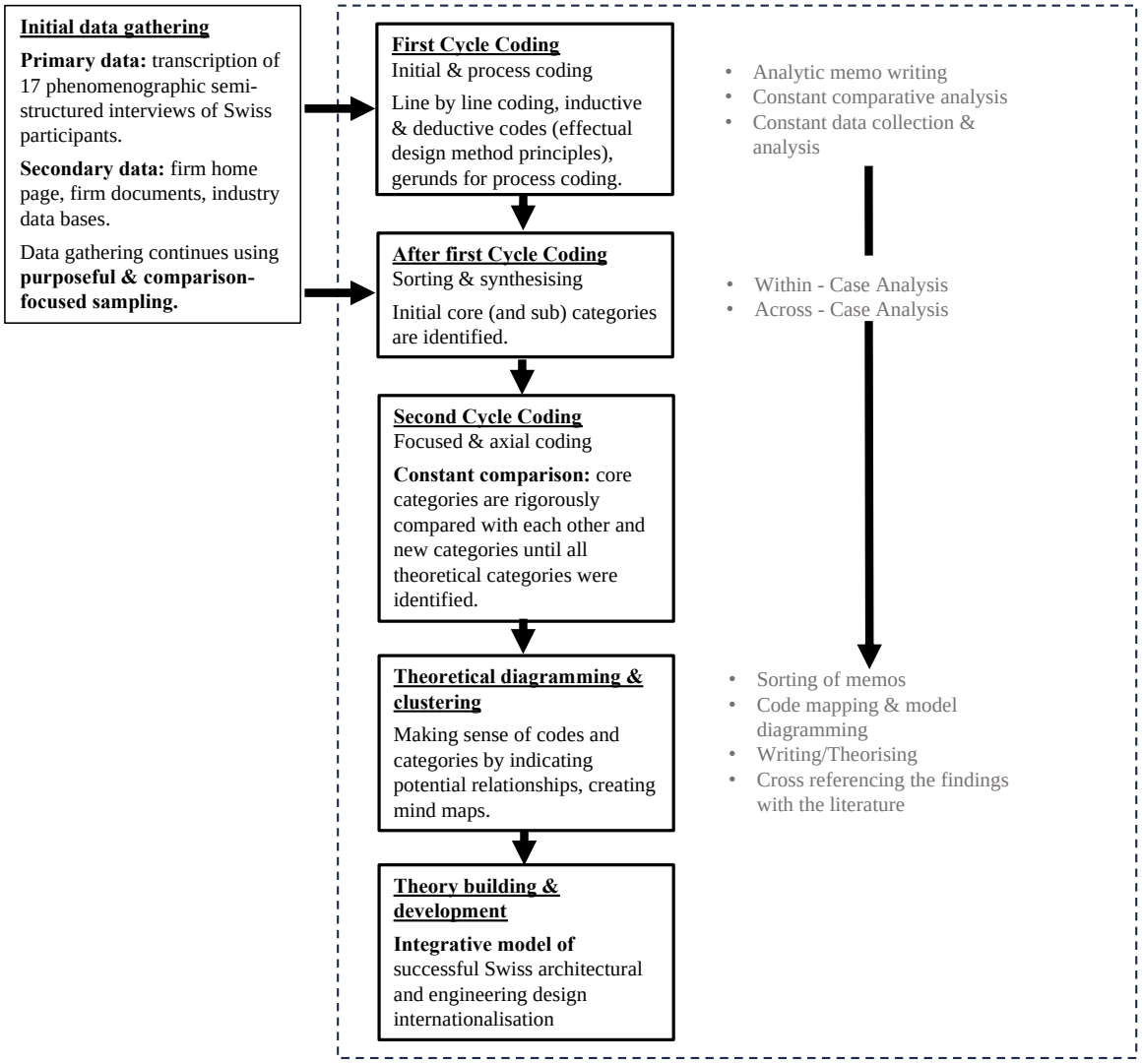

Figure 2 Coding Scheme (by the Authors)

Table 3 Integrative Model Coding Scheme (by the Authors)

Concept / Category	Code	Frequency	Concept / Category	Code	Frequency
International Opportunity Formation			**Exogenous context**	Uncertain	15
Effectual design	**Individual available means**		Environment	Unknown	12
	What I know	17	Unexpected events	Global crisis (COVID/Finance)	17
	Who I know	11		Economic crisis	10
	Who I am	10			
	Organisational affordable loss		Foreign institution	Political framework	10
	What are we known for (Reputation)	10		Financial regulations	10
	Organisational available means				
	Who we know	14			
	What we know	12	Foreign client	Price expectations	15

