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Understanding the heterogeneity of corporate entrepreneurship programs

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7 Mapping CE programs and their outputs

This chapter aims at answering RQ3: *Can causal relationships between CE programs and their outputs be identified?* To answer RQ3, it is divided into the following three sub-questions.

- RQ3a: What relationships between CE programs and outputs can be identified?
- RQ3b: Do structural or contextual elements influence the occurrence of outputs?
- RQ3c: Which CE programs are suited to achieve certain types of outputs?

Chapter 7 is based on the following three publications:

- C. J. Selig, T. Gasser and G. H. Baltes (2018) "**How Corporate Accelerators Foster Organizational Transformation: An Internal Perspective**", 2018 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), Stuttgart, 2018, pp. 1-9.
- C. J. Selig, T. Gasser and G. H. Baltes (2019) "**Effects of Internal Corporate Venturing on the Transformation of Established Companies**", In: Baierl R., Behrens J., Brem A. (eds) Digital Entrepreneurship. FGF Studies in Small Business and Entrepreneurship. Springer, Cham, pp. 159 – 183.
- C. J. Selig and G. H. Baltes (2020) "**Strengthening Organizational Ambidexterity through Corporate Entrepreneurship**", 2020 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), Virtual Conference 2020, pp. 1-9.

For analyzing the relationships between the CE programs and the outputs, we used the content management program NVIVO. It offers the function to create automated reports that are comparing different variables, in our case, the CE programs and the respective outputs.

To answer the three sub-questions of RQ3, the following steps are undertaken. Section 7.1 describes six different types of relationships as a basis for our analysis. In Section 7.2, the relationships between CE programs and outputs will be described (answering RQ3a). Section 7.3 examines the role of structural and contextual elements in influencing the occurrence of certain outputs (answering RQ3b). Section 7.4 focuses on identifying the CE programs that are

suited best to create the respective outputs (answering RQ3c). In Section 7.4, we will conclude on the findings and their contribution by answering the original RQ3.

7.1 Different aspects of relationships

We briefly describe six aspects of relationships that are potentially relevant for answering our research question (see, e.g., Allen, 2017; Frey et al., 1999)

- (A) *Uniqueness of relationship*: Describes the exclusivity of a relationship between two or more variables.
- (B) *Direction of relationship*: Describes in which direction the relationship between the variables can be observed.
- (C) *Strength of relationship*: Describes the quality (or strength) that can be identified between the variables.
- (D) *Mechanisms of relationship*: Describes how the relationship between two variables can be explained by focusing on the cause and the effect.
- (E) *Time aspect of relationship*: Describes impact time can have on the relationship between two variables.
- (F) *Form of the relationship*: Describes how the two variables behave to each other, which can have different functions.

The six aspects of relationships will be briefly described to set a common basis for our investigation. When analyzing the relationships between the CE programs and the outputs, these different aspects of relationships will serve as a basis to identify potential patterns.

A: The uniqueness of relationship

The understanding of the uniqueness of relationships is illustrated in Figure 7.1. It shows types of relationships between two variables A and B that are potentially relevant in our work, whereby A reflects the CE programs and B the outputs. The underlying assumption of this work is that CE programs have different sets of outputs. In some cases, it is expected that an output might be obtained by all CE programs, which is a special case of many-to-many relationships. The four types of relationships (many-to-one, many-to-many, one-to-one, and one-to-many) in Figure 7.1 are ideal types. In addition to them, it is also possible for CE programs to have hybrid relationships that are combinations of several of the four types from the figure.

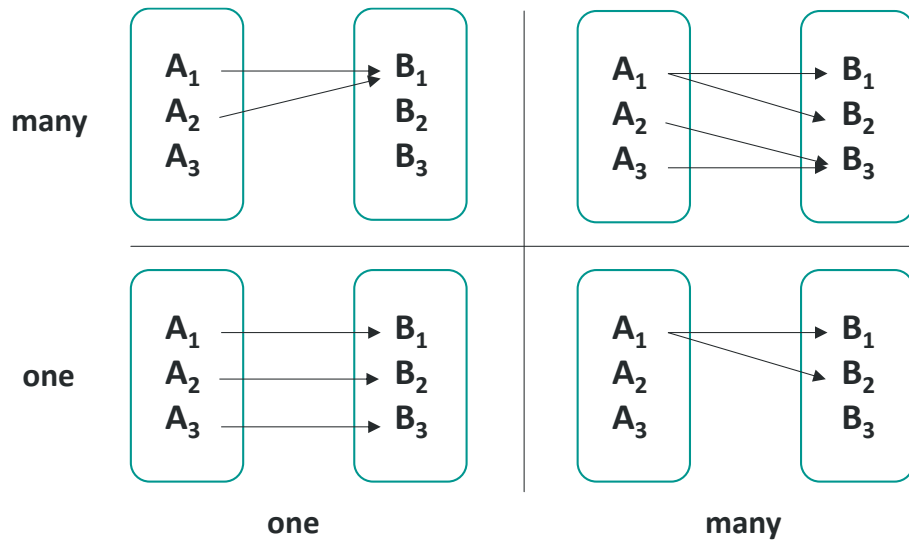


Figure 7.1: Different types of relationships between two variables A and B

For our results, it is expected that (a) the different CE program types (A_1 to A_4) show multiple relationships to outputs (B_1 to B_4) and that (b) each CE program type shows a different set of relationships to outputs (see Figure 7.2, 1 to 4). For example, in (1) CE program A_1 with the outputs B_1 and B_2 , whereas in (2) CE program A_2 shows a relationship to outputs B_2 and B_3 .

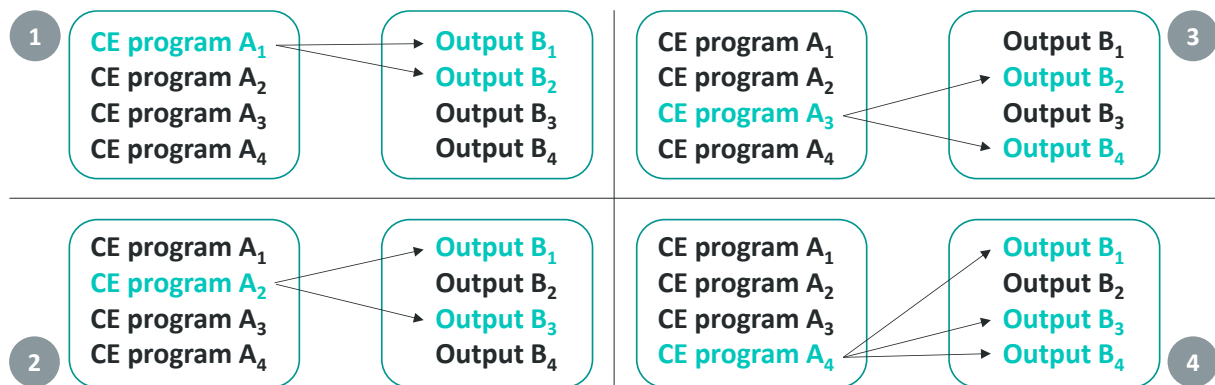


Figure 7.2: Expected relationships for CE program types and outputs

B: The direction of the relationship

For the direction of the relationship, we distinguish between unidirectional relationships and bidirectional relationships. A real-world example would be the radio as a unidirectional relationship, where a message is sent without feedback, whereas the telephone would be an example for a bidirectional relationship, as messages can be sent in both directions.

For our study, we focus on unidirectional relationships between CE programs and outputs with the aim to answer the question if the respective CE programs lead to certain outputs.

C: The strength of the relationship

In general, there are several conceivable ways how the *strength of the relationship* can be defined. On the one hand, measurement instruments can be created to define whether a relationship is weak or strong, e.g., a questionnaire with a rating scale of 1 - 5 for each variable. On the other hand, the strength of a relationship can also be described by the frequency of occurrence by which the relationship can be observed, e.g., how often does A lead to B.

For CE programs, different approaches seem to be appropriate for studying their relationship to outputs, such as assessing the fit between the outputs and the objective (intended output) or using the subjective evaluation by the company's employees. Based on the available data in our study, we decided to use the frequency of occurrence of an output in order to define the strength of a relationship.

For example, how often does the output *new stand-alone business* occur in relation to the CE program type *venture builder*. In general, all values between 0% – 100% are possible. To distinguish between a weak and a strong relationship we used a limit of >50%, meaning only relationships occurring in more than half of the cases are considered as strong relationships.

We define a strong relationship as follows.

Definition 7.1 A *strong relationship* is defined as a relation between an output and a CE program type that has a frequency of occurrence higher than 50% across the examined cases per CE program type.

D: The mechanism of the relationship

The *mechanism of the relationship* focuses on how the relationship between two variables can be explained. Can certain elements be identified and used to explain the underlying principles behind the relationship, and how do variables A and B influence each other? Understanding the mechanism between two variables is necessary to study the causality of a relationship. Applied to our study, the mechanism of relationship can be identified by examining elements of the structure or context of a CE program (Section 7.2) that are the cause of a particular effect, i.e., that can be used to explain the creation of particular outputs.

E: The time aspect of the relationship

The *time aspect of a relationship* is focusing on the impact that time can have on the relationship between two variables A and B. This aspect of a relationship generally can have various occurrences. For example, what is the time interval required to observe a relationship between the two variables, or is the relationship between the two variables changing over time? As previously already mentioned, for the direction of the relationship, there is a difference between outputs (near-term) and outcomes (long-term). In our study, we focus on the outputs, which are expected to be observed after a rather short period as a result of the CE program's activities. The aspect of time seems to be relevant when investigating rather young CE programs as it might be possible that not all outputs can be observed directly from the beginning, in particular, compared to CE programs, which are much older.

F: The form of the relationship

The *form of a relationship* describes the behavior between two variables, which can follow different forms. While some variables have a linear relationship, such as a craftsman who is paid by the hour, meaning every hour, the price increases by the same amount (discounts not considered). Other variables may have an exponential relationship, such as in the Corona pandemic, where the number of infected people doubled each week once it reached an "R number" higher than 1.0 (describing how many people are infected by a patient). In CE programs, there can be different forms of relationships depending on the type of outputs being created. For example, if events are held to raise awareness of innovations, there may be an optimal number of events because it is expected that there will not be an infinite number of participants. This means that beyond a certain point, new people will not be attracted even if the number of events is increased.

The six aspects of relationships (A-F) will be considered when answering the original RQ3.

7.2 Understanding relationships of CE programs and outputs

The first part of the analysis focuses on RQ3a, which reads as follows: *What relationships between CE programs and outputs can be identified?*

We will analyze the relationships for each CE program category separately. The analysis will focus in a first step on describing the general relationships between CE program types and outputs and in a second step on the strong relationships that can be identified. Subsection

7.2.1 begins with the general analysis for internal CE program types, followed by Subsection 7.2.2, which focuses on the strong relationships between internal CE programs and their outputs. This procedure is repeated for external CE program types in Subsections 7.2.3 and 7.2.4 and for radical innovation units in Subsections 7.2.5 and 7.2.6.

