Japanese Process Management Through a Startup Lens

A Case Study of New Product Development Process Patterns in Tokyo-based Startup Companies

Abstract

The past few decades have been turbulent for the Japanese economy. Creating a thriving startup environment is one of the pillars of Prime Minister Shinzo Abe's plan to revive the country's economy. Against this background, and the rich manufacturing history of Japan, this thesis researches a crucial part of the process of building a successful startup, namely the product development process. Specifically, we study the patterns of creating more ideas, called diverging, and closing down ideas, called converging, in Japanese, Tokyo-based startup companies. We also look at the experience and behaviors of founding teams that pursue these patterns of divergence and convergence. This area of study lies in the intersection between entrepreneurship and new product development/innovation management as part of operations management. The area has been covered extensively in pop-science literature, but to a lacking degree in academia. We can conclude from our research, that a pattern of deliberate diverging and converging is associated with success while skipping diverging and converging and going straight to implementation is associated with failure. Founding teams that use a deliberate approach and have both market experience and implementation experience seem to be more successful than those who are missing either area. The most typical divergence behavior is brainstorming, and the most commonly cited convergence behavior is speaking to customers. Founding teams that go straight to implementation, in many cases do it because of having seen a successful business model elsewhere and tried to copy it. The framework presented could be used to study a larger number of subjects, to provide proof where we find mere associations and to allow for comparison where we merely report findings from a narrow context.

Keywords Operations Management; Innovation Management; New Product Development; Process Methods; Startup Companies

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/Axel and William

Core Concepts

Operations management (OM): An area of management concerned with designing and controlling the process of production and redesigning business operations in the production of goods or services.

Startup company: An entrepreneurial venture which is typically a newly emerged, fast-growing business that aims to meet a marketplace need by developing or offering an innovative product, process or service.

Innovation: A new idea, device or method.

Divergence: The phase in which ideas are created, where an idea is understood as a basic element of thought that can either be visual, concrete, or abstract.

Convergence: The phase in which ideas are closed down.

Minimum Viable Product (MVP): In product development, an MVP is a product with just enough features to satisfy early customers, and to provide feedback for future development.

Ideation: The creative process of generating, developing, and communicating new ideas.

Validation: The process in which the usefulness of an idea is verified with customers.

Software as a Service (SaaS): SaaS is a software delivery model in which software is licensed on a subscription basis and is centrally hosted. It can also be referred to as "software on demand".

Learning Management System (LMS): A software application for administration, documentation, tracking, reporting, and delivery of educational courses and training programs.

Pivot: A term used in the Lean Startup context meaning a structured course correction designed to test a new fundamental hypothesis about the product, strategy, and engine of growth.

Product/market fit: The degree to which a product satisfies a strong market demand.

Agile: An iterative, incremental management method that aims to provide new product or service development in a highly flexible and interactive manner.

Idea Fidelity: The degree of exactness to which an idea is defined/materialized.

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1 Introduction

This introductory section highlights the background as to why we chose our area of research, and what value it can add from an academic standpoint. We then reveal the purpose of our study, how it is delimited, and the research questions around which we have structured the study. Finally, we discuss the intended theoretical contributions of our research.

1.1 Background

We chose this area of study because of two intersecting interests of the researchers. Both are fascinated by the complexities of operations management, particularly lean management, and the novelty and excitement of startups. These areas of interest intersect in an interesting manner in Japan. Post-war, quality management was brought to Japan to great effect. Japan developed into an economic powerhouse and developed quality management to what is commonly known as lean manufacturing today. These practices spread to globally, not only to manufacturing, but to other applications as well, including the startup context. The past few decades have been economically tumultuous in Japan, and one of the initiatives current Prime Minister Shinzo Abe is driving to revive the economy is promoting the development of innovative startups. Big changes are afoot, as the VC-funding raised doubled from 1 billion USD to 2 billion USD between year 2014 and 2015 (Foreign Affairs, 2016).

The area is worth studying from an academic standpoint as an abundance of pop-science literature has been written on the management of startups, The Lean Startup by Eric Ries (2011) being one of the most prominent ones. Innovation management is important for any company, but it is crucial for a startup, as its survival depends on creating solutions that are innovative enough to compete with established rivals. The current literature on innovation management in startups is interesting but lacks academic backing. That is where this thesis aim to make a theoretical contribution.

1.2 Purpose of the Thesis & Research Questions

This thesis aims to find empirical backing for practices and principles within lean startup methodology. To fit the scope of a bachelor thesis, we narrowed down our area of study to

a part of the new product development process in startups. We chose to research the way companies create more options, called diverging, and the way they close down options, called converging. We also investigate the experience of founders, and the behaviors that they display when going through the divergence and convergence phases of the development process. To study these areas, we have chosen the following research questions:

1. What patterns of divergence and convergence can be found within the startups we study, and with what outcomes are they associated?

2. What type of experience do founding teams have, and what behaviors and reasoning do they display in leading divergence and convergence within their companies?

1.3 Intended Theoretical Contribution

The areas of new product development and innovation as evolutionary processes of either iterative or linear nature are established and mostly agreed on. However, at the intersection of the above areas, entrepreneurship and operations management, there is a plethora of pop-scientific literature, but little with sound academic backing. Specifically, the patterns of divergence and convergence are relatively unexplored and deserve further research to identify, validate and evaluate product development patterns and the outcomes with which they are associated.

Our intended theoretical contribution is based on looking at the new product development process in startups through the lens of divergence and convergence patterns. We then want to see whether certain patterns, and the behaviors and experience associated with those patterns, are associated with success or failure. Academically, we aspire to contribute with a framework of divergence and convergence patterns that other researchers can use to collect more empirics and go on to prove that certain experience, behaviors or patterns lead to success. Our framework could be used to study startups in a wider context, in a broader set of industries and regions, as well as for comparative research.

2 Literature Review

In this section, we present our literature review. It covers two main areas: New Product Development/ Innovation Management as part of Operations Management, and Entrepreneurship. There is little academic research in the intersection between these areas, and that reveals our research gap which in turn guides us toward our intended theoretical contribution.

2.1 Innovation & New Product Development as Part of Operations Management

2.1.1 Evolution of Innovation & Product Development in OM

In their literature review on product development research, Brown and Eisenhardt (1995) reverberate Adler's (1989) claim that innovation research is split into two main areas:

1. **Economics-oriented, macro-level research on, for example, differences in patterns of innovations in regions and evolution of specific technologies, and;**
2. **Firm-oriented, micro-level research on the development of new products with regards to "structures and processes by which individuals create products." (Brown & Eisenhardt 1995, p.343).**

Brown and Eisenhardt (1995) then suggest that Adler's second category is split into another three streams of research stemming from pioneering work in NPD process management. From these streams, an arguably vast and fragmented body of literature has evolved:

- **Rational stream: Based on Myers and Marquis (1969) and the SAPPHO projects (Rothwell, 1972; Rothwell et al., 1974). This line of research view innovation and product development as a process of planning a superior product for an attractive market and successfully executing the plan. The focus of the study is on what independent variables (such as market and technology) affect the financial success of a product development process.**
- **Communication Web stream: Based on the early work of Allen at the Massachusetts Institute of Technology (MIT) (1971, 1977). Whereas the rational stream provides a greater research width, this stream provides a greater depth.**

Solely one independent variable, communication, is extensively studied with regards to its effect on product development process performance.

- Disciplined Problem-Solving stream: Based on Imai and colleagues' (1985) research on successful Japanese firms. This stream views product development as a "deliberate business process involving hundreds of decisions, many of which can be usefully supported by knowledge and tools" (Krishnan & Ulrich 2001, p.1).

2.1.2 Innovation & NPD Processes in Practice

An important starting point in the studies of innovation and NPD process practices in OM literature is the view of the process along which different variables are studied. A common approach to looking at a development process is through the lens of a phase-review framework (Krishnan & Ulrich 2001; Ulrich & Eppinger 2011). Essentially, this involves studying the timing, nature, motivations (and other variables) behind decisions made in more or less predefined development phases. Kagan, Leider, and Lovejoy (2017) suggest that on a high level, these frameworks include three phases:

1. "ideation," where product design is thought up and determined,
2. "realization," where product design is rendered in physical representations, e.g. prototypes, and;
3. "commercialization," where a product is fully launched including sales force and supply chain ramp up.

2.2 Divergence & Convergence in NPD as Connected to Entrepreneurship

2.2.1 NPD & Innovation Management Theories

There is a plethora of theories on the management of innovation processes, both from academic research and popular literature. A common denominator of these theories is their role in reducing the procedural uncertainty to focus on product uncertainty. The role of uncertainty in innovation is nuanced: at the same time as variation/uncertainty is problematic, its removal arguably affects an organization's ability to create product novelty. Linked to this is what Kagan, Leider, and Lovejoy (2017) call the experimentation-execution trade-off. This trade-off centers around the notion that cost of design decisions rises whereas uncertainty about product/market fit falls towards the end of a product

development process, closer to the launch. Hence, executing (realizing) a product design idea early in the development process might seem reasonable from a cost perspective. However, given the lack of market knowledge at this point, the risk of developing a product with low market fit increases, and costly late design changes might follow, a phenomenon called "firefighting" (Repenning, Gonçalves & Black 2001).

2.2.2 Divergence & Convergence in NPD & Innovation Management

The timing and nature of product development decision phases regarding the opening up (diverging) and narrowing down (converging) of alternatives of different fidelity have a key role in innovation processes. A considerable amount of literature treating this herald from studies of successful Japanese manufacturers, especially Toyota, that were shown to produce higher quality products faster and with better product/market fit without cost increases (e.g. Ward et al 1995; Thomke & Fujimoto 2000; Mansfield 1988). The task presented in these studies is to design a process that optimizes development costs and product/market fit by successfully overcoming the experimentation-execution trade-off.