Table 3 (Continued) Integrative Model Coding Scheme (by the Authors)

	Forming partnerships			Technical solutions	10
	New relationships	13			
	Pre-existent relationships	10	Foreign business culture	Foreign business habits	17
	Goal oriented			Foreign business processes	16
Causal design	Business model	15		Foreign business methods	15
International Opportunity Evaluation					
Effectual design	**Affordable loss**		**Endogenous context**	Organisational structure	14
	Risk evaluation	17	Organisational characteristics	Compliance regulations	11
Causal design	**Expected return**			Financial structure	10
	Finance evaluation	12			
	Potential competitor				
	Competitors	11	**Successful International Opportunity**	New international project	16
	Market	10		New wholly owned foreign subsidary	12
	Price	15			
	Market entry mode	13	**Commitments for**		
	Avoid Surprises		Design & Resources	Pre-Design & design	17
	Project related	17		Project Planning	17
	Available resources	17		Resources	15
	Finance	15		Feasability study	13
	Exogenous context	12		New design & engineering method	12
International Opportunity Exploitation					
Effectual design	**Leverage contingencies**		**What can I do?**	Professional network	17
	Ad hoc opportunities	10		Community network	15
	Providing consulting	11		Privat network	13
Causal design	**Goal oriented**				
	Internationalisation mode	17	**What can We do?**	Architects & Urban Planners	17
	Expected return			Civil & Structural Engineers	15
	Manpower - Available human resources	16		Construction firms	15
	Finance - Available financial resources	15		Public Institutions	11
	Know-how - Available expertise	10			

4.1 The International Opportunity Process

The study's findings reveal the characteristics of the endogenous and exogenous contexts in which an individual design entrepreneur interacts throughout the international opportunity process. Simon (1996) argued, all designs are structurally similar in that they deal with artefacts designed at the interface between the inner and outer systems. The findings of the present study demonstrate the importance of the endogenous and exogenous contexts in which a design entrepreneur interacts and reacts. Endogenous context refers to the existing firm's organizational characteristics, such as organizational and

financial structures, and declared compliance standards. CHE_05 provides examples of financial and organizational structures.

> "We do not pay dividends to owners. This means that all the capital remains in the company. Additionally, we have no borrowed capital. This provides a comfortable situation. Quick and brief decisions can be made in the financial sector. [] We did not incur a large overhead. We have fast decision-making processes and a flat hierarchy."

... and CHE_03 explains the compliance regulations.

> "Compliance is a major issue in this industry. Therefore, we adhere to our ethical charta. In addition, we have many contracts from the World Bank or from the European Bank for Reconstruction, and it takes very little for you to get blacklisted there, and if you get blacklisted, this reputation sticks to you."

Furthermore, design entrepreneurs connect with employees' knowledge (what we know) and their networks (who we know) by utilizing available organizational means. However, the exogenous context is more dynamic and complex, with high uncertainty that is either ontologically real or socially constructed and is a vital aspect of international business environments with an unknowable and unpredictable future. The environment is a structure within which a design entrepreneur is embedded, providing international design services. CHE_06 explains the exogenous context as follows.

> "Curiosity is not without risk. When you leave your own country, your own norms. At the beginning, one goes into areas that are unknown to the other."

... whereas CHE_01 describes an example of an unexpected event that influenced their international project business.

> "We currently have projects in England that are somewhat unstable with this entire Brexit story. Now, everything still looks good, but that can change very quickly, and we must tackle other markets as well."

Throughout the design internationalization journey, the design entrepreneur is (inter)acting in both endogenous and exogenous environments. Individual entrepreneurial actions are based on exogenous environmental uncertainty, implying an unknown outcome (Knight, 1921; Alvarez & Barney, 2005). Ambiguity is essential for entrepreneurial action (McMullen & Shepard, 2006). Environmental isotropy is a precondition for the effectual design method (Galkina et al., 2015; Kalinic et al., 2014). Design entrepreneurs use the effectual design logic principle to leverage contingency. In other words, when an external or internal event occurs, they simply adjust their perspectives on the situation. They take advantage of what is happening. Instead of avoiding surprise, they leverage both positive and negative contingencies. They have a positive attitude towards unexpected events, in which effectual design logic is viewed as a vital source of opportunity (Harmeling & Sarasvathy, 2013). Meanwhile, causal design logic follows a linear process that seeks to reach the target as efficiently and with as little surprise as possible (Harmeling & Sarasvathy, 2013). This is a reaction to the surrounding environment (Sarasvathy, 2008; Mauer et al., 2021).