7.2.1 Internal CE program types and their outputs

Table 7.1 (see page 174) is illustrating the relationships between the internal CE program types and the outputs. The output categories and the respective outputs are listed in the first two columns of the table, followed by the four CE program types of the internal category (See Subsection). Behind the name of each CE program type, the number of investigated cases is shown between the brackets.

For each CE program type, two different kinds of information are provided in a separate column below the CE program's name. The first column shows the number of cases¹⁸ in which the respective output was created. The second column shows the frequency of occurrence for the respective output. To highlight differences in the frequency of occurrence, automated color-coding was applied.

Table 7.1 shows that all 27 outputs (rows in Table 7.1) are created by at least one of the internal CE program types. Twelve out of the 27 outputs were created by all four CE program types, whereas six outputs are created by two or fewer CE program types. Internal CE programs show one-to-many and many-to-many relationships but no one-to-one or many-to-one relationship.

The CE program type that created the most different outputs (number of rows in Table 7.1) is the intrapreneurial excubator, with 24 out of 27 outputs, reflecting 88.9 % of all possible outputs. Followed by the assisted incubator and the venture builder, both with 23 out of 27 outputs (85.2%). The idea validator has the lowest number with 16 out 27 outputs (59.3%). Based on this, it can be stated that the three CE program types of the intrapreneurial excubator, assisted incubator, and venture builder can be considered as allrounders regarding their value creation, whereas the idea validator is more focused.

¹⁸ The absolute number of the underlying cases must also be considered for the evaluation of the meaningfulness of the frequency of occurrence that is shown in the tables of this chapter.

Output category	Outputs	Idea validator (4)		Assisted incubator (7)		Intrapreneurial excubator (9)		Venture builder (3)	
Innovation capability	Innovation services & expertise	1	25%	2	29%	5	56%	3	100%
	Additional innovation paths	2	50%	4	57%	5	56%	1	33%
	Digital capabilities	0	0%	2	29%	1	11%	1	33%
	Roles or formats to support innovation	1	25%	0	0%	4	44%	0	0%
Innovation culture	Sensitized senior management	3	75%	4	57%	9	100%	3	100%
	Increased awareness for innovation	3	75%	6	86%	6	67%	1	33%
	Increased openness for innovation	1	25%	2	29%	5	56%	2	67%
Innovation ecosystem	Strategic partnership	2	50%	2	29%	4	44%	2	67%
	Venture portfolio	0	0%	0	0%	3	33%	2	67%
	Reputation within innovation eco-system	0	0%	1	14%	0	0%	1	33%
Innovation know-how	Intelligence on trends	0	0%	3	43%	4	44%	2	67%
	Technological know-how	0	0%	3	43%	4	44%	2	67%
Intrapreneurial empowerment	Entrepreneurial skills & methods	4	100%	6	86%	9	100%	1	33%
	Intrapreneurship community	1	25%	2	29%	2	22%	1	33%
	Network of supporters	2	50%	0	0%	3	33%	0	0%
New offerings	Validated innovation idea	4	100%	6	86%	9	100%	3	100%
	New product	1	25%	5	71%	5	56%	1	33%
	New stand-alone business	1	25%	5	71%	8	89%	3	100%
	Value adding services or feature	2	50%	2	29%	1	11%	1	33%
	New market	0	0%	1	14%	0	0%	0	0%
	Reconfigured business model	0	0%	0	0%	1	11%	1	33%
Organizational transformation	Increased efficiency	2	50%	3	43%	3	33%	0	0%
	New ways of working	0	0%	2	29%	5	56%	2	67%
	Digital infrastructure	2	50%	1	14%	0	0%	3	100%
	Improved flexibility & speed	0	0%	3	43%	2	22%	2	67%
	Improved corporate image	0	0%	3	43%	1	11%	1	33%
	Employer Branding	0	0%	2	29%	1	11%	2	67%

Table 7.1: Relationships between internal CE programs and outputs

7.2.2 Strong relationship of internal CE program types and their outputs

To gain a deeper understanding of the value creation of the internal CE programs, the next step will focus on strong relationships (frequency of occurrence higher than 50%). In total, ten outputs did not meet the >50% criteria and were removed. This step resulted in Table 7.2, which covers a reduced set of 17 outputs that have a strong relationship (highlighted in gray) to at least one of the internal CE program types.

Output category	Outputs	Idea validator (4)		Assisted incubator (7)		Intrapreneurial excubator (9)		Venture builder (3)	
Innovation capability	Innovation services & expertise	1	25%	2	29%	5	56%	3	100%
	Additional innovation paths	2	50%	4	57%	5	56%	1	33%
Innovation culture	Sensitized senior management	3	75%	4	57%	9	100%	3	100%
	Increased awareness for innovation	2	50%	6	86%	6	67%	1	33%
	Increased openness for innovation	1	25%	2	29%	5	56%	2	67%
Innovation ecosystem	Strategic partnership	2	50%	2	29%	4	44%	2	67%
	Venture portfolio	0	0%	0	0%	3	33%	2	67%
Innovation know-how	Intelligence on trends	0	0%	3	43%	4	44%	2	67%
	Technological know-how	0	0%	3	43%	4	44%	2	67%
Intrapreneurial empowerment	Entrepreneurial skills & methods	4	100%	6	86%	9	100%	1	33%
New offering	Validated innovation idea	4	100%	7	100%	9	100%	3	100%
	New stand-alone business	1	25%	5	71%	8	89%	3	100%
	New product	1	25%	5	71%	5	56%	1	33%
Organizational transformation	New ways of working	0	0%	2	29%	5	56%	2	67%
	Digital infrastructure	2	50%	1	14%	0	0%	3	100%
	Improved flexibility & speed	0	0%	3	43%	2	22%	2	67%
	Employer Branding	0	0%	2	29%	1	11%	2	67%

Table 7.2: Outputs with strong relationships to internal CE programs

The CE program type with the most outputs that show a strong relationship is the venture builder, with 14 out of 17 outputs (82.4%). Followed by the intrapreneurial excubator with ten outputs (58.8%), the assisted incubator with seven outputs (41.2%), and the idea validator with three outputs (17.6%) that show a strong relationship. Below, we (A) discuss the

similarities and differences in the value creation, (B) we show outputs with a strong relationship to the category of internal CE programs, and (C) we conclude on internal CE programs and their outputs.

A: Similarities and differences in the value creation of internal CE programs

Analyzing the overlap outputs of the CE program types with a strong relationship will be used to identify similarities and differences in their value creation. Table 7.2 shows that three CE program types of (a) idea validator, (b) assisted incubator, and (c) intrapreneurial excubator share many similarities in their value creation, whereas (d) the venture builder differs from them. Figure 7.3 illustrates the overlap in the value creation of the three CE programs (a to c).

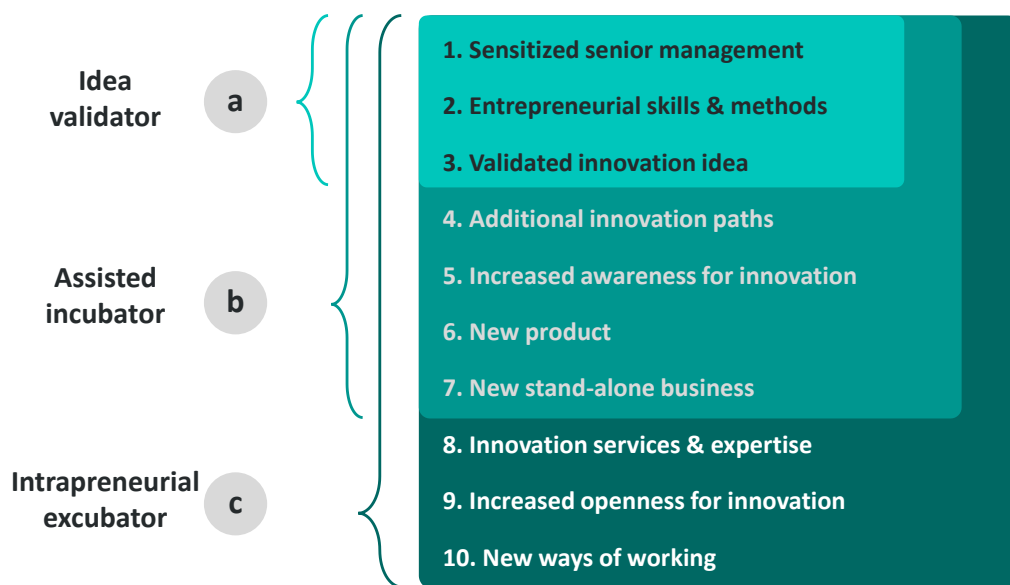


Figure 7.3: Similarities in value creation of CE program types belonging to internal incubation

As shown in Figure 7.3, the idea validator has three outputs with a strong relationship. These three outputs do also show a strong relationship to the assisted incubator and to the intrapreneurial excubator, which leads to a 100% overlap. The assisted incubator has seven outputs with a strong relationship. All of these seven outputs do also show a strong relationship with the intrapreneurial excubator, which again leads to a 100% overlap. For these three CE program types, it can be stated that output-wise, they show a high level of similarity. This finding on the organizational design shows that these three types can be counted to the internal incubation concept (see Subsection 5.1.5).

Table 7.2 also reveals that the venture builder shows a clear difference regarding the value creation to the other three internal CE program types. In total, the venture builder shows 14

strong relationships, of which seven (50%) have no overlap with another type of internal CE programs. Again, this goes in line with the findings from Chapter 5, showing that the organizational design of the venture builder is different from that of the incubation concept.

Nonetheless, the venture builder does also share some similarities in the value creation with the other internal CE program types. The venture builder and the intrapreneurial excubator have the highest overlap with six outputs with a strong relationship to both of them. A potential explanation for this might be found in the organizational design of the two CE program types. Both of them share the characteristic of an inside-out direction as the main innovation flow, e.g., by creating spin-offs, and are focused on creating new businesses.

B: Category of internal CE program and outputs with a strong relationship

Below, we switch the perspective and present the outputs that have a strong relationship to at least three of the four internal CE program types. Based on this we identify the outputs that are most likely to be created by the category of internal CE programs. The outputs that meet this criterion are summarized in Table 7.3. They are the four outputs of (a) sensitized senior management, (b) entrepreneurial skills & methods, (c) validated innovation ideas, and (d) new stand-alone business. The table allows no indication of the differences of the CE programs.