Some attention has been attracted to studying the concepts of how to experiment and execute on product design ideas (diverge and converge) of small-to-medium sized organizations, e.g. studies on Agile development (e.g. Thomke & Reinertsen 1998). The bulk of studies in this discipline have been done on large manufacturing and service organizations, predominantly in North-America and Japan (e.g., Cooper & Kleinschmidt 1987, Mansfield 1988; Zirger & Maidique 1990). The entrepreneurial startup domain with regards to overcoming the experimentation-execution trade-off, on the other hand, seems sparsely covered in academic literature. Instead, this domain is richly covered by popular literature. Examples of work in innovation process management in startup projects are Reis' (2011) pioneering book The Lean Startup and Furr & Dyer's (2014) book The Innovator's Method. These books introduce methods to reduce development uncertainty early and at low cost (e.g. through MVPs and rapid prototyping), thus overcoming the experiment-execution trade-off.

2.3 Research Gap

Based on the literature review, there seems to be a lack of academic research done in the intersection of the two general research areas of Entrepreneurship (startups) and

Operations Management (Innovation/NPD processes) regarding divergence and convergence patterns of startup companies. A lot of pioneering works in popular literature treat this gap and there is much writing about process management and NPD/innovation independently. However, the intersection is incoherent, and incomplete in the startup context. Patterns of divergence and convergence are even less explored.

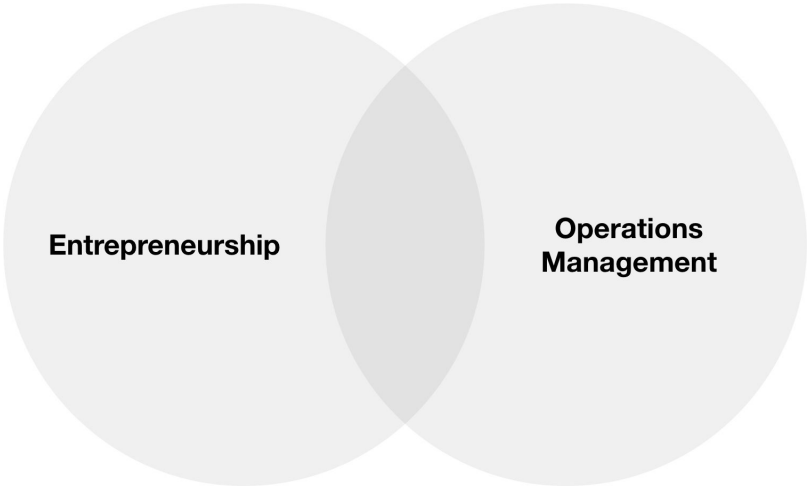

Figure 2.1: *Research gap and area of study is in the intersection between Entrepreneurship and Operations Management.*

3 Theoretical Framework

The theoretical framework presented in this section guides our exploration of the patterns of convergence and divergence. It is coupled with an inquiry along factors explaining the behaviors and experiences underlying the patterns, to form an integrated framework piloting the thesis. The resulting framework represents a mix of the three research streams that are in line with Brown and Eisenhardt's (1995) suggestion to combine the streams to develop a more integrative model for studying innovation processes.

3.1 Product Development Cycles

As suggested by Meissner and Sprenger (2010), the approaches to describe innovation processes in a rigid manner (Cooper 1998; Erweich & Ulrich, 2009) can be considered insufficient to capture the irregularities of organizational innovation processes. Kagan, Leider and Lovejoy's (2017) three-stage phase-review framework offers a suitable starting point. However, the hitherto lack of providing a homogenous phase-model to describe innovation processes makes it desirable to refrain from too many restrictions when defining the process phases. Instead, this thesis attempts to present a process framework including development phases that can be considered more neutral to the actions and thereby better capture the purpose of the study.

The framework includes three development phases, namely: "divergence," "convergence" and "implementation." Although these terms are seldom used to describe development phases in OM literature, Flavell (1972), Riegel (1969), and Van Den Daele (1969) suggest that developmental processes unfolding over time in social science be studied with a vocabulary of recurrent progressions of "convergent", "parallel" and "divergent" streams of activities. A short description of the phases follow:

1. **Divergence phase: The phase in which a company generates multiple options or ideas.**
2. **Convergence phase: The phase in which a company narrows down their ideas so that they have one they can implement.**

3. **Implementation phase: The phase in which the idea the company has decided to pursue gets fully materialized and ready for launch to consumers. It involves marketing/sales-force and supply-chain ramp-up.**

These set of development phases then make up a development cycle which leads to an outcome, and sometimes to a new cycle, either through pivoting or adding more features/improving on the existing product. An end-to-end development project can include several development cycles of different patterns of divergence and convergence as determined by the nature of its constituent phases. The usage of cycles was intended to keep the framework flexible and taking into account that an end-to-end NPD process can vary significantly.

3.2 Divergence & Convergence Patterns & Their Corresponding Outcomes

We look at the patterns of divergence and convergence as companies go through development cycles, and to what outcomes they are associated. The factors dictating the nature and outcomes of the divergence and convergence patterns were:

1. **Ideas over time: This is the number of ideas, options, concepts, prototypes or alternatives that the company has open over time. We deliberately kept this concept very broad in order not to unnecessarily steer the development patterns toward existing models. To be taken into account, the ideas considered had to be represented by an observable transaction (e.g. discussed, put in writing on a whiteboard).**
2. **Outcome: We let interviewees define success and failure in their words. In general, success has meant either a product that is selling on the market or the startup securing funding. Failure has meant the opposite, namely a lackluster response for the product from the market, or the startup not being able to obtain financing. The mixed outcome was added to take into account the development cycles that could not be characterized by the interviewee as either successes or failures. We based the delimitation of the outcome factor to self-assessments with the aim of showing associated tendencies rather than empirically thick assertions about outcomes.**

3.3 Experience & Behaviors

The factors along which we study the experience and behaviors corresponding to the divergence and convergence patterns were chosen partly based on their adherence to the aspects studied in the Minnesota Innovation Project (Van De Ven, Poole 1990). The behaviors studied were restricted to the divergence and convergence phases of a development cycle. Hence, we did not consider the behaviors adhering to the implementation phase. The factors studied, and their corresponding definitions were as follows:

1. **Experience of founding team: Involve the degree of technical and business experience based on education and professional careers of the founding team. The experience of the founding team was also assumed to be a driver of behavior, meaning that this factor serves a dual purpose in providing findings to both aspects of the second research question.**
2. **Behaviors: What the founding team does to open up options, diverge, and close down options, converge. Note that these behaviors include the reasoning behind choosing their diverging and converging actions.**

3.4 Integrated Product Development Framework

The following integrated framework is presented to address the purpose of studying divergence and convergence patterns with regards to their existence, associated outcomes and factors behind them. The framework consists of desensitized innovation process theories and purposefully widely defined concepts along which we evaluate the processes and their associated outcomes.

Besides guiding the treatment of the research questions, the framework is ideally transferable to future studies of divergence and convergence patterns in other cases in the same or a different context. To this end, the built-in flexibility of the framework serves an important function, although, further improvement and adoption of context-specific conditions is encouraged.

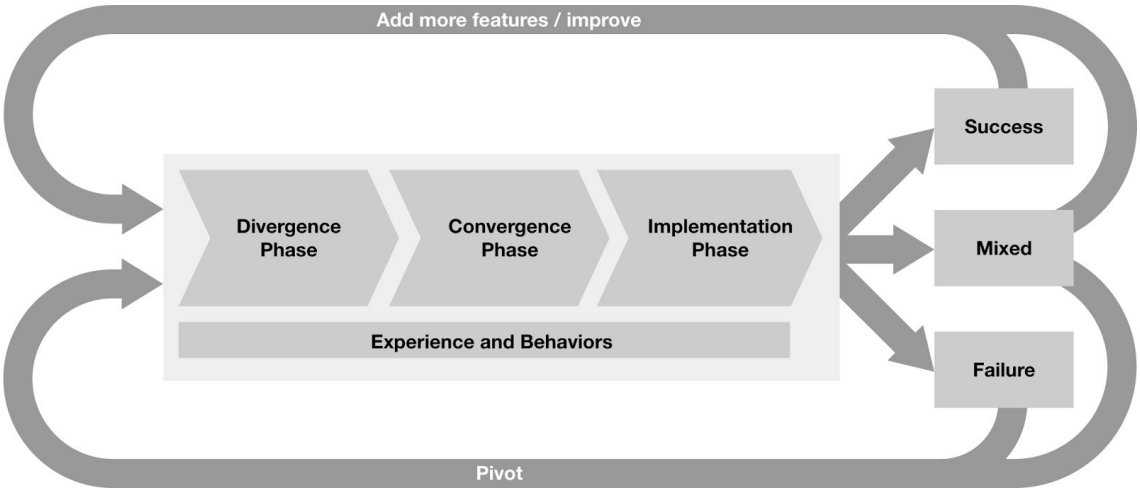

Figure 3.1: *Integrated Product Development Framework.*

4 Method

In this section, we start by outlining the scientific approach we are using in our study. The research design and path are then described. Finally, we conduct a discussion critiquing our use of method.

4.1 Scientific Approach

Existing innovation management theories form a key stepping stone for this thesis' inquiry into startup convergence patterns. They provide the theoretical constructs along which we established the theme, research questions and analytical tools of the thesis. However, as suggested by Van de Ven (2007), innovation processes are far beyond the explanatory capabilities of any single process theory found in the literature. Thus, in avoiding the development of an unstable theory or a self-fulfilling prophesy out of data, an abductive reasoning was adopted.

4.2 Research Design & Path

This thesis applies a multiple case study design allowing for "the in-depth study of instances of a phenomenon in its natural context and from the perspective of the participants involved in the phenomenon" (Gall et al 1996, p.545). Also, the multiple case study design allows for observing replication of patterns through cross-case comparison (Yin, 2009). Key elements of the research design come from Yin (2009, 2014) and Van de Ven (2007) which lend appropriate design features for case studies and studies of change processes in the social sciences respectively. To reflect the relaxed degree of theoretical formalism to prior theory, the a priori theory-building goes under the term "thematizing the study" (Rose, Spinks, Canhoto 2015). The tentative character of the early formulation of research questions and theoretical constructs in case studies is supported by Eisenhardt(1989). We followed the below six-step research path:

1. **Select a research question and thematizing study.**
2. **Case selection. Theoretical sampling, that is, selecting relevant interview subjects.**
3. **Collection of relevant data.**

4. Analysis and interpretation of data. Constant comparison for finding themes within our concepts by looking for patterns of divergence and convergence that are associated with certain founding team behaviors and experience.
5. Development of conceptual and theoretical framework.
6. Writing up of findings and conclusions.