4.2 International Opportunity Formation

Throughout the first design problem space, design entrepreneurs initiate international opportunity formation by assessing the effectual design principles of individual available means, affordable loss, and the goal-oriented causal design principle. This study provides empirical evidence that international opportunities occur through interactions, reactions, commitments, and co-creation between individual design entrepreneurs and stakeholders to create opportunities for foreign market entry, network building, and design creation. The design internationalization described by participants consisted of the synergistic use of causal and effectual design logic principles in interaction with the

embedded individual endogenous and exogenous environments.

International opportunity formation is created through the dominant effectual design logic principle of the available means. The formation of international opportunities is a crucial step in the international opportunity process (Zahra et al., 2005; Muzychenko & Liesch, 2015). Based on the findings, three main factors were found to influence the creation of international opportunities: prior individual identity, knowledge, and social network structure (Sarasvathy, 2001, 2008).

Not only are the individual available means crucial, but firms' available means are also important. The available means for existing employees include specialized professional knowledge, knowledge of foreign business culture interactions, and foreign language skills. In addition, the effectual design principle of affordable loss is primarily related to reputation. The Swissness of an individual or firm in providing high-quality design services, meeting project deadlines, and having internationally designed and constructed architectural and engineering reference projects is significant. Creating a foreign network focused on long-term and trusted relationships for future commitments by interacting with local architects, urban planners, construction firms, and public institutions is crucial. Traditional business internationalization theories and best practices suggest collecting information to perform in-depth market research, asking for support from consulting companies, selecting a clearly defined goal, and transforming it into a specific line of action. However, none of the 17 cases defined a precise internationalization strategy before internationalizing their design services. These findings are consistent with those of Kalinic et al. (2014) and McQuillan et al. (2018).

This research was conducted in Switzerland, while four of the 17 participants were non-Swiss citizens. EU citizens created, evaluated, and exploited their first international opportunity in their foreign home country by directly using their available means. Swiss nationals have primarily created, evaluated, and exploited international opportunities through their networks. CHE_01 explains the following.

> "We were never really specialized in the Swiss market. We all came from international companies, and, from the beginning, it was clear that we would be more international. We already had British citizens in our first team… [], at that time, especially sales in other countries who have networks and know people to have the chance to offer in other countries. This was the basic condition when we started the fresh start-up. From the beginning, we have been in various countries to acquire, offer, and work on projects."

Rather than clearly defining the goals or predicted opportunities, each company begins with what is already within their control. They map their available means as individuals and their firm employees. This focuses on identity (e.g., foreign nationality), knowledge (e.g., foreign language skills), and existing professional and social relations (Galkina et al., 2021). The qualifications of those who handle the acquisition and implementation of design projects are crucial. Human factors are needed to realize design based on personal interactions, and therefore, personal competence (Scheuer, 2003). Personal competencies, such as foreign language skills, general knowledge of the respective country, customs and social norms, and knowledge of institutions, are key to providing international services (Scheuer, 2003). Human capital, knowledge, reputation, and relational capital are important factors (Canavan et al., 2012). With these available means, design entrepreneurs have the foundation for acting (Dew et al., 2009) and interacting with, e.g., governmental ministries, investors, and construction firms. The available means provide the foundation for new international opportunities, including "Who I am" (traits, abilities, attributes), "what I know" (expertise and experience), and "who I know" (social networks). Action and transformation, rather than planning and analysis, create international opportunities.

Design entrepreneurs must carefully consider what actions are possible, based on their individual available means. Rather than calculating the risk-adjusted expected return, entrepreneurs invest no more than they can afford to lose. Design entrepreneurs begin by interacting with others, some of whom are targeted. However, the majority are dependent on their current lives and circumstances. Each interaction provides an option for stakeholders to self-select. Each interaction participant can choose to invest only in what they can afford to lose. These available means are not static and can be composed or decomposed over time. Through this process, the identity, knowledge, and contact network of design entrepreneurs are transformed into new means. CHE_05 explains international opportunity creation as follows.