Output category	Outputs	Idea validator (4)		Assisted incubator (7)		Intrapreneurial excubator (9)		Venture builder (3)	
Innovation culture	Sensitized senior management	3	75%	4	57%	9	100%	3	100%
Intrapreneurial empowerment	Entrepreneurial skills & methods	4	100%	6	86%	9	100%	1	33%
New offering	Validated innovation idea	4	100%	7	100%	9	100%	3	100%
	New stand-alone business	1	25%	5	71%	8	89%	3	100%

Table 7.3: Outputs with a strong relationship to the internal CE program category

C: Conclusion on internal CE programs and their outputs

Concluding on the results for the internal category, it can be stated that there are clear similarities and differences in the value creation of the four CE program types (see Table 7.2). Thereby, the differences in the value creation seem to be aligned with the findings on the organizational designs (internal incubation vs. company building, see Subsection 5.1.5).

Next, as a natural sequel, we will apply the same analysis for external CE programs and radical innovation units.

7.2.3 External CE program types and their outputs

In this subsection, we focus on describing the relationships between the external CE program types and the outputs. The external CE programs consist of the five types of (1) startup facilitator, (2) collective matchmaker, (3) cooperative explorer, (4) investing co-creator, and (5) strategic investor (for more details, see Subsection 5.2.6).

As illustrated in Table 7.4, 24 of the 27 outputs show a relationship to at least one of the five external CE program types.

Unlike the internal category, there are three outputs that do not show any relationship with the external CE program types. These three outputs are (a) intrapreneurship community, (b) reconfigured business model, and (c) new ways of working. Further, six outputs do show a relation to two or fewer CE programs. This implies that external CE programs are less broad in their focus than the CE program types from the internal category.

Generally, the relationship between the external CE program types and the outputs can be characterized as a hybrid of one-to-many and many-to-many relationships. For eight outputs, we see that they are created by all five external CE program types (see Table 7.4). External CE programs show no one-to-one or many-to-one relationship.

The startup facilitator and the investing co-creator show the highest number of outputs created by an external CE program type, at 19 outputs (70.4%). They are followed by the cooperative explorer and collective matchmaker with 18 outputs (66.7%) and ending with the strategic investor having a relationship to 14 outputs (51.9%).

Based on this, it can be stated that in contrast to the internal CE programs (intrapreneurial excubator with 88.9% and assisted incubation & venture builder with 85.2%), the external CE program types are less allrounder regarding their value creation.

Output category	Outputs	Startup facilitator (6)		Collective matchmaker (3)		Cooperative explorer (3)		Investing co-creator (5)		Strategic investor (3)	
Innovation capability	Innovation services & expertise	2	33%	0	0%	2	67%	3	60%	1	33%
	Additional innovation paths	2	33%	1	33%	1	33%	1	20%	0	0%
	Digital capabilities	1	17%	1	33%	0	0%	1	20%	0	0%
	Roles or formats to support innovation	1	17%	0	0%	2	67%	0	0%	0	0%
Innovation culture	Sensitized & educated higher management	4	67%	3	100%	3	100%	4	80%	3	100%
	Increased awareness for innovation	4	67%	3	100%	1	33%	5	100%	1	33%
	Increased openness for innovation	3	50%	1	33%	3	100%	3	60%	0	0%
Innovation ecosystem	Strategic partnership	6	100%	3	100%	3	100%	5	100%	3	100%
	Venture portfolio	2	33%	1	33%	1	33%	4	80%	3	100%
	Reputation within innovation eco-system	1	17%	2	67%	2	67%	4	80%	1	33%
Innovation know-how	Intelligence on trends	3	50%	2	67%	3	100%	4	80%	3	100%
	Technological know-how	2	33%	2	67%	3	100%	3	60%	2	67%
Intrapreneurial empowerment	Entrepreneurial skills & methods	0	0%	0	0%	0	0%	1	20%	1	33%
	Intrapreneurship community	0	0%	0	0%	0	0%	0	0%	0	0%
	Network of supporters	1	17%	1	33%	0	0%	0	0%	0	0%
New offerings	Validated innovation idea	6	100%	3	100%	3	100%	2	40%	0	0%
	New product	1	17%	2	67%	3	100%	1	20%	0	0%
	New stand-alone business	0	0%	0	0%	0	0%	1	20%	2	67%
	Value adding services or feature	1	17%	2	67%	2	67%	1	20%	0	0%
	New market	0	0%	1	33%	1	33%	0	0%	1	33%
	Reconfigured business model	0	0%	0	0%	0	0%	0	0%	0	0%
Organizational transformation	Increased efficiency	6	100%	2	67%	1	33%	1	20%	1	33%
	New ways of working	0	0%	0	0%	0	0%	0	0%	0	0%
	Digital infrastructure	2	33%	0	0%	0	0%	1	20%	0	0%
	Improved flexibility & speed	2	33%	1	33%	0	0%	1	20%	2	67%
	Improved corporate image	0	0%	2	67%	2	67%	0	0%	2	67%
	Employer Branding	0	0%	0	0%	1	33%	0	0%	0	0%

Table 7.4: The relationships between external CE programs and outputs

7.2.4 Strong relationship of external CE program types and their outputs

Having described the general distribution of outputs, they are next examined for strong relationships. For this purpose, all outputs are removed that do not meet the criteria for a strong relationship. This step results in Table 7.5, whereby the outputs with a strong relationship are highlighted in gray. In total, there are 17 outputs covered in Table 7.5 that show a strong relationship to at least one of the external CE program types.

Output category	Outputs	Startup facilitator (6)		Collective matchmaker (3)		Cooperative explorer (3)		Investing co-creator (5)		Strategic investor (3)	
Innovation capability	Innovation services & expertise	2	33%	2	67%	0	0%	3	60%	1	33%
	Roles or formats to support innovation	1	17%	2	67%	0	0%	0	0%	0	0%
Innovation culture	Sensitized senior management	4	67%	3	100%	3	100%	4	80%	3	100%
	Increased awareness for innovation	4	67%	1	33%	3	100%	5	100%	1	33%
	Increased openness for innovation	3	50%	3	100%	1	33%	3	60%	0	0%
Innovation ecosystem	Strategic partnership	6	100%	3	100%	3	100%	5	100%	3	100%
	Venture portfolio	2	33%	1	33%	1	33%	4	80%	3	100%
	Reputation within innovation ecosystem	1	17%	2	67%	2	67%	4	80%	1	33%
Innovation know-how	Intelligence on trends	3	50%	3	100%	2	67%	4	80%	3	100%
	Technological know-how	2	33%	3	100%	2	67%	3	60%	2	67%
New offering	New product	1	17%	3	100%	2	67%	1	20%	0	0%
	Validated innovation idea	6	100%	3	100%	3	100%	2	40%	0	0%
	New stand-alone business	0	0%	0	0%	0	0%	1	20%	2	67%
	Value adding services or feature	1	17%	2	67%	2	67%	1	20%	0	0%
Organizational transformation	Increased efficiency	6	100%	1	33%	2	67%	1	20%	1	33%
	Improved flexibility & speed	2	33%	0	0%	1	33%	1	20%	2	67%
	Improved corporate image	0	0%	2	67%	2	67%	0	0%	2	67%

Table 7.5: Outputs with strong relationships to external CE programs

Of the five CE program types in the external category, the cooperative explorer shows the highest number of strong relationships with twelve of the 17 outputs (70.6%), followed by the collective matchmaker with eleven of 17 outputs (64.7%). The investing co-creator shows a

strong relationship with nine outputs (52.9%), and the strategic investor with eight outputs (47.1%). The startup facilitator has the lowest number, with five of 17 outputs (29.4%).

The fact that the startup facilitator shows, on the one hand, the lowest number of strong relationships and, on the other hand, the highest number of general relationships to the outputs is surprising at first glance. A possible explanation might be found in the narrow focus of the startup facilitator. It is geared to support the validation of innovation ideas of startups, which is seen as a potential starting point for a partnership between the startup and the core organization. Many outputs are case-specific since they depend on the innovation idea that is validated. For example, when a technology is improving the service of an existing product, the output is different from that of a technology that is automating processes.

Consequently, there are only a few outputs that frequently occurred (strong relationship), such as strategic partnership, whereas the results of the partnership mainly depend on the innovation ideas themselves and hence are not reflected in the strong relationships.

Below, we (A) discuss differences between internal and external CE programs, (B) we compare startup engagement types, (C) we compare startup investment types, (D) we highlight the differences between startup engagement and startup investing, (E) show outputs with a strong relationship to the external CE program category, and (F) conclude on external CE programs and their value creation.

A: Differences between internal and external CE program types

Twelve of these outputs from Table 7.5 have an overlap with the ones identified for internal CE program category (see Table 7.1). In addition, there are five outputs (with a strong relationship) that are identified exclusively for external CE program types. These outputs are (a) roles and formats to support innovation, (b) reputation within innovation ecosystem, (c) value adding services or features, (d) improved corporate image, and (e) increased efficiency. Subsequently, we will briefly discuss potential explanations for this difference.

The two outputs *reputation within innovation ecosystem* and *improved corporate image* are directed outward which fits to the locus of opportunity of external CE program types and could explain why they are not created by internal ones. For the two outputs *value adding services or features* and *increased efficiency*, a potential explanation for showing a strong relationship to external CE programs but not to internal ones may also be found in the locus of opportunity. Internal CE programs are mainly used to complement the R&D activities of a company and to

develop innovations that have a strong market orientation, e.g., new products or new services. In contrast, external CE programs have a broader innovation scope, as they focus on identifying startups that have an innovation that could be relevant for the core organization. Thereby, the type of innovation can also focus on improving the companies processes or on features that are complementing existing products.

B: Comparing startup engagement types

For the analysis, we have grouped the five CE program types according to their two main activities *startup engagement* and *startup investing* (see Subsection 5.2.6). The three CE program types that belong to the startup engagement group are (a) startup facilitator, (b) collective matchmaker, and (c) cooperative explorer. Correspondingly, the two CE program types (d) investing co-creator and (e) strategic investor belong to the startup investing group.

We start our analysis with the group of startup engagement. Figure 7.4 is illustrating the overlap between the three CE program types belonging to this group. The outputs in the figure are ordered according to their association to the three CE program types (a to c).