The latter three stages have been cycled through continuously as work on the thesis has progressed.

4.2.1 Selecting Research Questions & Thematizing Study

Based on general conceptual constructs on process and innovation management, a research question was formulated to induce the thematic boundaries of the thesis. Following this, we performed a selective review of the process management literature with regards to innovation and product development processes to define the intended theoretical contribution of the study as suggested by Yin (2010). As we went through the literature review and later the collection of empirics, we modified our research question in accordance with the abductive research approach.

4.2.2 Case Selection

We primarily based the selection of organizations to study empirically on their regional origins (Tokyo, Japan), ability to speak English, company character (startups of varying size) and industry belonging (tech). The latter of these selection criteria was partly based on perceived ability to deliver cross-case consistency for pattern recognition, partly on the convenience of access. Two startup incubators representing knowledge about the development processes of several startups were interviewed to expand the reach of the study and add nuance to our empirical platform. The people interviewed were in all cases high ranking business developers working closely with the founders, and in 3 cases they were co-founder themselves.

4.2.3 Collecting Relevant Data

We collected empirical data during a total of 8 interviews, 6 of which we conducted on the premises of the company, and two of which we conducted via Skype. The interviews lasted 45-60 minutes, including a limited introductory section of our line of research and were attended by both authors.

The interviews were conducted in a semi-structured way, in part by using a questionnaire covering the basic dimensions underpinning our theoretical framework and in part by issuing a self-completion graph (see Appendix 9.2 and 9.3). The graph was limitedly presented to the interviewee and then filled in during the interview, allowing for ongoing questioning. Letting the interviewee illustrate the NPD path in a graph allowed us to gather a richer picture of events and expand the narrow reach of words in agreement with Van de Ven (2007). After filling in the process graphs collaboratively, the authors repeated back how the process went in order to uncover and correct any misunderstandings.

The interviews were subsequently automatically transcribed (using software provided by YouTube) and then edited for clarity and correctness with the help of listening to original recordings.

4.2.4 Analysis of Data & Development of Theoretical Framework

The analysis was performed using a methodological framework that conforms to qualitative research methods in general (Bryman & Bell 2015, Yin 2010) and innovation processes in particular (Van de Ven, Scott Paul). The on-sight renderings of graphical representations of process data combined with short summaries of the same enabled within-case analysis before cross-comparing the cases in search for process patterns per Eisenhardt (1989). We followed the below procedure in conducting the analysis:

1. Compiling: Product development process graphs were filled in collaboratively with the interviewees throughout the interview and transcription of the interviews was subsequently conducted.
2. Disassembling: We coded the transcripts in accordance with the concepts described in the theoretical framework, namely outcomes, people, behaviors, and ideas over time. This process entailed highlighting quotes from the transcripts that corresponded to the above-mentioned categories. The graphs that had been collaboratively completed with the interviewees were also disassembled into separate development cycles. This is exemplified by the graph of KUFU's overall development, which we then disassembled into four separate development cycles (see Appendix 9.4).

3. **Reassembling (and Arraying): From our disassembled data, we created within-case summaries and cross-case summaries. We also created codes based on letters for each company we had data on (see Appendix 9.5), and numbers based on the development cycle the company was on. So for example, the code S2 would mean the second development cycle of Soracom. The disassembled cycles, outcomes and decisions about whether to "pivot" or "add more features/improve" were plotted into our analytical tool (see Appendix 9.6). Each combination of a certain outcome and certain patterns and their outcomes was then tabulated (see Appendix 9.7).**
4. **Interpreting: Starting from the tabulated frequencies, pattern-outcome paths were uncovered, leading to the possibility of associations between certain patterns and outcomes. The next step of interpretation was in looking at what experience and behaviors founding teams displayed and if they could be associated with certain patterns.**

Following the abductive research approach, each stage of analysis of data was accompanied by continuous comparison with literature, the preliminary theoretical framework, and our research question.

4.3 Discussion of Method

This section discusses possible limitations to the quality of the research method and the tactics adopted to address those. Yin (2009) proposes the following four tests to maximize the quality of a case study:

1. **Construct validity: To ensure that we are measuring what we think we are measuring, we have conferred with established researchers in the area of management research about the concepts we have used, and we have addressed the concerns they raised.**
2. **Internal validity: A common critique of qualitative studies is the risk of interpretation bias of empirical data, in other words, making false inferences about observations. To address this, the interviews were recorded and transcribed in the presence of both authors. Furthermore, process graphs were validated by the interviewees during and after the interview by asking follow-up questions and**

confirming that the authors' understanding of the illustrated process aligned with that of the interviewee (Van de Ven et. al 1995). Another possible limitation to this is the dissemination of meaningful data out of the large amount of documentation from transcriptions (Yin 1981). To address this, within-case summaries were produced after the interviews. Also, the graphical illustration tool used in the interviews to make sense of development actions and tabulate meaningful events (Yin 1981) was used to the same effect.

3. External validity: Possible limitations to the study can be attributed to the sample selection, especially regarding the generalizability of the findings. The restriction to conveniently accessible, Tokyo startups and incubators might have presented the empirical platform with a skewness towards a sample of success stories. To mitigate this possible limitation, a wide variety of startup companies as to their respective sizes and development stages were interviewed. Also, following the replication logic (Yin 2009), cross-case comparisons allowed for each case to confirm or disconfirm the general findings of the other, making generalizations more plausible.
4. Reliability: Another limitation of qualitative studies is the risk of the subjectivity of the authors. To mitigate this limitation, coding of the transcripts from the first two interviews was performed independently by both of the authors in accordance with Van de Ven et. al (1995). In the case of differences as to the suitable code for a particular event, transcripts were entered into event codes only after agreement about a unified way of coding was reached.

5 Empirical Findings & Analysis

This section shows the empirical findings and analysis done in our study. First, a tabulation of the association between different patterns of divergence and convergence and outcomes is done. The experience and behaviors of founding teams behind the different pattern-outcome paths are then explored.

5.1 Divergence & Convergence Patterns & Their Corresponding Outcomes

5.1.1 Introduction to Patterns & Outcomes

The coded qualitative data from the 15-company large sample indicated two patterns of divergence and convergence, associated with three different outcomes. This amounted to six possible pattern-outcome paths, of which five were represented in the empirics. The discontinuities of the patterns were based on the nature of the development phases, including the existence and formality of divergent and convergent decisions. The resulting patterns were "straight to implementation" and "deliberate" divergence and convergence in the development cycles. Below follows an explanatory section about the empirical manifestations of the two patterns and the associated outcomes.

5.1.2 How Patterns & Outcomes Manifest in the Empirics

The results in this section draw from the data represented by the development graphs that were filled in collaboratively with the interviewees (see Appendix 9.4 for a sample) and then coded into patterns using the analytical tool (see Appendix 9.6).

The "straight to implementation"-pattern was free from any apparent divergence or convergence activities of generating or validating ideas. The graphical representations follow a straight line going from one idea, coupled with the notion of starting to develop that one idea from the outset. Noriaki Sakamoto at UTEC mentioned that for an affiliated software security company "it's always a single [alternative along the graph], we saw how the technology could be suitable for the client at the first meeting, and that hypothesis has not changed over six or eight months." Kensuke Naito at KUFU said "actually we didn't consider many ideas before that. Just thought up and create it." when talking about their first attempted product development.

The "deliberate"-pattern involves intentional or structured activities to early consider a large number of ideas to then converge upon. Several companies point to brainstorm sessions as starting points in their product development. Also, some companies showed an ability to quantify the number of ideas considered in a clearly defined initial divergence phase. For, e.g., Voyagin actively considered around 30 ideas at the beginning of their second development cycle. Added to this are the interview graphs showing early divergence to many ideas in an ideation stage followed by a gradual convergence.

The respective outcomes associated with the identified development patterns were manifested by the interviewees' take on development outcome. Takuya Oikawa said about Qiita's first failed development cycle that "after three or four months you know, it didn't work well. Q&A didn't work well in Japan. So they changed their minds to re-establish that community, not through the Q&A site but the pure sharing knowledge site." This knowledge sharing site now forms Qiita's core business with market traction. However, the subsequent hardships with monetizing this indicate a mixed outcome. Similarly, in their first development cycle, Voyagin developed the technical platform that was not successful in the market, but would later form the foundation of the product that would gain market traction later on, indicating a mixed outcome.

5.1.3 Frequencies and Identified Patterns

	Straight to implementation	Deliberate
Fail	5	0
Mixed	2	9
Success	2	20

Table 5.1: *Observed frequencies of combinations of patterns and outcomes.*

Table 5.1 shows the frequencies of development cycles adhering to the different diverge-converge patterns and the corresponding outcomes. Many of the companies interviewed did not follow one distinct path with a particular divergence and convergence pattern, but several development cycles with different patterns before commercializing the product. Hence, the number of development cycles and the corresponding outcomes tabulated amount to 38, which is more than the 15 companies we have in our sample.

The only recorded development failures across the three patterns can be found in the "straight to implementation"-pattern where 5 out of 38 were classified as failures. Thus, considering a single idea to implement tends to be more prone to failure than the other pattern. Also, these failed development cycles were in all cases the first attempts (and also 2nd for KUFU) that subsequently proceeded to other patterns and outcomes. However, 4 out of 9 cycles of this pattern is also represented by mixed and successful outcomes respectively, adding considerable nuance to the tendency to fail.

A little over half (20 out of 38) of the cycles studied recorded deliberate development patterns associated with success. Also, several companies ended up succeeding after developing along this pattern in their second or third development cycle, having gone through other patterns with failed or mixed outcomes (for example Coursebase and KUFU).

5.1.4 Sub-conclusion

The analysis of empirical data identifies two divergence and convergence patterns; "straight to implementation" and "deliberate." The general tendency of these patterns is that the "straight to implementation"-pattern is associated with failure whereas the "deliberate"-pattern is associated with success. In other words, deliberately considering many ideas early on tends to lead to success. However, there is substantial nuance to these tendencies, especially along the "straight to implementation"-pattern, legitimizing the following analysis of the behavioral factors behind the identified patterns.