> "However, how this occurs is always very different. It is project-dependent and not country specific. Through various contacts in our office. Whether it is through architects, companies, or other contacts through which our projects come about. It is quite clear that the willingness must be there that one dares to take this step."

4.3 International Opportunity Evaluation

Through international opportunity evaluation, design entrepreneurs mainly apply causal design principles to analyze and calculate to form partnerships and commitment, such as manpower and financial resources, pre-design, and design, as well as to offer and tender phase services. The causal design criteria of international opportunity evaluation are mainly the expected returns and potential competitors, and to avoid surprises by evaluating the primal risk, legal, and tax regulations of international opportunities. The effectual design criteria of affordable loss in the form of reputation and the available organizational means to form a network were applied. CHE_04 describes the international opportunity evaluation as follows:

> "You must look at the contract carefully and use clauses that provide sufficient security. This is especially true in a contract with a local ministry or public sector. Therefore, this is relatively difficult. There are relatively few possibilities for making such adjustments. The biggest difficulty we face is related to tax issues. Usually, when you are doing a project or making a proposal in a new country, you do not have much time to figure out all the tax issues. So, in the offer, you simply say, 'All taxes are excluded.' … []"

Design entrepreneurs use the synergistic actions of causal and effectual design logic principles to determine whether an opportunity is valid and sufficiently substantial for exploitation. Tools and frameworks, such as business model canvas, are available to guide actions. Through analysis, risk can be minimised or mitigated to achieve optimal returns (Dew et al., 2008; Sarasvathy, 2008). However, international opportunity assessment cannot merely consist of secondary market research or a pure analysis. Instead, design entrepreneurs must talk to potential stakeholders and bring them onboard for successful design internationalization.

4.4 International Opportunity Exploitation

In the final stage of the international opportunity process, design entrepreneurs form partnerships with pre-existing and new social ties. These resources provide specialized knowledge, skills, manpower, and financial resources. Furthermore, by applying the causal expected return principle, they focus on finance topics and define the relevant international market-entry mode. They interact with those who commit resources to an international venture, allowing them to self-select. Attitudes towards the outside world (Dew et al., 2009) involve forming partnerships and obtaining pre-commitments (Dew & Sarasvathy, 2007) from self-selected stakeholders to co-created opportunities, while causal design logic involves competitive

market research and planning. Rather than seeing the future as driven by trends outside their control (e.g., climate change, pandemics, and artificial intelligence), they learn how human beings shape and co-create new opportunities. CHE_05 describes international opportunity exploitation as follows.

> "We work in a big network organization, so depending on what it is, the employees, for example, in Thailand, work a lot for Swiss projects… [] and employees in Switzerland working on our Thai projects. Basically, we work here (Bangkok) onsite with local partners … [] That is why our office in Bangkok is not so big. We are four employees. … [] We have a lot of interest from local companies who want to come together with us. So, it's going in the direction that in the future we will merge with local companies and then expand quite quickly and significantly."

International opportunity exploitation primarily involves synergistic actions that combine expected returns (causal design) with available means (effectual design). Design entrepreneurs tend to do what is available at hand (Sarasvathy, 2001, 2008). This includes identifying, accessing, and creating resources from network ties and other firms to exploit these opportunities. This reflects a growing level of prior knowledge and existing network ties, as internationalizing designs requires a cultural mindset, knowledge of foreign cultural habits, and a business culture to maintain prior international network ties and cultivate long-lasting relationships. CHE_02 stated the following.

> "…local way of doing things that you have somehow to coming in terms with, like content wise mean understanding the values of local people and local stakeholders and understanding their culture way of how they have been used to do things, to understand their interest and expectations …"

4.5 Successful International Opportunities

Design entrepreneurs create and discover successful international opportunities by synergistically applying causal and effectual design logic principles. These international opportunities are created as human-made artefacts through action and co-creation with different stakeholders, leading to two main directions: new wholly owned international foreign subsidiaries, and new international projects. Successful internationalization of architectural and engineering design results in international commitments for resources or creative designs such as feasibility studies, project planning, biding, and negotiation, and finally for the construction of buildings and infrastructure to create a human-made abstract artefact–a sustainable city.

Contingencies occur throughout the international opportunity processes. They emerge from an exogenous context and interact with designer entrepreneurs. An uncertain, unknown, and unpredictable environment creates opportunities for interactions. The output of an interaction is an artefact that serves as input to the individual's available means. Surprises are presented as ad hoc opportunities in the form of unexpected design tasks, possible mergers and/or gaining a new local partner through a client. This occurrence marks a pivotal moment. Contingencies represent events that are beyond control. This is completely unexpected and exemplifies pervasive uncertainty (Sarasvathy, 2008).