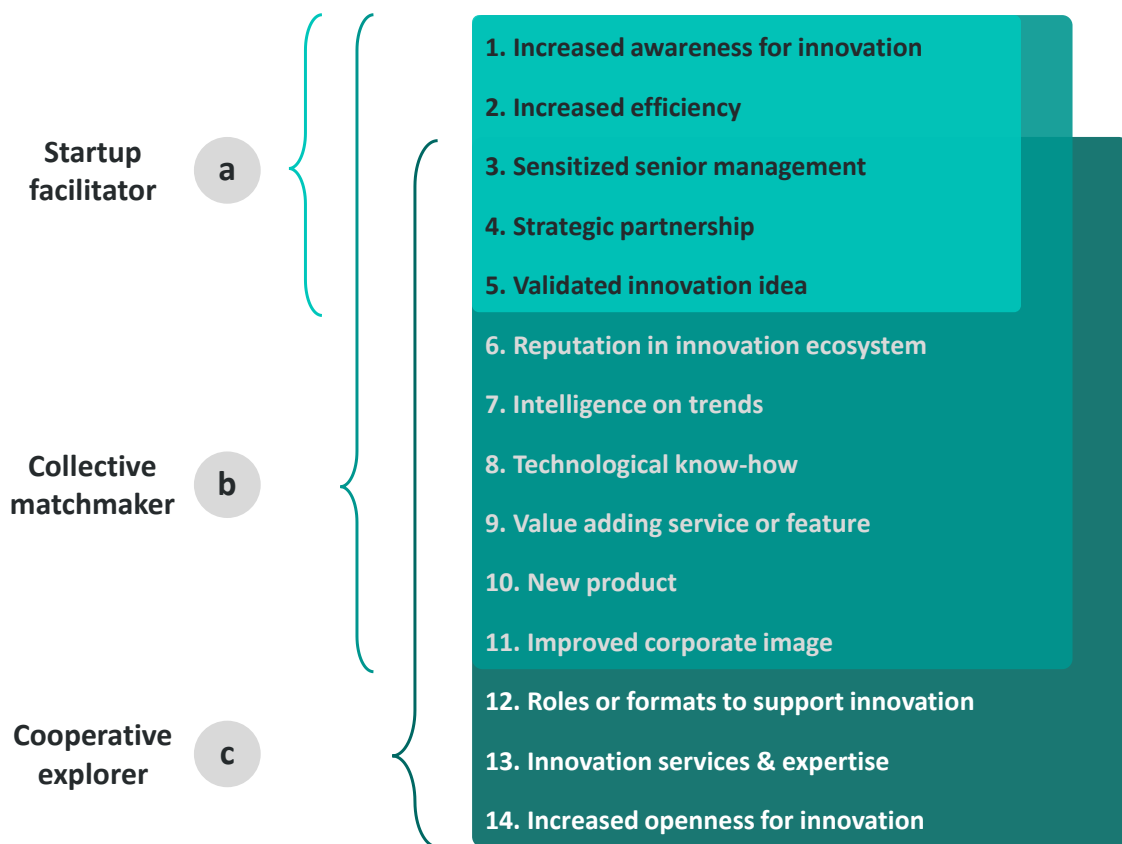


Figure 7.4: Similarities in the value creation (strong outputs) of three startup engagement types

Based on Figure 7.4, the following three observations can be made.

- 1) The startup facilitator has 100% overlap with the collective matchmaker and around 60% of the strong outputs are in common with the collaborative explorer.
- 2) The collective matchmaker has an overlap of around 80% with the cooperative explorer regarding the outputs with a strong relationship.
- 3) The cooperative explorer shows a strong relationship to three outputs that are different from the other two CE programs (highlighted with white color in Figure 7.4).

The similarities and differences in the value creation can be traced back to the organizational design of the three CE program types. The startup facilitator is focusing mainly on process innovation, which explains why outputs such as product innovation, new business, or intelligence on trends show no strong relationship.

In contrast, the cooperative explorer focuses mainly on product and service innovation but not on process innovation. This seems to explain why the two CE program types have a rather low overlap in their value creation and also serves as an explanation for the cooperative explorer's strong focus on outputs centered on product innovation and technologies.

The collective matchmaker can be understood as a hybrid CE program type regarding its focus as it addresses both process and product or service innovation simultaneously. This is also reflected in the value creation of the collective matchmaker, which has a high overlap with both the startup facilitator and the cooperative explorer.

C: Comparing startup investment types

We will now focus on the two types that belong to the startup investment group. Figure 7.5 (on the next page) shows the twelve outputs have a strong relationship to at least one of the two CE program types. Five of the twelve outputs (5-9) have an overlap, meaning they show a strong relationship to both of them, whereas seven outputs show a strong relationship to only one of the two CE program types.

A key activity of the two types of (d) investing co-creator and (e) strategic investor is to identify startups that show a strategic value for the core organization and to invest in them. This activity is reflected in the common outputs of venture portfolio, strategic partnership, technological know-how. However, the two CE program types differ in the reasons for the investments. Whereas the investing co-creator is investing in startups to strengthen or enable

collaboration with them, the strategic investor acts similar to an institutional investor and has a main focus on the investment itself.

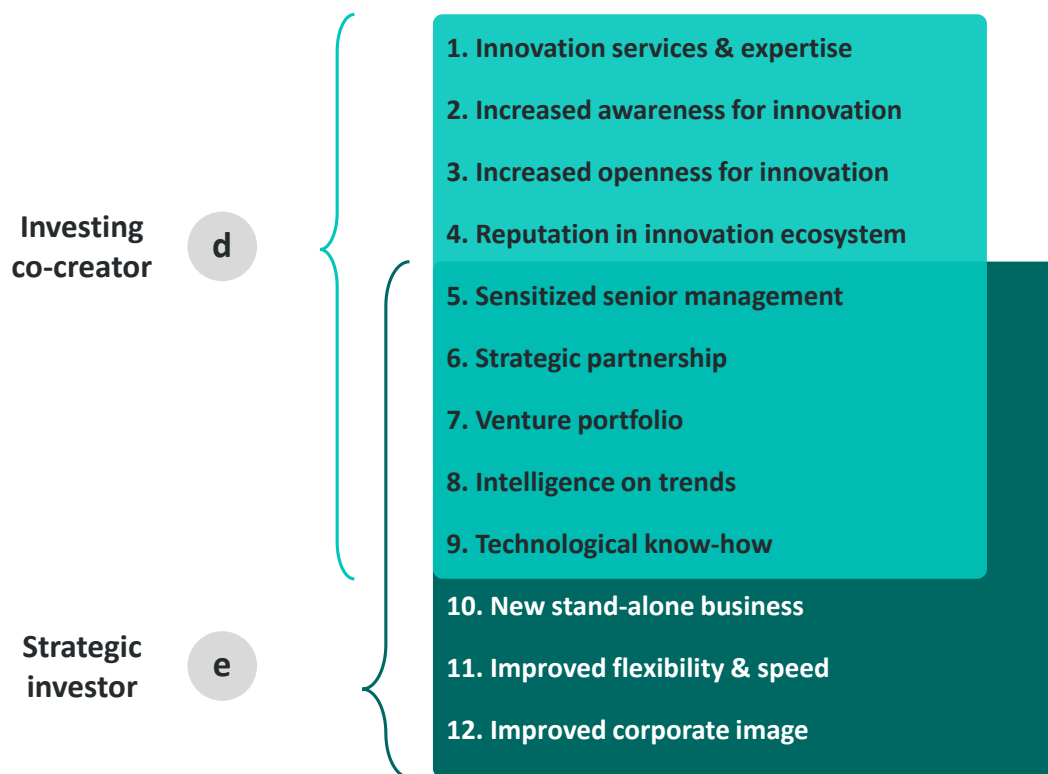


Figure 7.5: Similarities in the value creation (strong outputs) of two startup investing types

The focus on collaboration and investment by the investing co-creator serves as an explanation for the differences in outputs. Successful collaboration requires that the core organization is willing to collaborate with the startup and that the need or relevance of potential collaboration is clearly understood. This is reflected in the two outputs *increased awareness for innovation* and *increased openness to innovation*.

Furthermore, due to the strong interaction with the core organization, the know-how and expertise of the investing co-creator are recognized and demanded, which explains the strong relationship to the output *innovation services & expertise*.

The fact that the output *reputation in innovation ecosystem* shows only a strong relationship to the investing co-creator but not to the strategic investor might be explained by the circumstance that all strategic investors in our data set were located in the Silicon Valley, which is home to a number of world-renowned investors and companies, making it much more difficult to build a good reputation than in the DACH region.

The strategic investor shows a strong relationship with three outputs that are different from those of the investing co-creator. These three outputs are (a) new stand-alone business, (b) improved flexibility and speed, and (c) improved corporate image.

Regarding the output new stand-alone business, it may be expected that this is also created by the investing co-creator, since it is also aimed at developing new products or businesses. One reason why this is not the case could be that the investing co-creators mostly target joint development projects that involve rather long development cycles, while the strategic investors had a focus on joint commercialization of innovations that were more mature in their development and required less development effort to bring them to market. It is expected that over time, the activities of the investing co-creator will also lead to the creation of new products and new businesses.

D: Differences between startup engagement and startup investing types

For the two groups of *startup engagement* programs and *startup investing* programs, the following observation can be made. Startup engagement programs show more short-term outputs, as they do also focus on rather transactional relationships to startups that can be understood as a customer-supplier relationship. In such cases, no or only a few development efforts are required to use the solution of the startup, which consequently leads to more direct results that can be observed in the outputs such as increased efficiency, value adding service or feature, or new products (using white-label products or through distribution agreements).

Startup investments do not necessarily lead to the direct creation of new products or services, but they do seem to provide the foundation for innovations, e.g., accessing new technologies by creating strong partnerships (investments) with startups. Depending on the maturity of the startup and their technology, the time horizon of observable results for new products or new businesses might be more mid-or long-term.

E: Category of external CE programs and outputs with a strong relationship

Table 7.6 summarized that outputs that show a strong relationship to three or more external CE program types. These outputs are considered as being likely to be created when operating external CE programs. In total, eight outputs can be identified that meet this criterion, which are illustrated below.

Output category	Outputs	Startup facilitator (6)		Collective matchmaker (3)		Cooperative explorer (3)		Investing co-creator (5)		Strategic investor (3)	
Innovation culture	Sensitized senior management	4	67%	3	100%	3	100%	4	80%	3	100%
	Increased awareness for innovation	4	67%	3	100%	3	33%	5	100%	1	33%
Innovation ecosystem	Strategic partnership	6	100%	3	100%	3	100%	5	100%	3	100%
	Reputation within innovation ecosystem	1	17%	2	67%	2	67%	4	80%	1	33%
Innovation know-how	Intelligence on trends	3	50%	3	100%	2	67%	4	80%	3	100%
	Technological know-how	2	33%	3	100%	2	67%	3	60%	2	67%
New offering	Validated innovation idea	6	100%	3	100%	3	100%	2	40%	0	0%
Organizational transformation	Improved corporate image	0	0%	2	67%	2	67%	0	0%	2	67%

Table 7.6: Outputs with a strong relationship to the external CE program category

External CE program category shows twice the number of outputs that have a strong relationship to the overall category (compared to internal CE programs). External CE programs seem to be suited well for creating outputs belonging to the three output categories of *innovation culture*, *innovation ecosystem*, and *innovation know-how*. These three categories consist of a total of eight outputs, whereof six outputs show a strong relationship to the overall category of external CE programs, as shown in Table 7.6.