5.2 Experience & Behaviors That Form Different Patterns

5.2.1 Introduction to Founder Experience & Behaviors

In this section, we explore the experience of founders and the behaviors they display in leading their companies, organized around the patterns identified in the above analysis. Therefore, we look at founder experience and behaviors as associated to the following two patterns:

1. "Deliberate" divergence and convergence tends to lead to success.
2. Going "straight to implementation" tends to lead to failure.

We look at founder experience as a driver of their behavior. Different founders bring different mindsets, tools, and skills into the product development process, which thereby drive different outcomes. In outlier cases, for example, when founders use a deliberate ideation and validation approach but do not reach success as would be expected, we describe possible explanations for these occurrences.

5.2.2 Behaviors & Experience Behind the "Deliberate"-pattern

The companies that used the "deliberate"-pattern tended to be successful. None of the companies we observed with this pattern were unsuccessful.

5.2.2.1 Experience of Founding Teams Drive Behaviors

The experience of the founding team drives the behaviors they display in going through the development process. In our empirics, we see that this experience can come from multiple different sources, such as technical expertise from academia, market experience from working at a consultancy, or experience from previous startups or previous development cycles in the same company.

A commonality between founding teams who are successful and who use the "deliberate"-pattern is that they have a mix of both the technical experience required to implement the solution, and the market knowledge necessary to create a product that fits the intended market. The drone company with a focus on agricultural applications, ACSL, had significant technical expertise as it was started by a University of Tokyo professor. This knowledge was complemented with the knowledge of the people at the UTEC incubator, who had market experience from consultancies such as McKinsey. Another example is the developers of the learning management software, Coursebase, who in their deliberate second and third development cycles reached success. This as they both had the technical knowledge on board, strong financial backgrounds, and the understanding gained from a previous less successful development cycle where they had followed a trend in the market instead of looking for what is useful for customers.

A commonality between founding teams who got mixed results while using the "deliberate"-pattern, is that they were missing either the market knowledge or the technical knowledge needed for effective implementation. Holo Eyes, the VR startup focusing on the surgery market, had the technical and medical know-how essential to create a useful

product, but they missed the business side of things, "like making the business plans and talking to VC's," limiting their success. On the other hand, a startup focused on AR, Gatari, consisted of a team of students who had a strong vision of what they wanted to do and of what was attractive on the market, had issues implementing their vision because of lacking engineering talent.

5.2.2.2 Behaviors Driving the "Deliberate"-pattern

The founding teams that follow a "deliberate"-pattern display some similar patterns in the loosely structured divergence and convergence of ideas. By deliberately diverging and converging, teams can have procedural certainty, meaning they know roughly what stages to go through when developing their product. Being certain that they are following an established process can limit the uncertainty of the startup process to that which relates to the product.

In our empirics, we have found that most companies start out by having one low-fidelity idea of what they want to do. For example, the founders of KUFU knew they wanted to start something in the HR SaaS-space. They, and the other companies we observed, then went on to use different divergence tactics to create more high-fidelity ideas of how the product or service would manifest. This included, among other things, ideas about features to be offered, and how those features would work.

The primary divergence tactic that we found was a set of one or more brainstorming sessions. These could be carried out as part of the day-to-day work, or as in the situation of the agricultural drone company ACSL, on an off-site. At least 10, and in some cases as many as 150 ideas were generated in these brainstorming sessions. Brainstorming was an activity that all three incubators encouraged their participating companies to partake in.

Teams did not start their brainstorming with an entirely blank slate. We found that they used the following sources of inspiration when generating ideas:

- Customers as inspiration: Talking to customers and asking for their candid feedback was something we saw in common for many of the companies on a successful development cycle. The founders of Coursebase had first of all recently been customers of a product similar to what they were developing themselves.

"yeah as a former employee of a company I felt you know submitting things to HR was very difficult, so we wanted to fix that part." They noticed however that their personal experience was not enough. "so we started off with a few functionalities that our prospective clients wanted which is us managing submissions. Then we branched out from there, like with all these other functionalities. But yeah I mean from day one it was always client feedback."

- **Competition as inspiration: Some teams looked at what the competitors were doing to see how they could differentiate their product and create something better. As one of the co-founders of Coursebase recounted to us: "We tried as many LMSs as we could, and a lot of these LMSs, they don't have demos, right? So you have to ask your friend to log in and show you after work hours, right? So we're trying to test as many LMS as we can to figure out how other LMS's are doing it and at the time they're mostly the same." From this research, founders found an idea for a feature that they could create that did things differently and better.**
- **Metrics as inspiration: Some companies used their metrics as a guide to what areas to pursue further development. For example, the professional social networking provider Wantedly, looked the usage metrics of their products for inspiration: "So we're constantly looking at all of our data and seeing: 'Okay, here the people are active and here it's starting to stagnate and here we have to push more.' So we have to do something about that, and as a result, a new product evolves."**
- **Similar companies as inspiration: Leaders of incubators deemed an important part of incubator programs as being that the companies can take inspiration from each other. For example, Nayoa Koji, Producer at the Tokyo VR Incubation Center pointed out that the companies benefited from being each other's presence. The companies were in "different stage[s], but it was good that people in the different stages were in the same place, because they kind of inspire each other."**

Once companies have diverged, they have a collection of ideas that they can explore. To choose which ones to pursue further, they need to converge and find one on which to focus. Multiple companies indicated that they found it was important to focus on only one

or two ideas, as startups have limited resources, and cannot afford to pursue several ideas at the same time. Noriaki Sakamoto from UTEC said the following about the reasoning that ACSL had used in choosing to focus on their agricultural application: "it's one application… actually in the end. Because you know that focus is... so in my opinion the focus is the single weapon for startup companies. We need to fight with DJI, it is the world's biggest drone company. It is impossible to fight with multiple aspects, so we need to focus on a single one." This statement is in opposition to traditional OM literature that advises companies to hold options and flexibility open as long as possible. The reasoning may hold true for a large manufacturer such as Toyota, but is hard to implement for a resource-constrained startup company.

Our empirics indicate that startups that do well converge as soon as possible but do so after they have reduced the uncertainty about whether or not the product will fit the market in a manner that is as cost-effective as possible. The tactic that, from our empirics, seems most useful for reducing uncertainty and converging on the right idea to implement is in talking to customers. We saw this manifest in a few different ways:

- **The founders of KUFU said: "We interviewed with my friends... I have friends who are CEO's. So I ask them is this a problem for you? Is this also your problem? Ask, ask, ask!" This allowed the founders to see if the idea they contemplated working on was something their target audience wanted to have solved. They also highlighted the importance of the questions being open, so that they could avoid steering the interviewee too much. They saw interviewing as a skill that could really help the company.**

- **At UTEC highlighted the importance of asking the question "what if X-feature existed?", and gauging the reaction to narrow down options.**

- **The founders of Coursebase used a strategy that secured them a deal with a large customer, in exchange for developing certain features: "our first client was Rakuten, and they basically said: 'if we had these features,' they'll start using Coursebase. So with our early clients we use to promise them features in exchange for contract and so let's say it's like December now, and by March we can have all these functionalities that they want ready so let's sign a contract upfront for that, and**

> **we'll develop it for you, everything. Then in March we'll release it, and they'll start using our kind of a very simple version of a platform, and they give more feedback and keep continue to develop and that has continued for five years."**

- **Mentors for incubator companies could have a significant impact, even though they were not the actual customer. For example, Okai-Ichi-Mun, the VR gaming company, got valuable feedback from a mentor and investor: "so this investor was really excited to see their game, the prototype, but he kind of got disappointed. So the Okai-Ichi-Mun team decided to change everything."**

Apart from speaking to customers, companies converged on the idea they were going to pursue by considering general factors such as the market size, level of competition, technical viability and the potential profitability of the product. Companies that were further along in their development, such as Soracom, Wantedly, and Coursebase, tended to have a more structured approach to converging on the idea they would develop next. At Coursebase, a list of most requested features was continually kept. The highest priority ones were brought up for brainstorming of how the feature could be implemented. Wireframes of the user experience were created and tested internally. Once satisfied with the experience, a Minimum Viable Product was made for testing internally and with a limited set of clients. Once happy with the feature, it was finally released to all customers.

A method specific to incubator companies, which seemed to focus teams and speed up their convergence, was the use of the deadlines created by the demo-days that were scheduled as part of the program. Founders did not want to come up on stage with nothing to show, so they worked hard to converge on an idea as quickly as possible so they could commence implementation.

We see no clear difference in the behaviors that are deliberate and lead to mixed outcomes and behaviors that are deliberate and result in success. It seems that the experience of the founding team is more closely associated than behaviors when the deliberate approach is used.

5.2.3 Behaviors & Experience Behind the "Straight to Implementation" -pattern

5.2.3.1 Experience of Founding Teams Drive Behaviors

Of the companies that went straight to implementation and failed in the first cycle, a mix of experiences is represented in the founding teams. KUFU had a cross-functional team with a high technical ability to design SaaS-products but possibly lacking market experience. Coursebase had extensive business and finance experience from working in the finance industry, going through the flawed LMS systems first-hand. However, they lacked startup expertise in the first cycle. Qiita was started by a university student of engineering with a strong vision, but little or no experience with execution or business.

The companies going straight to development resulting in mixed outcomes were Qiita (second cycle) and Voyagin. Having gone through a failing first development cycle, Qiita's founders drew from this experience to develop the community sharing site forming the company's primary service. Voyagin's founders had experience from extensive traveling and technical backgrounds.

The two companies that went straight to implementation were both backed by extensive technical and business experience. The founders of Soracom have a background from Amazon Web Services with experience in technology and its market applications. The software security company at UTEC coupled technical know-how from academia with the business and strategic strength of the people at UTEC.

5.2.3.2 Behaviors Driving the "Straight to Implementation"-pattern

Naturally, this section lacks findings adhering to diverging and converging behaviors. John at Coursebase mentioned that "five years ago social was still kind of new and big, so our first approach was: can we introduce social features?", indicating some divergent thinking from the outset. However, this activity is seen as part of a thought process which in accordance with the instructions in section three do not affect the nature of the development pattern. Voyagin and Qiita were influenced by Airbnb and Quora respectively when deciding what to develop. Thus, taking influence from existing successful product

concepts (predominantly from Silicon Valley) was one driver behind going straight to implementation.