Figure 3 depicts the integrative model developed based on the empirical data analysis of 17 Swiss architectural and engineering design internationalization practice cases.

5. IMPLICATIONS AND CONTRIBUTIONS

The findings reveal the actions of individual design entrepreneurs in the international opportunity process of Swiss architect-

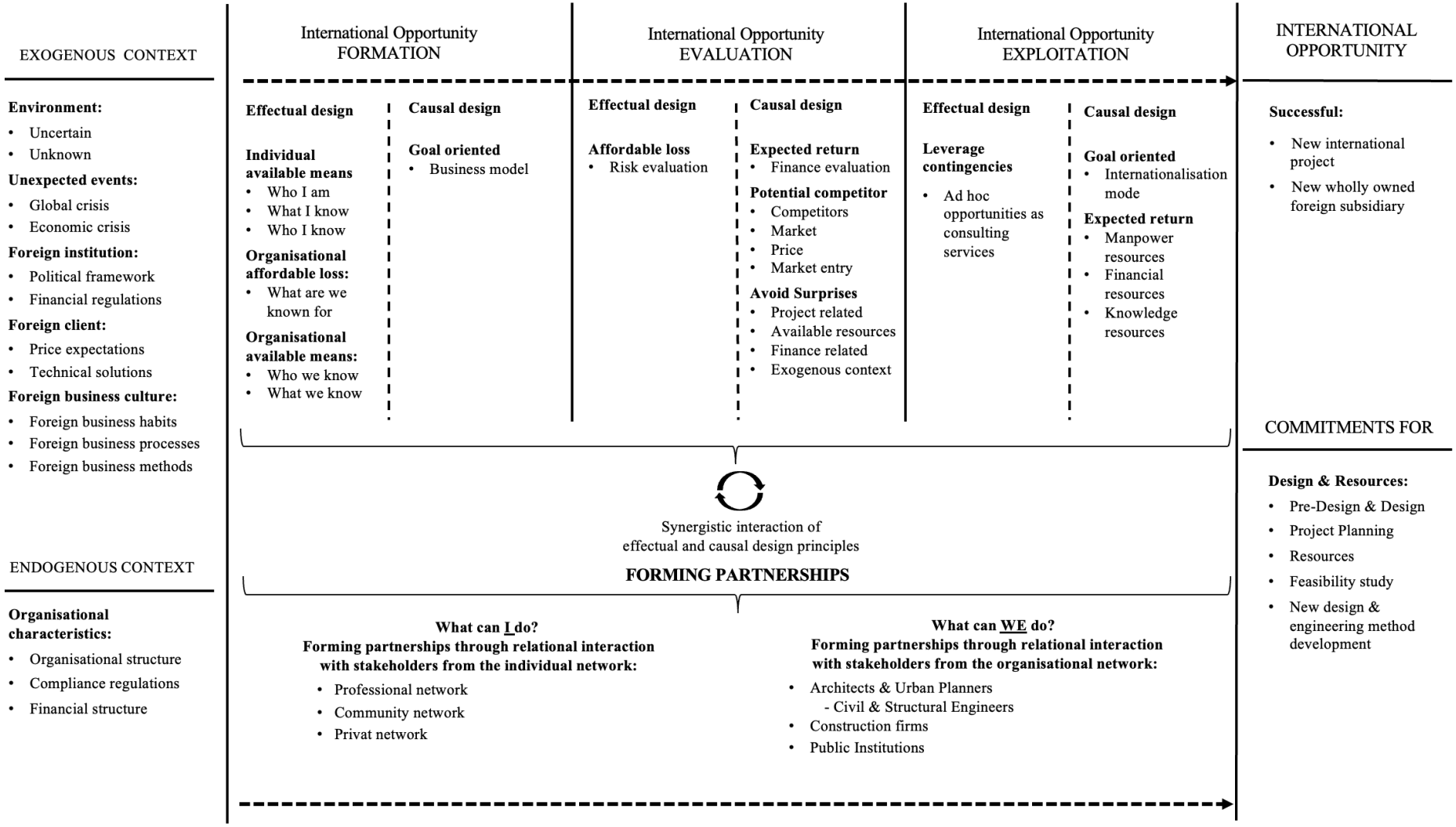

Figure 3 An Integrative Model of Successful Swiss Architectural and Engineering Design Internationalization (by the Authors)

tural and engineering designs. Practically, any individual design entrepreneur can create international opportunities by asking (a) who I am?, (b) what I know?, and (c) whom I know?. This study provides new insights into the role of design entrepreneurs in Switzerland's international architectural and engineering design sector. The findings correspond to directions for future effectuation research, as suggested by Tabares et al. (2020).