F: Concluding on external CE program types

To summarize the results presented in this subsection, external CE programs exhibit a wide range of value creation, especially in terms of outputs with a strong relationship. Moreover, the results show that external and internal CE programs exhibit clear differences. Understanding these differences is critical to selecting the organizational design that is best suited to achieve the intended objective.

In addition, we have seen that the five CE program types clearly differ in their value creation. However, the results also show that it is important to deepen the understanding of the quality of the outputs. For example, the output *strategic partnership*, which describes a relationship between a startup and the core organization is created. This relationship can have different manifestations, such as a customer-supplier relationship or a joint development agreement, which are rather different in quality and intensity.

7.2.5 Radical innovation units and their outputs

This subsection will describe the relationships between the outputs and the organizational design belonging to the radical innovation unit category. Even though they are not directly contributing to answering RQ3, it is supportive to understand how they differ from the various internal and external CE program types to ensure a more effective management.

The three types that belong to the radical innovation unit category are (1) the digital factory, (2) the innovation lab, and (3) the tech lab (for more detail, see Subsection 5.3.4)

For the radical innovation units, 24 of the 27 outputs show a relationship to at least one of the three organizational designs belonging to this category. The three outputs that show no relationship to are (a) roles and formats to support innovation, (b) network of supporters, and (c) increased efficiency.

For nine outputs, the relationship can be observed for all three types, whereas eight outputs do show only a relationship to one or no type (see Table 7.7). The relationships between the radical innovation unit types and the outputs can be characterized as a hybrid of one-to-many and many-to-many relationships, but not as one-to-one or many-to-one.

The innovation lab shows with 22 outputs (81.5%) the highest number of different outputs (rows in the table) that are created. Followed by the digital factory with 17 outputs (62.9%) and the tech lab with 13 ones (48.1%).

The fact that the innovation lab has the highest number of relationships to the different outputs can be explained by the variety of organizational designs that are covered under this type. Typically, an innovation lab consists of multiple CE and innovation activities, which consequently lead to a higher number of outputs than a more focused type such as the digital factory and tech labs.

All in all, this means that the innovation lab seems to be the most allrounder organizational form (as well as the most ambiguous, see Subsection 5.3.4) of the radical innovation units.

Output category	Outputs	Digital factory (4)		Innovation lab (5)		Tech lab (2)	
Innovation capability	Innovation services & expertise	1	25%	2	40%	1	50%
	Additional innovation paths	1	25%	0	0%	1	50%
	Digital capabilities	4	100%	1	20%	0	0%
	Roles or formats to support innovation	0	0%	0	0%	0	0%
Innovation culture	Sensitized senior management	1	25%	4	80%	2	100%
	Increased awareness for innovation	3	75%	4	80%	0	0%
	Increased openness for innovation	1	25%	2	40%	1	50%
Innovation ecosystem	Strategic partnership	0	0%	2	40%	1	50%
	Venture portfolio	0	0%	1	20%	0	0%
	Reputation within innovation eco-system	0	0%	1	20%	2	100%
Innovation know-how	Intelligence on trends	4	100%	2	40%	2	100%
	Technological know-how	1	25%	2	40%	2	100%
Intrapreneurial empowerment	Entrepreneurial skills & methods	1	25%	4	80%	0	0%
	Intrapreneurship community	0	0%	1	20%	0	0%
	Network of supporters	0	0%	0	0%	0	0%
New offerings	Validated innovation idea	1	25%	4	80%	1	50%
	New product	1	25%	2	40%	1	50%
	New stand-alone business	0	0%	2	40%	0	0%
	Value adding services or feature	3	75%	2	40%	1	50%
	New market	3	75%	0	0%	0	0%
	Reconfigured business model	1	25%	1	20%	0	0%
Organizational transformation	Increased efficiency	0	0%	0	0%	0	0%
	New ways of working	3	75%	2	40%	1	50%
	Digital infrastructure	4	100%	2	40%	0	0%
	Improved flexibility & speed	0	0%	2	40%	0	0%
	Improved corporate image	0	0%	3	60%	1	50%
	Employer Branding	2	50%	1	20%	0	0%

Table 7.7: The relationship between radical innovation units and outputs

7.2.6 Strong relationship between radical innovation units and their outputs

Next, we will focus on the outputs that show a strong relationship to at least one of the three types. After having removed all outputs without a strong relationship, 13 outputs (highlighted in gray) are remaining, which are summarized in Table 7.8.

Output category	Outputs	Digital factory (4)		Innovation lab (5)		Tech lab (2)	
Innovation capability	Digital capabilities	4	100%	1	20%	0	0%
Innovation culture	Sensitized senior management	1	25%	4	80%	2	100%
	Increased awareness for innovation	3	75%	4	80%	0	0%
Innovation ecosystem	Reputation within innovation ecosystem	0	0%	1	20%	2	100%
Innovation know-how	Intelligence on trends	4	100%	2	40%	2	100%
	Technological know-how	1	25%	2	40%	2	100%
Intrapreneurial empowerment	Entrepreneurial skills & methods	1	25%	4	80%	0	0%
New business offering	Validated innovation idea	1	25%	4	80%	1	50%
	Value adding services or feature	3	75%	2	40%	1	50%
	New market	3	75%	0	0%	0	0%
Organizational transformation	New ways of working	3	75%	2	40%	1	50%
	Digital infrastructure	4	100%	2	40%	0	0%
	Improved corporate image	0	0%	3	60%	1	50%

Table 7.8: Strong relationships between radical innovation units and outputs

For the outputs that have a strong relationship, the digital factory shows the highest number with seven out of 13 outputs (53.8%), followed by the innovation lab with five outputs (38.5%) and the tech lab with four outputs (30.8%). The fact that the innovation lab has a relationship to 22 outputs but only four outputs with a strong relationship may be explained by its organizational design and which shows various manifestations leading to different outputs. For the tech lab, the low number of outputs with a strong relationship seems to be rooted in the narrow focus on understanding new technologies.

For the digital factory, it can be observed that the outputs show a strong focus on digital topics, e.g., digital capabilities, digital infrastructure, or intelligence on trends. At the same time, the transformative impact is shown with the outputs of new ways of working as well as new market, which in all cases covers the creating of new, digital sales channels.

The innovation lab, on the other hand, shows a strong value creation for a company's innovation culture, the individual skills of the employees, and the corporate image. Regarding the development of product or service innovation, an innovation lab seems to be suited well for validating innovation ideas but rather not for their implementation.

The last type of this category is the tech lab. This form has a strong focus on exploring new technologies and understanding trends that might be relevant for the company. Tech labs focus on the development of new technological know-how that is transferred back into the core business. In both cases, the tech lab was located in the Silicon Valley, which improved the company's reputation in the innovation ecosystem as well as regular contact with the senior management, leading to sensitization for trends and current development.

The results of this subsection show that the radical innovation units do not only differ strongly regarding their organizational designs as compared to the CE programs but also regarding their value creation. The focus on technology and on digitalization makes them complementary to the value creation of CE programs.

7.2.7 The relationship between CE programs and outputs

The results presented in this section show that there are clear differences in the value creation of CE programs. For each organizational design, a subset of outputs that show a strong relationship to the respective form has been identified. Thereby, the relatedness in the organizational designs, for example, between the idea validator and assisted incubator, can be used as an indicator for similarities regarding the outputs that are created by CE programs.

Furthermore, three outputs have no strong relationship to any CE program type. These outputs are (a) *intrapreneurship community*, (b) *network of supporters*, and (c) *reconfigured business model*. For (a) and (b) it seems that they are rather supporting outputs that are used to achieve a primary objective. Since there are also other ways to support the work of the CE program, this might explain why they show no strong relationship. For the reconfigured business model, it can be observed that this output was created by different CE programs. As it requires a high transformative effort to change the business model, it is not surprising that this output has the lowest number across all outputs of the new offering category.

In addition, we have seen that some outputs have a rather weak relationship with CE programs, while others have a higher-than-average frequency of occurrence (defined as a

strong relationship). Figure 7.6 provides an overview of the output categories and outputs that show such a strong relationship for more than 50% of the CE program types within the respective category. This overview shows that the internal and external CE program categories are clearly distinct but complementary in their value creation. In contrast, the category of radical innovation units is rather an additional way to create the respective outputs.

Output category	Output	Internal CE programs	External CE programs	Radical innovation units
Innovation culture	Increased awareness for innovation		X	X
	Sensitized senior management	X	X	X
Innovation ecosystem	Strategic partnership		X	
	Venture portfolio		X	
	Reputation within innovation ecosystem		X	
Innovation know-how	Intelligence on trends		X	X
	Technological know-how		X	
Intrapreneurial empowerment	Entrepreneurial skills & methods	X		
New offerings	New stand-alone business	X		
	Validated innovation idea	X	X	
Organizational transformation	Improved corporate image		X	

Figure 7.6: Distribution of strong relationships between CE program categories and outputs

7.3 Influence of contextual and structural elements

Having analyzed the relationships between the CE programs and the outputs, this section will focus on the question of how these relationships may be influenced by certain contextual or structural elements. This provides an answer to RQ3b, which reads as follows: *Do certain structural or contextual elements influence their occurrence?*

For answering this research question, the section is split into Subsection 7.3.1, which focuses on the influence of structural elements of CE programs can have on the occurrence of the outputs. Subsection 7.3.2 investigates the potential influence of contextual elements on the occurrence of certain outputs.

7.3.1 Influence of structural elements

In this subsection, we will focus on the question if certain structural elements can explain differences in the relationships between CE programs and the outputs they are creating. The term structural element is based on the configuration theory (see Subsection 2.2.3) and refers to what we have described as design elements¹⁹(see Section 4.2). Consequently, we will investigate if design elements (DE) are suited to explain the occurrence of certain outputs (O). The expected type of relationship is visualized in Figure 7.7.

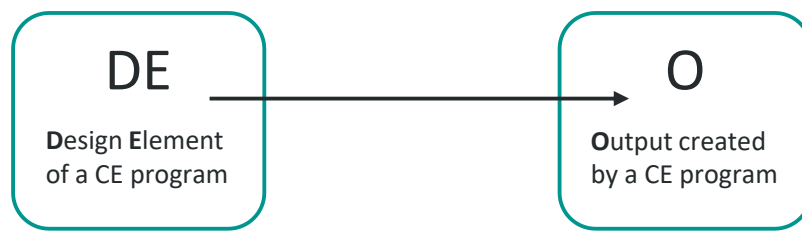


Figure 7.7: Visualization relationship between a design element and certain outputs

Below we will (A) discuss the analysis of two similar CE program types to investigate the influence of design elements, (B) present a first example of an output that seems to be influenced by a design element, (C) present a second example of an output that seems to be influenced by a design element, and (D) conclude on the influence of design elements on the occurrence of certain outputs.

A: Analyzing similar CE program types

For understanding how design elements may influence the relationship with certain outputs, we focus on CE programs that have a high degree of similarity in terms of their organizational design and outputs. We expect that the causes of differences between rather similar CE programs can be identified and explained more clearly than for CE program types with stronger differences.