5.2.4 Sub-conclusion

The empirics show that when founding teams follow the "deliberate"-pattern, and have both market based experience and specific knowledge related to implementing the solution, they fare better than if they lack either market or implementation experience. If founders use the "jump to implementation"-pattern, and still reach success, it seems that it is often because they have extensive experience.

We have seen that the behaviors behind the "deliberate"-pattern are primarily focused around brainstorming when diverging, and around talking to customers when converging. When following the "jump to implementation"-pattern, founders have often copied an already successful product, which has seldom lead to success.

6 Discussion

In this section, we critique the findings of our study by looking at alternative explanations to patterns of divergence and convergence. We also discuss the explanatory power of our findings in terms of predicting both outcomes. Sources of error in monitoring are also addressed.

6.1 Alternative Explanations of Divergence & Convergence Patterns

Answering the call from Yin (2009) to meet one's findings with skepticism to strengthen a research study, the following section discusses alternative explanations for the divergence and convergence patterns identified by the empirical findings in the previous section.

6.1.1 Alternative A: Flawed Phase-review Framework of Development Process

Although the flexible analytical tool enabled us to disseminate several convergence patterns (cycles) in one end-to-end development path, there is a possibility that the framework is an inaccurate representation of the NPD process. For example, the discontinuity of "ideas" made in the framework (observable transactions) can be burdensome thanks to the abstract nature of ideas. This is especially relevant in the "straight to implementation" pattern

where one could argue that developers always consider more than one idea, only that it occupies a microscopic time slot and happens as a thought processes in the heads of the founders.

6.1.2 Alternative B: Overly Simplified Representation of Development Patterns

Another possible source of error is that the findings of divergence and convergence patterns aided by the analytical tool lead to the construction of overly simplified patterns. Although the graphical interview tool was generally accepted and well understood. Inevitably, some amount of simplification will have to be accepted to be able to study a subject from a new and different angle.

6.2 Explanatory Power of Convergence & Divergence Patterns on Outcomes

When connecting certain patterns of divergence and convergence to affiliated outcomes, it is of importance to be mindful of the possibility that patterns of divergence and convergence have little say in actual outcomes. This potential lack of causality is addressed by the author's treatment of findings in terms of "association" with certain patterns rather than the actual effect of patterns. This latter claim is left for further research. The associations of outcomes with divergence and convergence patterns were strengthened by carefully following the interviewees' line of reasoning when mentioning outcomes in accordance with their previous development actions. Thus, the identified development patterns are considered weak regarding their power to explain the effect of on outcomes, yet the validated outcome associations form the basis for further research.

There is also the possibility that the lens of divergence and convergence through which we have chosen to study development processes leaves out more important factors that could affect outcomes to a greater degree. Such factors could include what happens after the convergence phase, namely the implementation phase. This opens an avenue for further research.

It is also possible that behaviors the companies display after the launch of the product contribute to their outcomes. For example, Wantedly had a product that had the potential to be successful but was not: "it was beautiful, it was absolutely amazing you can still

download it from four years ago and look at it and say it's the most beautiful news app we've ever seen. However, we have close to no users on that because we never marketed it." Actions such as these are not strictly part of the new product development process but affect its outcomes nevertheless.

6.3 Sources of Error in Monitoring Experience and Behavioral Patterns

6.3.1 Alternative 1: Incorrect Interpretations of Empirical Data

Although methodological measures to mitigate this source of error are in place, making inferences about the causality of behaviors and people's experience to certain process patterns is associated with the risk of drawing false conclusions. This is especially apparent given the restricted reach of the thesis. Thus, the limited opportunity for thick, longitudinal studies of process patterns in line with those of MIRP (Van De Ven et al.) should be taken into consideration.

6.3.2 Alternative 2: People are Forgetful

An important source of error to consider when conducting a qualitative case study in line with this one is that descriptions of events are rendered through the prism of people's perceptions. Hence, there is a possibility that the data does not reflect the actual sequences of events because of respondent subjectivity or lack of recollection. An alternative way to mitigate this would be to study the processes in real time. However, the possible risk of getting an inaccurate take on what happened is made up by the advantage of retrospectively studying cases to get the "big picture" of the whole development process (Van de Ven, 2007).

7 Conclusion

In this concluding section, we first highlight general conclusions that can be drawn from analyzing the empirical data. We then highlight principles that managerial teams can keep in mind when conducting their new product development processes. Finally, we propose areas where further research could lead to interesting findings.

7.1 General Conclusion

In this case study, we have researched the divergence and convergence patterns within several Japanese startup companies. Answering our first research question, "what patterns of divergence and convergence can be found within the startups we study, and with what outcomes are they associated?", we have found that a "deliberate" pattern of divergence and convergence is associated with success in the context we have studied, while a "straight to implementation"-pattern is associated with failure. In many cases, founding teams followed the latter pattern when trying to copy a product or service they had seen elsewhere.

Answering our second research question, "what type of experience do founding teams have, and what behaviors and reasoning do they display in leading divergence and convergence within their companies?", we find that founding teams with both market and area specific implementation experience are more successful than teams that lack either market or specific implementation experience. The most typical divergence behavior is brainstorming inspired by customers, competition, metrics, and other companies in similar situations. When converging, the most important behavior appears to be speaking to customers to verify that they desire the product or service. Considering competition, the potential profit margin, and what is technically feasible also plays a part in choosing what idea to converge on.

7.2 Managerial Implications

Based on the findings in this study, founding teams should keep the following points in mind when starting a product development processes:

- Do not be tempted to skip the divergence and convergence stages. Going through any process of divergence and convergence early on is better than developing an idea for a long time, and only finding out when it fails in the market that it was no good.
- Do not be lured to skip the divergence and convergence stages just because there is a product elsewhere that is successful. Simply copying seldom works. The idea needs to be adapted and developed to work.
- Talk to customers to both get ideas for how things can be implemented, and for validating if an idea is useful. Listen, and do not fall in love with your idea.

7.3 Further Research Directions

The framework of divergence and convergence, and the behaviors associated with it could be applied to a wider set of contexts. More startups could be studied, in a wider array of industries and regions. Such research has the possibility of proving cause and effect relationships, where this research merely uncovers associations between factors. If applied in multiple regions and contexts, the framework could add new insight in contrasting and comparing startup companies.

The framework could also be used in combination with quantitative analysis, to for example see if certain experience and behaviors can be predictive of financial success.

Opening up for research in other phases of the product development process, such as the implementation phase and post-launch phase could provide further insights.

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9 Appendix

9.1 List of Interviews

Institution (other companies covered)	Interviewee	Interview date	Description
Coursebase	**John Martyn** *Co-founder Co-CEO*	**April 5, 2017**	**HR (LMS) SaaS services**
Soracom (Enerbrain)	**Alexis Susset** *Technology Director & Evangelist*	**April 13, 2017**	**IoT platform.**
KUFU	**Kensuke Naito** *Development Manager*	**March 23, 2017**	**HR SaaS services.**
Qiita	**Takuya Oikawa** *Product Manager*	**March 27, 2017**	**Knowledge sharing and internal communication platform for developers.**
Tokyo VR Startups (Cover, Gatari, Holo Eyes, IcARus, Ouka-Ichi-Mon & Yomuneco)	**Nayoa Koji,** *Producer*	**April 4, 2017**	**Incubator focused on VR startups.**
UTEC (ACSL, Security Company)	**Noriaki Sakamoto** *Principal*	**April 17, 2017**	**Incubator and venture capital firm of University of Tokyo.**
Voyagin	**Masashi Takahashi** *Founder*	**March 29, 2017**	**Tourism services web-based platform.**
Wantedly	**Lisa Wäntig** *Global business development/ international growth*	**March 27, 2017**	**HR one-stop shop job searching and social media platform.**

9.2 Questionnaire

Questions for companies:

- **Development process**
  - **Can you describe/walk us through your current product development process from idea to launch?**
  - **Do you have a formalized process? If so, what are the components? (i.e different stages)**
  - **What are/were the biggest challenges in developing the product? How were these challenges managed?**
  - **What stage of the development process required most resources (time, money, information)?**
  - **Have you had other products/ideas in development? (different product same market, different product different market etc)**
  - **How did that development process compare to your current one? (also in terms of success)**
- **Timing**
  - **When was the idea for the product/feature first thought of?**
  - **When was the completed product launched?**
  - **Did you set any deadlines or stage gates during the process?**
- **Uncertainty**
  - **How did you know if you should close down an option or not? What criteria were used?**
  - **What kind of information did you seek to obtain in the different stages of the development process?**
- **Options (concepts/prototypes/ideas/choices)**
  - **How many different options were considered throughout the development process?**
  - **How many different options were considered at the start of the project?**
  - **How many different options were considered at the first quartile of the project?**

  - **How many different options were considered at the midpoint of the project?**
  - **How many different options were considered at the third quartile of the project?**
  - **When was it determined that the option that was launched would be the main one?**
- **Success**
  - **Was the process successful or unsuccessful?**
  - **Why do you think it was successful or unsuccessful?**
  - **What would you change about the process?**
  - **Would you close down options earlier or later?**
- **About company/product**
  - **What is the general business idea?**
  - **How long has the company existed?**
  - **Age, team and competency composition throughout the time of the company's existence**
  - **What is your main product that has been released?**
  - **Is it released continuously or at a specified launch date?**
  - **In what stage of development and release are you right now?**
  - **What is your strategic position right now? How does your product compare to competitors? Better/worse performance?**

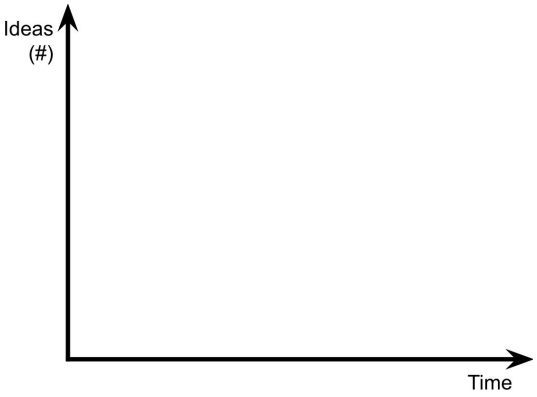
End by describing their process as we have understood it to merge with their understanding for validity.