This study demonstrates how individual design entrepreneurs use causal and effectual design logic principles at various stages of the international opportunity process. How both logics complement each other depends on an individual's personality, knowledge, and networks. The findings of this study emphasize the need for design entrepreneurs to be agile and switch between both logics depending on the context and circumstances.

The findings indicate that design entrepreneurs are unaware of the action logic they use, and unconsciously switch between causal and effectual design logic. Thus, architectural and engineering educational institutions must raise awareness among students about unconscious use and the need for conscious awareness. This study provides a new concept for architectural and engineering educational institutions to include the effectual design method in their syllabus. Macro-, small-, and medium-sized firms can use their resources to achieve international success without relying solely on market research, competitor analysis, and business planning. Policymakers and educational institutions should provide tools to teach architects and engineers when and how to use the effectual design method that combines causal and effectual design logic principles and explains their synergistic interaction. First, it is essential to explain the effectual design method and how it works. Second, from a practical perspective, the focus should be on forming partnerships by building new and maintaining pre-existing social relationships (Kalinic et al., 2014; Coviello & Martin, 1999).

This study enriches the international opportunity process literature (Mainela et al., 2013, 2018; Tabares et al., 2020) by providing insights into the effectual design method (Mansoori, 2017; Sarasvathy & Venkataraman, 2011; Sarasvathy, 2021). The study advances knowledge of how individual design entrepreneurs act through three international opportunity design problem spaces: (a) formation, (b) evaluation, and (c) exploitation. The study also contributes to the architectural and engineering internationalization literature, which focuses mainly on business planning and marketing analysis (Coviello & Martin, 1999; McQuillan, 2018; Winch, 2008). We propose an integrated approach involving five design principles, providing a comprehensive view of the internationalization of architectural and engineering services.

6. CONCLUSION

This study aimed to complement the existing international entrepreneurship literature on the international opportunity process (Tabares et al., 2020) by exploring the use of effectual and causal design logic (Sarasvathy, 2001, 2008) throughout the internationalization of Swiss architectural and engineering design. Specifically, it has aimed to comprehend how individual design entrepreneurs act across three international opportunity design problem spaces: (a) formation, (b) evaluation, and (c) exploitation. An integrative model was presented that indicates that international opportunity formation is created via the dominant effectual design logic principle; international opportunity evaluation mainly applies causal design logic; and international opportunity exploitation primarily uses synergistic actions, combining effectual and causal design logic principles.

A successful individual design entrepreneur must alternate between effectual and causal design logic. When the conditions are certain, analytical frameworks and forecasting to maximize performance and have an economic focus are sensible. When conditions are uncertain, trial and error and discovering what works, such as maintaining a social focus, are necessary. Similar to the

everyday idea of being able to equally use the right and left hands, design entrepreneurs are well served to use both prediction (causal) and creation (effectual) design methods. Design is a social art with multiple designers and stakeholders, such as clients, suppliers, investors, and governmental agencies, all working together to create a successful international opportunity as a human-made abstract artefact - a sustainable city (SDG 11).

7. LIMITATIONS AND FUTURE RESEARCH

This study has three limitations. The first limitation is Switzerland's specific empirical context and the conditions of institutional regulations for architectural and engineering services. Therefore, application of the findings in other national contexts may be limited and requires further investigation. The challenge here is the representativeness of the research subjects and generalization of the research results. Analytical generalization has been aimed at the level of theory, with the hope that future research will utilize the model to study contexts in other countries. The second limitation is the varying sizes of the analyzed design firms (micro, small, and medium). Size bias in decision-making may exist, and future studies should consider this. A quantitative study can control for the effect of firm size on international entrepreneurship. In addition, only one data collection point exists for the case study firms. Future research must apply action research (Lewin, 1946) or the design science approach (Cross, 1982) to inform longitudinal data collection to study architectural and engineering design internationalization. Longitudinal studies can examine entrepreneurial actions in detail and observe the time dynamics in the international opportunity process.

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