Two CE program types that exhibit a high degree of similarity are (a) the *assisted incubator* and (b) the *intrapreneurial excubator*. They are similar in terms of their outputs (see Figure 7.3) and their organizational design (see Subsection 5.1.3 & 5.1.4). We will focus on these two CE program types to better understand how design elements influence particular outputs.

¹⁹ Henceforth, we will use the term *design element* and *structural element* interchangeably.

For identifying design elements that are likely to explain the occurrence of a certain output, we focus on outputs that have a strong difference in their relationship between the two CE program types, e.g., an output that shows a relationship only to one of the CE program types. Two outputs that fulfill this criterion are (1) *roles or formats to support innovation* and (2) *sensitized senior management*.

Next, we will investigate if the difference in the relationship to the two outputs might be explained by differences in the organizational design of the two CE program types.

B: Example 1 – Roles or formats to support innovation

The output *roles and formats to support innovation*²⁰ is distinct for the two CE programs. The intrapreneurial excubator shows a frequency of occurrence of 44%, whereas in the case of the assisted incubator no relationship (0%) to this output was identified.

A deeper look at the organizational design of both CE programs reveals that the difference in the output may be explained by different types of support the two programs are offering (represented by the design element *key value proposition*).

- The intrapreneurial excubator offers resources, time (capacity), and a clear structured process that supports the innovation teams in validating and implementing their idea.
- The assisted incubator offers the same support and in addition, the temporary involvement of CE program's employees who complement the innovation teams and add missing competencies to the team.

Offering a support service where employees of the CE program support the innovation teams is much more resource-intensive than the support services offered by the intrapreneurial excubator. This higher resource intensity of the assisted incubator might be a reason why this format is not adopted by departments from the core organization, whereas the rather "lean" concept of the intrapreneurial excubator has been adopted in 44% of the. This difference suggests that the design element *key value proposition* can be used to explain differences in the relationships between the two CE program types and their outputs.

²⁰ Definition: New job roles or formats to promote innovation are transferred to the core organization, as they have proven valuable through the activities of the CE program.

C: Example 2 – Sensitized senior management

The second output is the sensitized senior management²¹. The activities of the intrapreneurial excubator frequently lead to the creation of new business units or spin-offs (reflected in the output *venture portfolio*). Both typically require the involvement of the companies' top management, mostly C-level. In this process, the senior management is confronted with new technologies, new business models, new markets that are building the basis for the investment decision. This confrontation is not only sensitizing them for current trends but also educates them in more entrepreneurial thinking and recent innovation topics.

For the intrapreneurial excubator in 100% of the cases, the output sensitized senior management was identified. On the contrary, for the assisted incubator only 57% of the cases did show this output. A potential explanation for this difference can be found in the design element *preferred exit path*. As mentioned above, the intrapreneurial excubator often leads to the creation of new business units or corporate spin-offs. The assisted incubator, in contrast, is designed to transfer the innovation idea back to the core business. The process of transferring the idea back does not necessarily require the involvement of the highest management of the company. If the senior management is involved, then most of the respective business unit that receives the innovation idea. The design element *preferred exit path* seems to explain differences in the output between the two CE program types.

D: Concluding on the influence of structural elements

As shown in this subsection, the design elements identified in Chapter 4 are not only suitable for defining and distinguishing the different types of CE programs but can also be used to explain differences in their value creation. However, since explaining the difference in the relationships between CE program types and their outputs was not the intention when deriving the design elements, there might be other ones that are better suited. Hence, further research is needed to deepen the understanding of which design elements show a relationship with the different outputs.

²¹ Definition: Senior management has regular contact to innovative topics, often involved as a jury member or in investment boards, which is sensitizing them for innovation.

7.3.2 Potential influence of contextual elements

In this subsection, we will focus on the influence of contextual factors on the relationship between CE programs and their outputs. Following the configuration theory (see Subsections 2.2.3), the context of an organizational unit is characterized by multiple elements. As shown in Figure 7.8, the context elements (variable C) can be divided into two groups.

First, the company-external context, meaning the environment in which the company is acting, e.g., the competitive situation or type of industry. Second, the company-internal context, that describes the characteristics of the parent organization in which the CE program is embedded, e.g., the size of the company or the ownership structure. We assume that both types of contextual elements can have a moderating influence on the relationship between CE programs and outputs (illustrated in Figure 7.8).

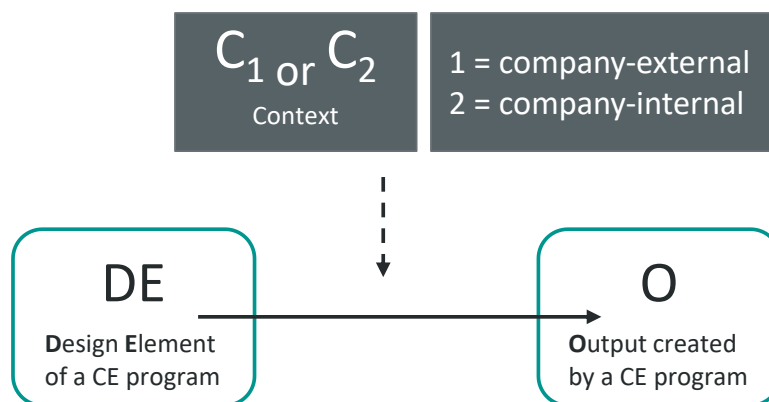


Figure 7.8: Influence of contextual elements on the “CE program – output” relationship

To understand the moderating influence of contextual elements on the relationship between CE programs and certain outputs, we will analyze (A) the industry class as a company-external context element and (B) the company size as a company-internal context element. In (C), we will conclude on the influence of context elements on the occurrence of outputs.

A: Industry class as a company-external context element

We will start with the influence of company-external context elements on the relationship between CE programs and outputs. For this purpose, we have selected the *industry type* as one company-external element, as it is available for all our cases of our data set.

Companies show different behaviors that can be traced back to the type of industry they are acting in (see, e.g., Gilsing et al., 2011; Andras & Srinivasan, 2003). Hence, we assume that depending on the characteristics of an industry, certain outputs of a CE program might vary

as well. Generally, there is a difference between companies that are developing and creating new hardware products and companies that are using these products to deliver their services. For example, a company that is building trucks has much longer product development cycles than a logistics company that is using these trucks to offer transportation services.

We also expect differences within the group of manufacturing companies. There are some industries that are particularly research and capital intensive. This is the case, e.g., for chemical & pharmaceutical companies and for automotive manufacturers. They often have long product development cycles of several years, while companies that manufacture comparatively simpler products, e.g., consumer electronics, release new products every year. Based on this consideration, we expect that depending on the type of industry in which a company operates, the results of the same type of CE program will vary.

For the investigation, we have selected the three internal CE programs of (a) idea validator, (b) intrapreneurial excubator, and (c) assisted incubator for this analysis. From an organizational design perspective, they belong to the group of internal incubation (see Subsection 5.1.5, the assisted incubator is a hybrid between internal incubation and company building) and they share similar outputs (see Subsection 7.1.1). We expect that due to the high level of similarities, variances in the outputs can be better traced back to external factors such as the industry class the company is operating in. In total, 20 cases belong to the internal incubation type of CE programs.

The 20 cases were clustered according to their industry classes (using the NAICS codes presented in Subsection 3.2.1). Internal incubation programs are focused on supporting the development of new businesses or products. By comparing the different industry classes, we have seen that in some cases, CE programs did not only focus on new products or businesses but also on process innovation, which is reflected in the output *optimization and efficiency*.

This output occurred in seven of the 20 cases studied. In all seven cases, the CE programs belong either to companies operating in research- and capital-intensive manufacturing industries (automotive, chemicals & pharmaceuticals, and medical equipment and supplies) or in service-oriented industries (finance & insurance, and transportation & warehousing).

Potential explanations for these differences might be based on the product characteristics of the respective industries.

- For service-oriented companies, process innovation is more than “saving costs” since it also leads to improved services that can be offered to their customers. Hence, process innovation leads to an improved product offering and is highly relevant.
- For research- and capital-intensive manufacturing companies, especially the chemical-pharmaceutical and automotive manufacturers, the product offering is concentrated on a few and expensive key products that are developed in the core organization. It is unlikely that a core business product (cars or medicine) is developed in a CE program.

As a result, CE programs must focus on other areas of innovation beyond the core products. Among other aspects, this can also include process innovation which is reflected in the output *optimization and efficiency*. This line of reasoning is further supported by the fact that the output *value-added services or features*. This output was created five times by internal CE programs, whereof three of them by CE programs belonging to the chemical & pharmaceutical or automotive industry. The difference in the types of innovation indicates that the industry type can have a moderating effect on the relationship to certain outputs.

B: Company size as a company-internal context element

In contrast to the company-external context elements, we could not identify any direct moderating influence of a company-internal context element on the relationship between CE programs and specific outputs. One possible explanation could be that the companies are highly diverse in terms of their organizational design and characteristics, and the dataset is too small in size to allow this variety to be studied well.

However, applying a broader perspective for investigating if company-internal contextual elements have an influence on the occurrence of outputs unveils an indirect moderating influence. Analyzing the company size in relation to the CE programs reveals that the choice of which CE program is initiated seems to be influenced by the size of the core organization.

The analysis shows that companies with less than 10,000 employees are running only one CE program at a time, whereas larger companies tend to have multiple ones in parallel (see Subsection 3.2.2). In addition, the share of external CE programs initiated by smaller companies is considerably lower than in large companies. Out of the nine CE programs that are operated by companies smaller than 10,000 employees, only two have an external focus (22.22%). The two companies operating an external CE program are subsidiaries of larger corporations. Some CE programs appear to be operated rather by large companies, such as

the strategic investor with an average number of 184,434 employees in the entire company or the collective matchmaker with an average number of 202,308 employees.

These findings suggest that also company-internal context elements, in this case, the size of the company, have an influence on the occurrence of certain outputs. Since smaller companies show a strong focus on internal CE programs, this has an indirect effect on the outputs, as internal and external CE programs show a clear difference in the outputs they are creating (see Figure 7.6 in Subsection 7.2.7).

C: Concluding on the influence of context elements

To conclude, the examples presented in this subsection show that the company-external and company-internal context can have an influence on the relationship between CE programs and their outputs. In our study, a difference between a direct influence for company-external context and an indirect influence for company-internal context was observed.

The results show that it is important to understand the context in which a company is operating. For example, when deciding on the innovation focus of a CE program, it is crucial to consider both (a) the readiness of the market and customers for new products and (b) how well do these new products fit the company's overall strategy. This is in line with the configuration theory that focuses on both the internal and the external fit of an organizational unit for understanding their performance (see Subsection 2.2.3).