Questions for incubators/industry experts:

- **About company/product**
- **Do you have a formalized process?**
- **Can you describe what you do as an organization and individual?**
- **What type of startups do you work with (age, industry)?**
- **Appr. how many startup companies have you worked with?**

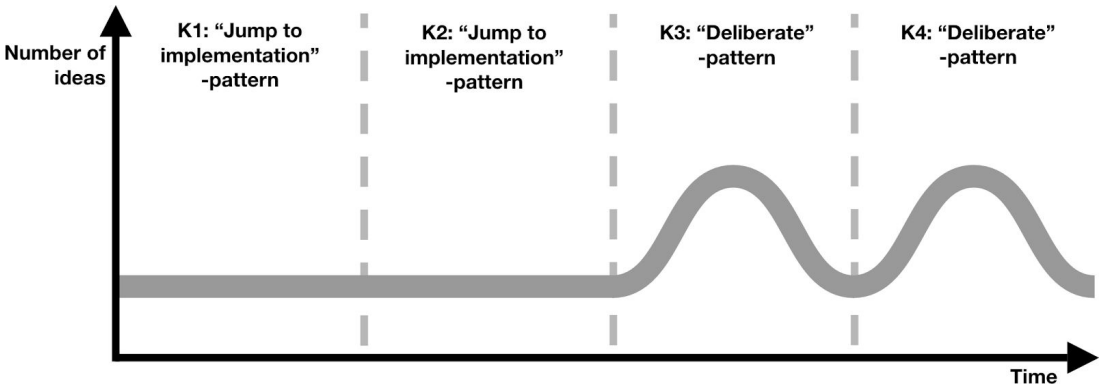
9.3 Self-Completion Graph

Number of ideas over time.



9.4 Sample of Completed Self-Completion Graph

Completed Self-Completion graph for KUFU. Dotted lines show where disassembly into separate development cycles was done for further analysis.

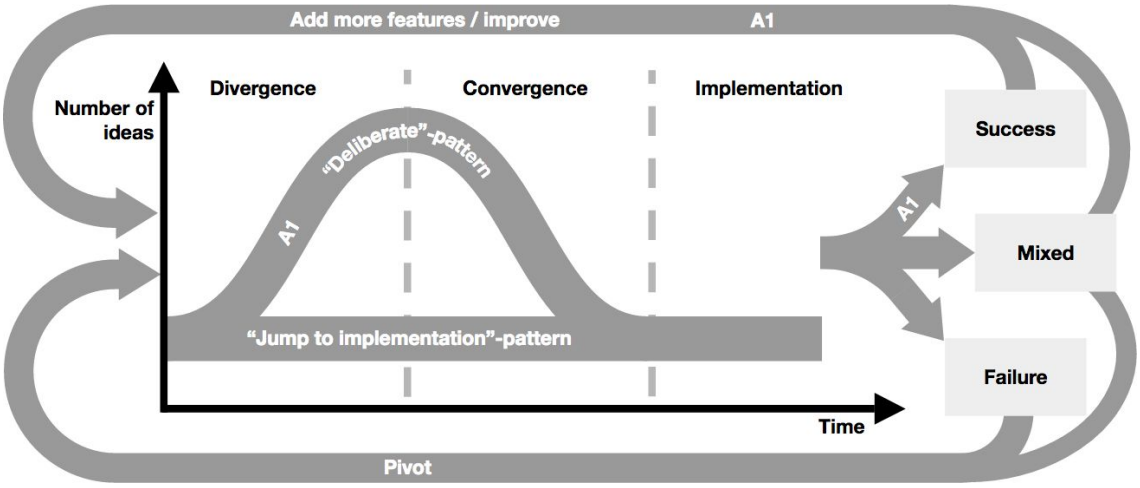


9.5 Codes for Different Companies

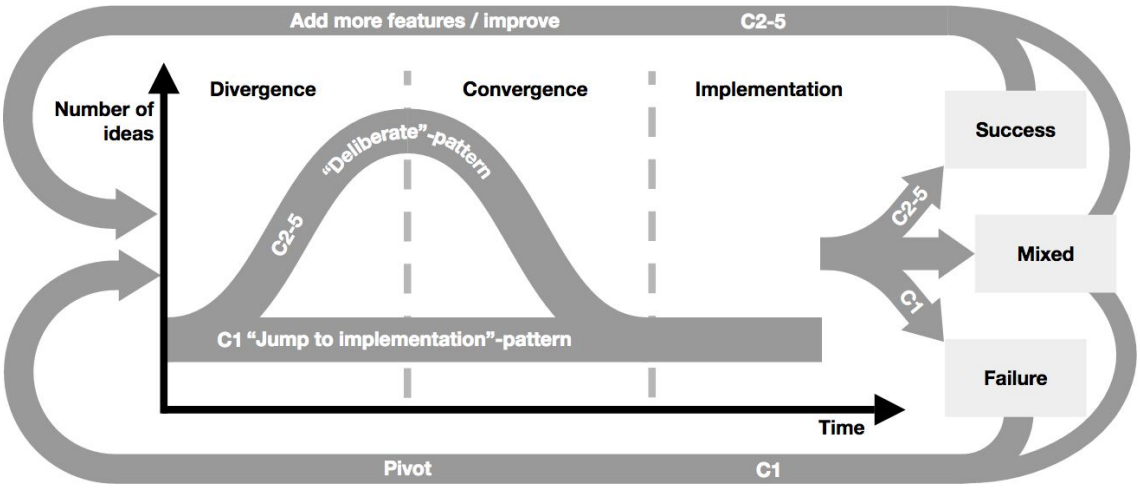
Code	Company name
A	ACSL
C	Coursebase
E	Enerbrain
G	Gatari
H	Holo Eyes
I	IcARus
K	KUFU
O	Ouka-Ichi-Mon
P	Cover
Q	Qiita
S	Soracom
U	UTEC Security Company
V	Voyagin
W	Wantedly
Y	Yomuneco

9.6 Empirics Translated Into Analytical Tool

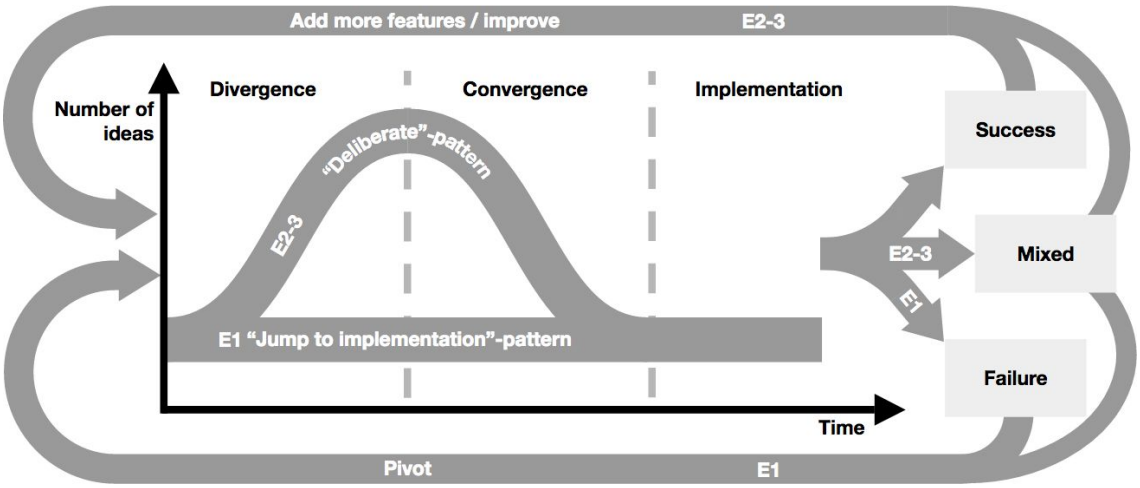
ACSL.



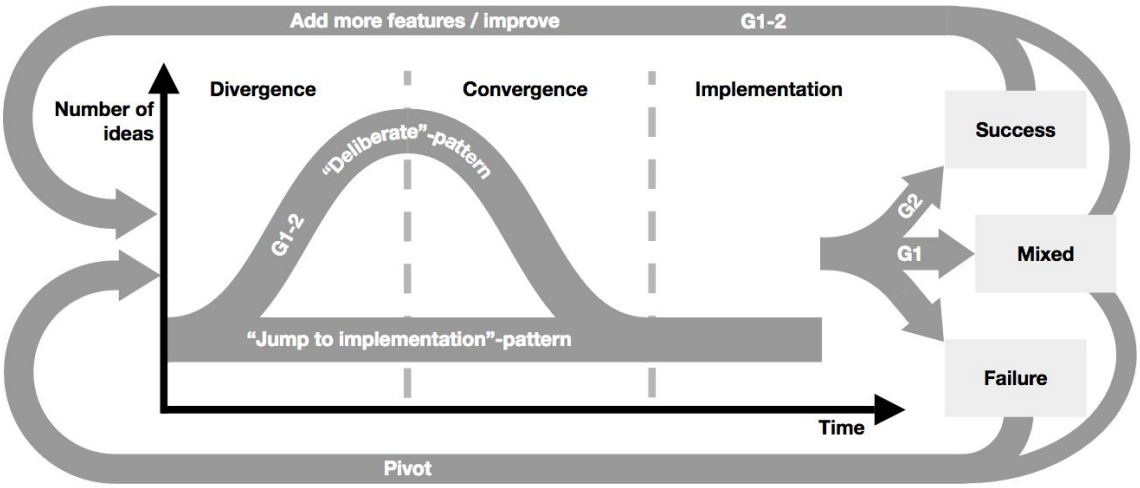
Coursebase.



Enerbrain



Gatari.