Since the context was not the main scope of our work, there is a need for more studies focusing on context elements. Similar to our results for the organizational designs and the outputs of CE programs, it would be important to understand which company-external and company-internal elements exist and to identify the ones that have a rather strong impact on the occurrence of the outputs created by CE programs.

7.4 Which CE program to use for the creation of certain outputs

In this section, we focus on understanding the “output – CE program relationship” from an output perspective. The aim is to answer RQ3c that reads as follows: *which CE programs are more suited to achieve the respective outputs?*

We start with an overview of the CE program types that have the highest frequency of occurrence for the seven output categories, meaning they are most likely to create outputs of the respective category. In Table 7.9, the five CE program types with the highest frequency of occurrence are illustrated for each of the seven output categories. In the case that CE program types show the same frequency of occurrence, this is indicated by using the same number in the column before the CE program’s name.

Output category	CE program types (overall frequency of occurrence)									
Innovation capability	1	Intrapreneurial excubator (41.7%)	1	Venture builder (41.7%)	1	Cooperative explorer (41.7%)	4	Digital factory (37.5%)	5	Assisted incubator (28.6%)
Innovation culture	1	Investing co-creator (80%)	2	Cooperative explorer (77.8%)	2	Collective matchmaker (77.8%)	4	Intrapreneurial excubator (74.1%)	5	Venture builder (66.7%)
Innovation ecosystem	1	Investing co-creator (86.7%)	2	Strategic investor (77.8%)	3	Collective matchmaker (66.7%)	3	Cooperative explorer (66.7%)	4	Venture builder (55.6%)
Innovation know-how	1	Cooperative explorer (100%)	1	Tech lab (100%)	3	Strategic investor (83.3%)	4	Investing co-creator (70.0%)	5	Venture builder ²² (66.7%)
Intrapreneurial empowerment	1	Idea validator (58.3)	2	Intrapreneurial excubator (51.9%)	3	Assisted incubator (38.1%)	4	Innovation lab (33.3%)	5	Venture builder (22.2%)
New offering	1	Venture builder (50.0%)	1	Cooperative explorer (50.0%)	3	Assisted incubator (47.6%)	4	Intrapreneurial excubator (44.4%)	4	Collective matchmaker (44.4%)
Organizational transformation	1	Venture builder (55.6%)	2	Digital factory (37.5%)	3	Assisted incubator (33.3%)	3	Innovation lab (33.3%)	5	Collective matchmaker (27.8%)

Table 7.9: CE program types with strongest overall relationship to the seven output categories

The results in Table 7.9 show that depending on the output category, there are different CE program types that are more likely to create the respective outputs. For some output

²² For innovation know-how category, the 5th rank is shared by collective matchmaker and the venture builder.

categories internal CE programs seem to suit better, e.g., innovation capability, whereas for other output categories, external CE programs show a better fit, e.g., innovation ecosystem.

Having presented the rather high-level relationships between CE program types and the output categories, we will focus on each of the seven output categories separately. Subsections 7.4.1 – 7.4.7 will analyze for each category, which of the nine CE programs and the three radical innovation units²³ are suited best to create the respective outputs.

7.4.1 CE programs and innovation capability

The output category *innovation capability* includes four outputs. They account for 12% of all coded outputs and were found in 29% of the cases studied. Table 7.10 shows the CE program types that have the highest frequency of occurrence for each output. If the output is created by less than five CE programs, the remaining columns are filled with (-). For being included in this consideration, only strong relationships were counted.

Output	CE programs (frequency of occurrence of respective output)				
	1	2	3	4	5
Innovation services & expertise	Venture builder (100%)	Cooperative explorer (67%)	Investing co-creator (60%)	Intrapreneurial excubator (56%)	Innovation lab (43%)
Additional innovation paths	Intrapreneurial excubator (67%)	Assisted incubator (57%)	Idea validator (50%)	Startup facilitator (33%)	Venture builder (33%)
Digital capabilities	Digital factory (100%)	Venture builder (33%)	Collective matchmaker (33%)	Assisted incubator (29%)	Investing co-creator (20%)
Roles or formats to support innovation	Cooperative explorer (67%)	Intrapreneurial excubator (44%)	Idea validator (25%)	Startup facilitator (17%)	-

Table 7.10: CE programs to create innovation capability outputs

CE program types with a strong relationship to the outputs are highlighted in gray. The table shows that both internal and external CE program types are suited for creating outputs of the *innovation capability* category. It must be stated that generally, the outputs in this category score low when it comes to strong relationships. For three outputs, only two or one CE program type show a strong relationship to them. Regarding the output *digital capabilities*,

²³ Henceforth, radical innovation units are included when mentioning CE programs or CE program types.

we see only a strong relationship to the digital factory type (radical innovation unit category), meaning that there is no CE program that has a strong relationship to this output.

7.4.2 CE programs and innovation culture

The output category *innovation culture* is covering three outputs, which comprise 19% of all coded outputs and was found in 64% of the investigated cases. Table 7.11 shows a fairly balanced distribution of internal and external CE programs suitable to create outputs in this category, with a slight majority of external ones.

Output	CE programs (frequency of occurrence of respective output)				
	1	2	3	4	5
Sensitized senior management	Intrapreneurial excubator (100%)	Venture builder (100%)	Cooperative explorer (100%)	Collective matchmaker (100%)	Strategic investor (100%)
Increased awareness for innovation	Collective matchmaker (100%)	Investing co-creator (100%)	Assisted incubator (86%)	Digital factory (75%)	Intrapreneurial excubator (67%)
Increased openness for innovation	Cooperative explorer (100%)	Venture builder (67%)	Investing co-creator (60%)	Intrapreneurial excubator (56%)	Startup facilitator (50%)

Table 7.11: CE programs to create innovation culture outputs

Furthermore, it can be observed that the output *sensitized senior management* has an average frequency of 100% for all five CE program types listed in the table. In particular, when decisions have to be made about investments or spin-offs of companies, the top management of the company is involved. The table shows that CE programs can support cultural change at all levels of the company, as they lead to increased points of contact for innovative topics and current developments that have a certain relevance for the company.

7.4.3 CE programs and innovation ecosystem

The output category *innovation ecosystem* is covering the three outputs. They comprise 12% of all coded outputs and were found in 40% of the investigated cases.

The following Table 7.11 is illustrating the top five CE programs with the highest frequency of occurrence for the respective outputs. The CE program types with a strong relationship to the three outputs are highlighted in gray.

Output	CE programs (frequency of occurrence of respective output)				
	1	2	3	4	5
Strategic partnership	Investing co-creator (100%)	Strategic investor (100%)	Collective matchmaker (100%)	Cooperative explorer (100%)	Startup facilitator (100%)
Venture portfolio	Strategic investor (100%)	Investing co-creator (80%)	Venture builder (67%)	Collective matchmaker (67%)	Intrapreneurial excubator (33%)
Reputation within innovation ecosystem	Tech lab (100%)	Investing co-creator (80%)	Collective matchmaker (67%)	Cooperative explorer (67%)	Strategic investor (33%)

Table 7.12: CE programs to create innovation ecosystem outputs

For the *innovation ecosystem* category, it can be stated that external CE program types are suited better to create the three outputs (eleven out of 13 CE programs with a strong relationship are external ones). In particular, the investing co-creator and the collective matchmaker are suited well, as they show a strong relationship to each of the three outputs.

For the strategic investor, we see a strong relationship to the first two outputs, but not to the *reputation within innovation ecosystem* output. As elaborated in Subsection 7.2.4, this seems to be rooted in the circumstance that all cases of the strategic investor were located in the Silicon Valley, which makes it more challenging to create a positive reputation than it might be in the DACH region. Increasing the number of cases for the strategic investor with ones located in the DACH region would eventually lead to another conclusion regarding the most suited CE program types for this category.

7.4.4 CE programs and innovation know-how

The output category *innovation know-how* is covering the two outputs (a) intelligence on trends, and (b) technological know-how. They comprise 11% of all coded outputs and were found in 54% of the investigated cases. Table 7.13 illustrates the top five CE program types with the highest frequency of occurrence for the respective output.

Output	CE programs (frequency of occurrence of respective output)				
	1	2	3	4	5
Intelligence on trends	Strategic investor (100%)	Cooperative explorer (100%)	Digital factory (100%)	Tech lab (100%)	Investing co-creator (80%)
Technological know-how	Cooperative explorer (100%)	Tech lab (100%)	Strategic investor (67%)	Venture builder (67%)	Collective matchmaker (67%)

Table 7.13: CE programs to create innovation know-how outputs

Table 7.13 shows that external CE programs are particularly suitable for creating the two outputs belonging to the innovation know-how category (6 out of 10 are external CE program types). One possible explanation for this can be found in the high rate of new (often digital) technologies that are currently emerging in practice. In this context, it hardly seems possible to build up the technological know-how for all technologies that are potentially relevant in-house. The opening of the innovation process is often discussed as one way to deal with current developments (see Bogers et al., 2019; Chesbrough, 2004).

7.4.5 CE programs and intrapreneurial empowerment

The output category *intrapreneurial empowerment* is covering the three outputs as shown in Table 7.14. The three outputs comprise 8% of all coded outputs and were found in 25% of the investigated cases.

Output	CE programs (frequency of occurrence of respective output)				
	1	2	3	4	5
Entrepreneurial skills & methods	Intrapreneurial excubator (100%)	Idea validator (100%)	Assisted incubator (86%)	Innovation lab (80%)	Venture builder (33%)
Intrapreneurship community	Venture builder (33%)	Assisted incubator (29%)	Idea validator (25%)	Intrapreneurial excubator (22%)	Innovation lab (20%)
Network of supporters	Idea validator (50%)	Intrapreneurial excubator (33%)	Collective matchmaker (33%)	Startup facilitator (17%)	(-)

Table 7.14: CE programs to create intrapreneurial empowerment outputs

As shown in Table 7.14, especially internal CE program types seem to be suited to create the outputs belonging to this category. As already indicated by the name of the category, the

outputs focus on supporting intrapreneurial employees, and hence, it is not surprising that the outputs are mostly created by internal CE program types.

In addition, the table shows that only the output *entrepreneurial skills & methods* has a strong relationship to four CE program types, whereas for the other two outputs, no strong relationship was identified. This might be explained as the two outputs *intrapreneurship community* and *network of supporters*, seem to be outputs that support the operation of the programs themselves instead of outputs that are intended as a result of the activity.

7.4.6 CE programs and new offering

The output category *new offering* covers six outputs. The outputs belonging to this category comprise 21% of all coded outputs and were found in 36% of the cases. Table 7.15 is illustrating the five CE programs with the highest frequency of occurrence for the outputs.

Output	CE programs (frequency of occurrence of respective output)				
	1	2	3	4	5
Validated innovation idea ²⁴	Idea validator (100%)	Intrapreneurial excubator (100%)	Assisted incubator (100%)	Venture builder (100%)	Startup facilitator (100%)
New product	Cooperative explorer (100%)	Assisted incubator (71%)	Collective matchmaker (67%)	Intrapreneurial excubator (56%)	Venture builder (33%)
New stand-alone business	Venture builder (100%)	Intrapreneurial excubator (89%)	Assisted incubator (71%)	Strategic investor (67%)	Innovation lab (29%)
Value adding services or feature	Digital factory (75%)	Collective matchmaker (67%)	Innovation lab (57%)	Idea validator (50%)	Venture builder (33%)
New market	Digital factory (75%)	Collective matchmaker (33%)	Cooperative explorer (33%)	Strategic investor (33%)	Assisted incubator (14%)
Reconfigured business model	Venture builder (33%)	Digital factory (25%)	Innovation lab (14%)	Intrapreneurial excubator (11%)	-

Table 7.15: CE programs to create new offering outputs

²⁴ The two CE program types *investing co-creator* and *collective matchmaker* do also show a 100% frequency of occurrence for this output. Meaning we have in total seven CE program types with the same strong relationship to this output.

The outputs category *new offering* is strongly associated with the concept of corporate venturing (creation of new business within the pursuit of an existing company, see Guth & Ginsberg, 1990). The outputs show strong relationships with each of the three CE program categories, whereof the internal CE program types have the highest share (9 out of 19).

The output *validated innovation idea* is created in total by seven different CE program types. Depending on the locus of opportunity, the validation focuses on innovation ideas for new products or services (internal focus) or on innovative solutions/technologies that can be insourced to solve challenges in the core business (external focus). Whereas *new stand-alone business* is dominated by internal CE program types, the remaining outputs show a balance between internal and external ones. For the output *new market*, which often refers to new sales channels, there is only one strong relationship to the digital factory type.

7.4.7 CE programs and organizational transformation

The output category *organizational transformation*, which consists of six different outputs, comprises 17% of all coded outputs that can be found in 28% of the investigated cases. In Table 7.16, these CE programs with the highest frequency of occurrence are summarized.

Output	CE programs (frequency of occurrence of respective output)				
	1	2	3	4	5
Increased efficiency	Startup facilitator (100%)	Collective matchmaker (67%)	Idea validator (50%)	Assisted incubator (43%)	Cooperative explorer (33%)
New ways of working	Digital factory (75%)	Venture builder (67%)	Intrapreneurial excubator (56%)	Innovation lab (43%)	Assisted incubator (29%)
Digital infrastructure	Venture builder (100%)	Digital factory (100%)	Idea validator (50%)	Startup facilitator (33%)	Innovation lab (29%)
Improved flexibility & speed	Venture builder (67%)	Collective matchmaker (67%)	Strategic investor (67%)	Assisted incubator (43%)	Startup facilitator (33%)
Improved corporate image	Collective matchmaker (67%)	Strategic investor (67%)	Cooperative explorer (67%)	Innovation lab (57%)	Assisted incubator (43%)
Employer branding	Venture builder (67%)	Digital factory (50%)	Cooperative explorer (33%)	Assisted incubator (29%)	Intrapreneurial excubator (22%)

Table 7.16: CE programs to create organizational transformation outputs

In general, it can be observed that this output category has the highest proportion of outputs with a strong relationship to radical innovation unit types of all seven output categories. One reason for this is the need to support the digital transformation, for which the digital factory appears to be well suited. A distinction must be made between outputs that lead to changes within the core organization, e.g., digital infrastructure, improved flexibility or speed, and new ways of working, while an improved corporate image and employer branding do not require changes in the organization itself.

In this context, it is surprising that the venture builder, the internal CE program with the highest degree of autonomy (structural separation), shows the highest number of strong relationships with outputs that require changes in the core organization. One explanation could be the fact that in all three cases, the venture builder was embedded directly under the CEO/CDO of the company. Based on its focus on creating new businesses adjacent to the core business, the venture builder developed a kind of "thought leadership" role and served as an example of good practice in creating an organization focused on digital innovation.

One output that tends to stand out from the other five is increased efficiency. The high rate of new technologies and innovations on the one hand and the historically grown structures, processes, and infrastructures of established companies, on the other hand, show great potential for optimization by using new technologies. External CE programs can be used as facilitators that identify internal innovation potentials and bring them together with innovative startups. This contributes to the digital transformation of the corporate structure and processes, even if the degree of innovation is rather low since, in most cases the startup and the established companies enter into a supplier-customer relationship.

7.4.8 The selection of a suited CE program

This section has shown that depending on the outputs, different CE program types are suited better to create them. The results can be used as a basis for selecting the CE program type that is suits best the intended objective (which can consist of multiple outputs). For example, the objective to foster bottom-up driven innovation in the company, which might cover different outputs such as entrepreneurial skills and methods, increased awareness for innovation and validated innovation ideas. Tables 7.10 -7.16 can serve as a basis for selecting suited CE programs after having defined the objective and outputs that should be created.

7.5 Chi Square test

We conducted a Chi-Square test to understand whether the CE program types differ statistically significantly regarding the distribution of outputs. Generally, the null hypothesis of a Chi-Square test states there is no difference between the distribution of two variables, in our case, the outputs and CE program types. Meaning the relative proportions of outputs are the same between the different CE program types. In other words, a Chi-Square test can be used to examine how likely a relationship is based on chance.

Due to the relatively small number of cases in our data set (compared to quantitative research), we have applied the Chi-Square test on the level of the output categories (see Section 7.2) and the four groups of CE program types (internal incubation, company building, startup engagement, and startup investing – see Subsection 5.2.6). By analyzing our data on this higher level (grouping the data together), we were able to meet the prerequisite for using a Chi-Square test, which is that the expected value must be greater than 5 (McHugh, 2013).

In total, for each of the seven output categories, a Chi-Square test was conducted to evaluate whether certain outputs occur more frequently with some groups of CE program types than with others. The results of these seven tests are represented in Table 7.17. For declaring a significant difference, we have chosen a confidence interval of 95%.

Output category	Chi-Square value	P-value
(a) Innovation capability	8.8686	0,262227171
(b) Innovation culture	3.4567	0,839785151
(c) Innovation ecosystem	39.3097	0,000001706 ***
(d) Innovation know-how	15.8016	0,026991398 **
(e) Intrapreneurial empowerment	36.9530	0,000004788 ***
(f) New offering	20.2536	0,005047028 ***
(g) Organization transformation	17.1571	0,016410552 **

Table 7.17: Chi-square test for the seven outputs categories and four CE program groups

The results show that for five out of seven output categories (c – g), the distribution of output categories differs significantly between the four CE program groups. For the two output

categories of (a) innovation capability and (b) innovation culture, no significant difference in their distribution could be identified.

Both observations are in line with the findings from Section 7.2. The results show that for some output categories, there are clear differences between the CE program types and some output categories show a rather balanced frequency of occurrence across all CE program types (see, e.g., Figure 7.6). Table 7.18 provides an overview of the frequency of occurrence (%) and the total number of outputs created for the seven output categories in relation to the four CE program groups that were used in the Chi-Square test.

The overview shows that there is a rather balanced frequency of occurrence for the two output categories (a & b) across all four CE program types. In contrast, the differences in the frequency of occurrence are stronger for the remaining output categories (c – g).

Output category	Internal Incubation		Company Building		Startup Engagement		Startup Investing	
(a) Innovation capability	19	37%	13	33%	13	27%	6	19%
(b) Innovation culture	27	69%	18	60%	25	69%	16	67%
(c) Innovation ecosystem	9	23%	8	27%	21	58%	20	83%
(d) Innovation know-how	8	31%	10	50%	15	63%	12	75%
(e) Intrapreneurial empowerment	21	54%	10	33%	2	6%	2	8%
(f) New offering	32	41%	28	47%	25	35%	8	17%
(g) Organization transformation	16	21%	24	40%	19	26%	8	17%

Table 7.18: Frequency of occurrence for output categories across the four CE program groups

The results of the Chi-Square test underline that the four CE program groups, namely (1) internal incubation, (2) company building, (3) startup engagement, and (4) startup investing, are not only similar regarding their organizational design but also in regard to their value creation.

To conclude, the Chi-Square test shows that the distribution of outputs differs significantly between the CE program groups. This suggests that the relationships between CE program types and the outputs described in Sections 7.2 to 7.4 are likely not caused by chance.

7.6 Concluding on the relationship between CE programs and outputs

The aim of Chapter 7 is to answer RQ3, which is divided into three sub-questions. For each of the three sub-questions, a separate section was used to provide the answer. Below, the answers are briefly summarized.

Answering RQ3a, which reads as follows: *What relationships between CE programs and outputs can be identified?*

Tables 7.1 – 7.6 have shown that the different CE program types share different relationships to the output that were identified in Chapter 6. Furthermore, Tables 7.2 and 7.5 show that some outputs are being created more likely than other ones, which are defined as “strong relationships”. Depending on the organizational design, the relationships and the number of relationships did show different manifestations.

Answering RQ3b, which reads as follows: *Do certain structural or contextual elements influence their occurrence?*

In Subsection 7.2.1, it was shown that context elements (internal and external) could influence the occurrence of certain outputs. The two examples used suggest that the moderating influence might occur at different levels. For the external context (the industry), a direct influence on the occurrence of an output, while the example for the internal context (company size) influenced the choice of CE program, which is a rather indirect effect on the occurrence of the outputs.

Subsection 7.2.2 examined whether certain design elements (structural elements) can be used to explain differences in the occurrence of outputs between the various CE program types. For this purpose, two rather similar CE programs were used to show that the differences in their outputs can be explained by certain design elements that did distinguish their organizational designs.

The two Subsections 7.2.1 and 7.2.2 did show that both contextual and structural elements can influence the occurrence of outputs. While a moderating influence was found for contextual elements, structural elements are suitable to explain differences in the value creation of CE program types.

Answering RQ3c, which reads as follows: *Which CE programs are more suited to achieve the respective outputs?*

Table 7.9 provides an overview showing that different CE program types are suited to create the outputs of the seven output categories. In Subsections 7.3.1 – 7.3.7, for each of the outputs, the respective CE program types are listed that are suited most to create the output.

Answering RQ3, which reads as follows: *Can causal relationships between CE programs and their outputs be identified?* To a certain extent, the results presented in this chapter answer the question regarding the causality between the CE program types and the various outputs. In Section 7.2, we show that there is a strong relationship between the CE program type and outputs. In addition, the results in Section 7.3 show that certain design elements can be used to explain the difference in the outputs that are created. This provides first insights into the mechanisms of the relationships between CE program types and the outputs. Nevertheless, further research is required to explain causality for all CE program types and outputs as well as to understand how the mechanisms can be investigated appropriately.

Having presented that last part of the empirical results, the next chapter will focus on evaluating how these results did contribute to answering the problem statement and research questions of this study. Furthermore, the limitation and the contributions of this study as well as the future avenues for research will be discussed.