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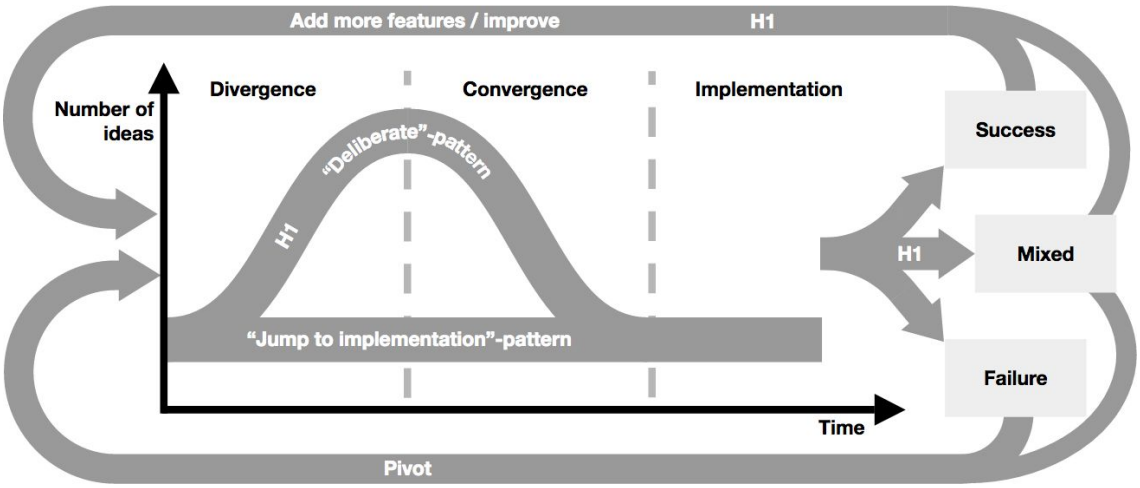

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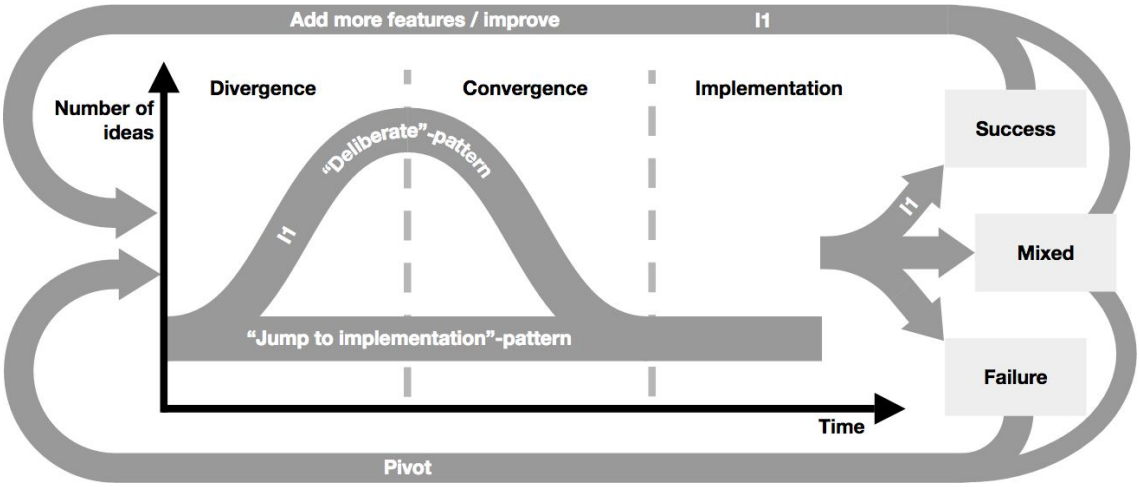

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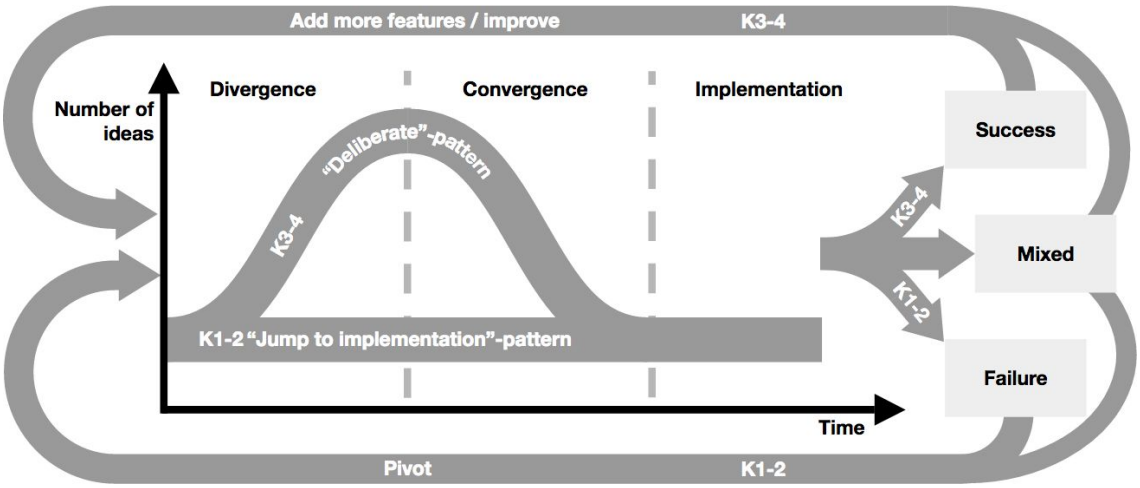

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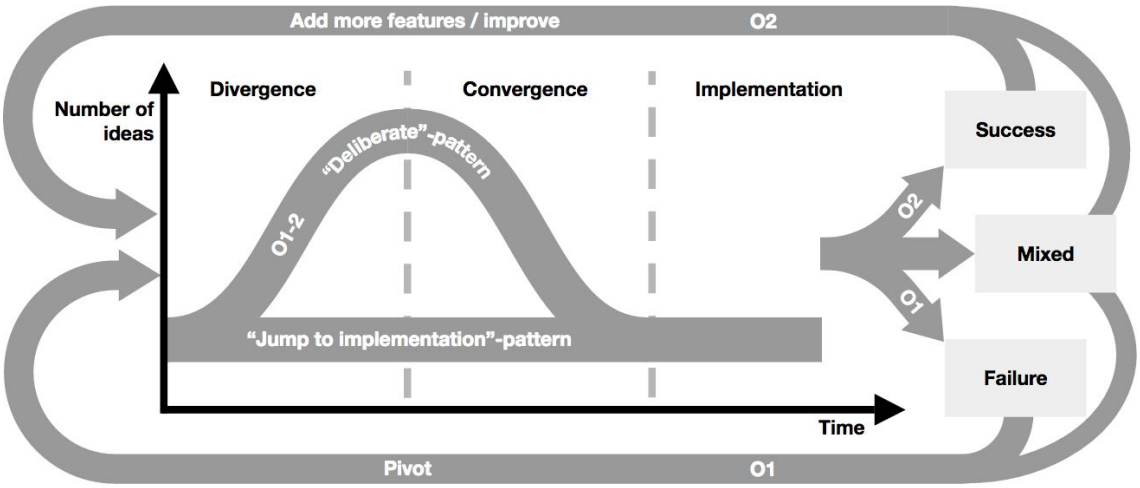

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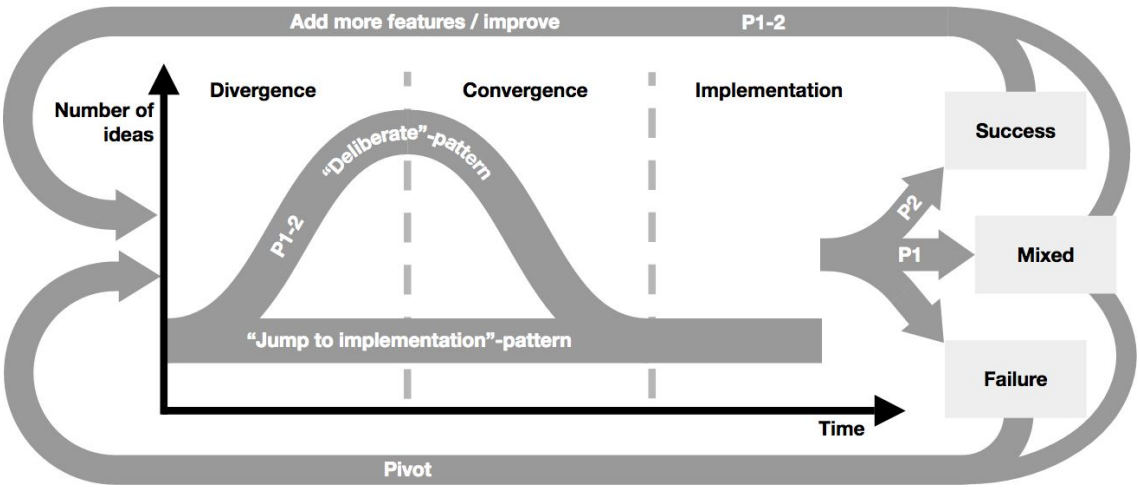

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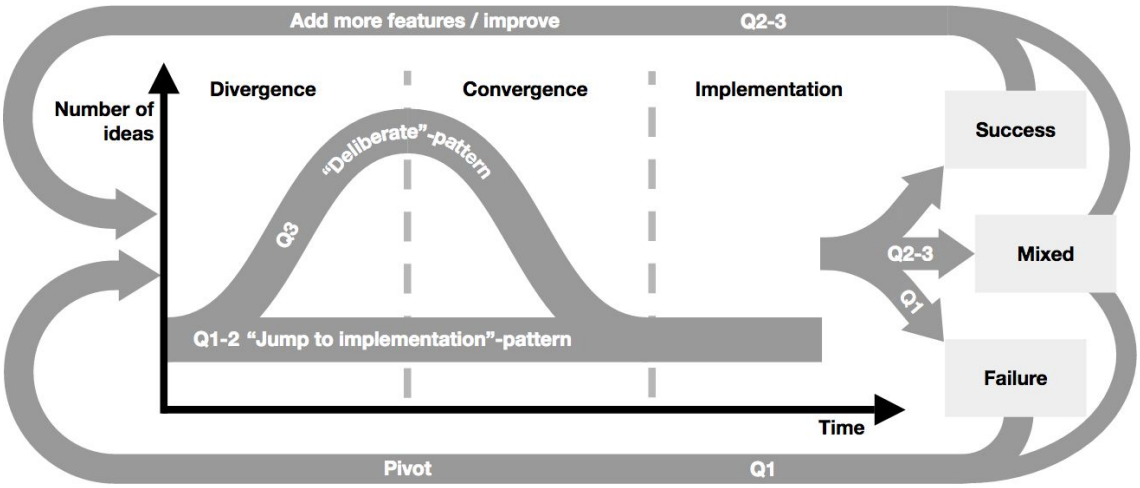

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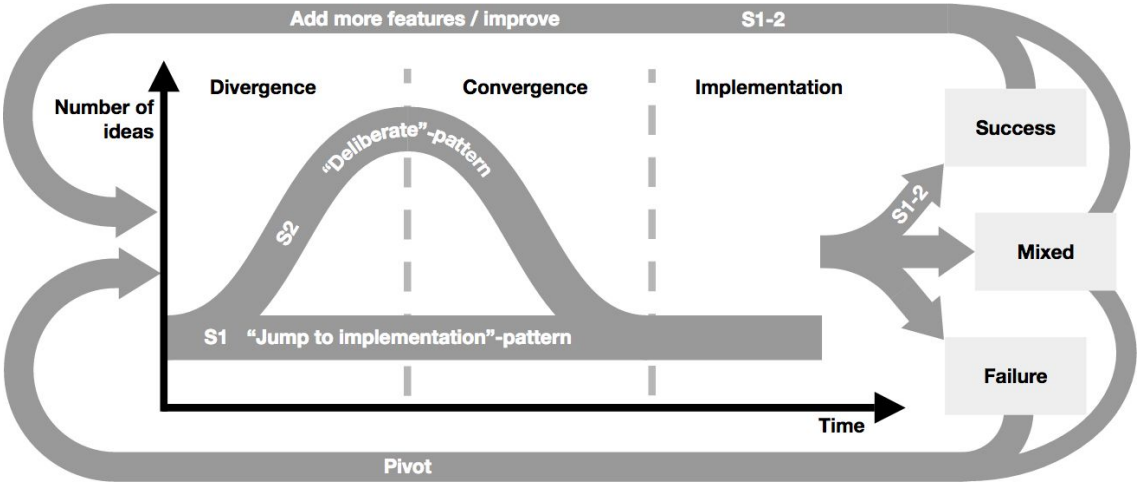
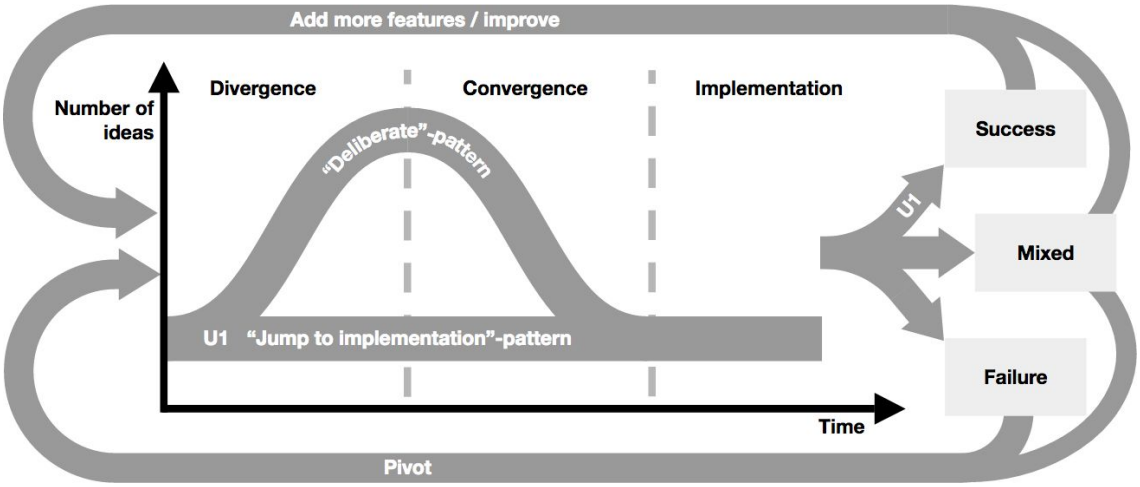


UTEC Security Company.



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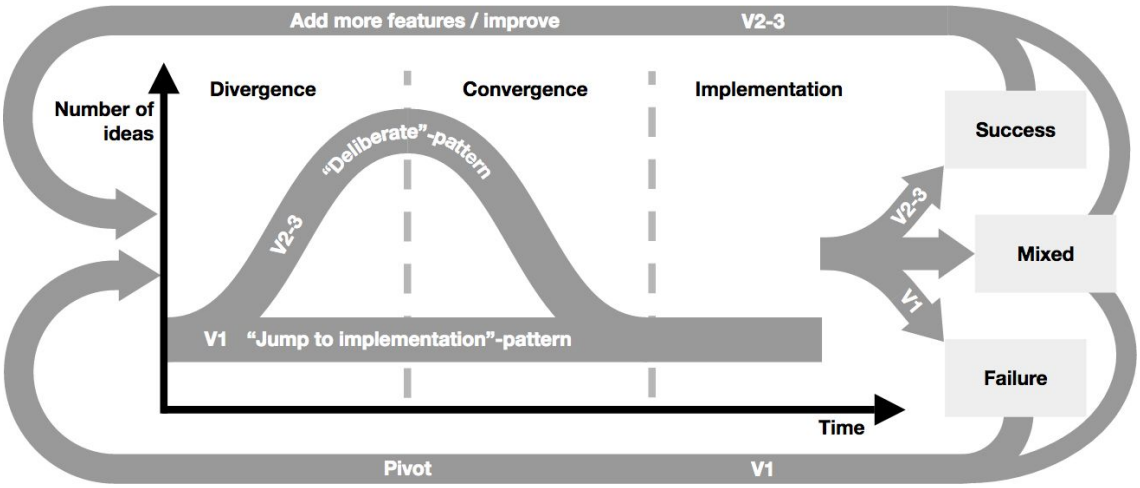

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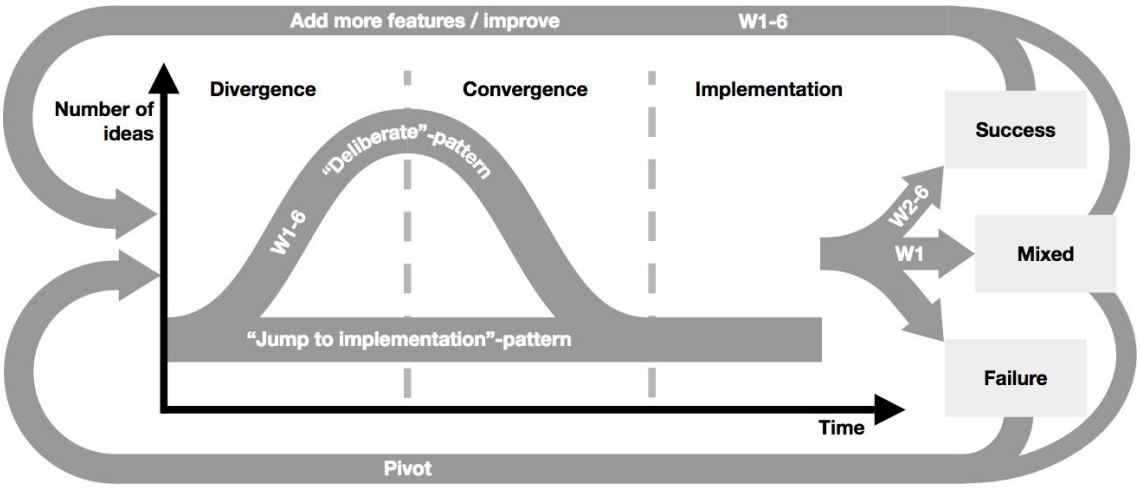

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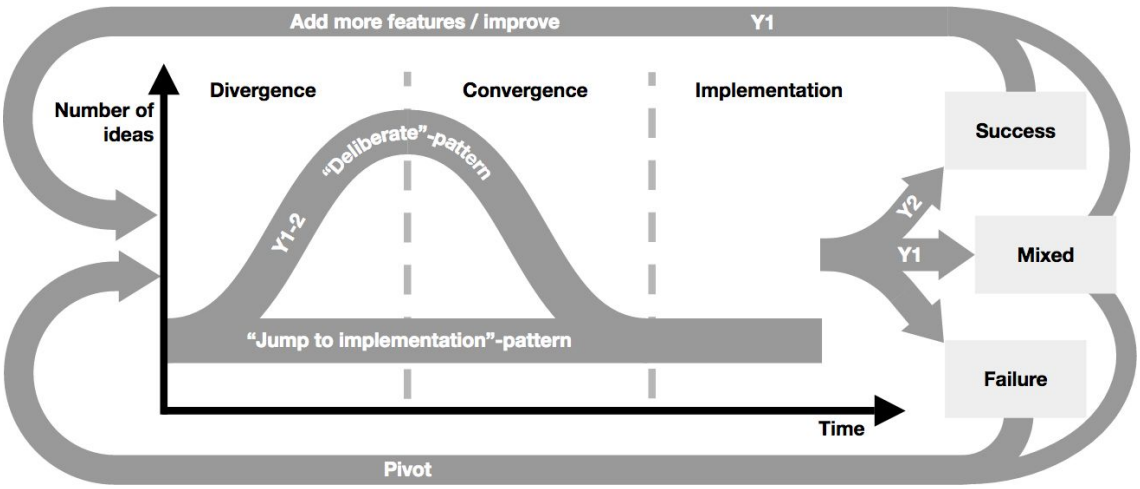

9.7 Tabulation of Different Pattern-Outcome Paths

Possible patterns. Letters correspond to company code; numbers correspond to number in sequence of development cycles.

	No	**Deliberate**
Fail	**C1, E1, K1 & K2, Q1**	
Mixed	**Q2, V1**	**E2 & E3, G1, H1, O1, P1, Q3, W1, Y1**
Success	**S1, U1**	**A1, C2-C5, G2, I1, K3 & K4, O2, P2, S2, V2-V3, W2-W6, Y2**