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The power of failure to ignite sensemaking and problem setting

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Abstract

The starting premise for our research was driven by what we saw as an understudied link between the role of failure and problem representation in driving strategic redirection and innovation. Using comparative case studies we set out to understand: (1) how do problem representations come to be changed as a result of failure and (2) how does failure trigger a rethinking of a previously implemented strategy? Our findings show that it takes a specific kind of failure for problem representations to come to be changed, and that the revised problem representations are a result of a sensemaking process which is both retrospective and prospective. We call this kind of failure pivotal. We describe the key characteristics of pivotal failure, and describe conditions that facilitate or hinder its power to drive needed redirection.

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Abstract:

Using comparative case studies, we explore the link between the power of failure and sensemaking, as well as their relationship to innovation. Our data analysis shows that pivotal failure – the kind of failure that causes project teams to return to the drawing board to reassess their understanding of the problem, leading to a change in core assumptions and consequently in strategic direction - is the needed trigger for sensemaking and the problem setting process. The conditions that increase the likelihood for a failure to become pivotal are also examined.

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INTRODUCTION

Organizations are adept at problem solving, and they will seek to solve problems in the most efficient way by referencing past experience that is engrained in rules, norms, and standard operating procedures (Cyert & March, 1992; Gavetti, Greve, Levinthal, & Ocasio, 2012). Organizations, and people in organizations, do not typically engage in sensemaking of their own volition. Sensemaking, and the cognitive shifts that it entails, is arduous for most (Weick, 1995). It requires getting out of the comfort zone of the status quo. Only those who innately thrive on ambiguity and divergence may find this fun! These are the creatives and the artists, but typically organizations are not made up of many of these people, and most organizational environments do not nurture such qualities, nor should they, in most organizational settings and situations. However, in a world where sustainable competitive advantage cannot be guaranteed, and competitive advantages are instead transient (McGrath, 2013), continual innovation is crucial. Innovation requires a deliberate break from the status quo and, as such, sensemaking and cognitive shifts.

In spite of the pressing need for continual innovation, organizational inertia (Tripsas & Gavetti, 2000) is such that even a firm call for innovation is insufficient to drive the sensemaking that innovation requires. The power of organizational inertia is particularly pronounced in extremely consensus-driven organizations. As a result, a forceful trigger is needed. We suggest that the most powerful trigger of all is failure. In the face of failure, there is little choice but to question pre-established assumptions. Failure is perhaps the most powerful force to kick into gear the required cognitive shifts and sensemaking needed to resurrect an innovation from failure and turn it into a success.

Cognitive shifts and sensemaking happen at an individual level and at the team level. In order for them to happen at the team level, however, a deliberate process that tries to

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reconceive the problem from various perspectives and define it in various alternatives is needed. This is where problem setting comes in. Problem setting is defined as “a process in which, interactively, we *name* the things we will attend and *frame* the context in which we will attend to them” (Schön, 1983, p. 40). Although the phenomenon is written about under various terms that are used almost interchangeably in the literature, such as problem formulation, problem definition, and problem discovery, to name a few, it is a topic of interest in the management strategy, organizational behavior, operations research, and creativity literatures. In spite of the fact that we have not arrived at a singular understanding of the phenomena of the problem setting, each stream of literature expounds its importance to innovation, or to assuring that the right problem is solved.

In this paper we seek to expose an understudied link between the power of failure and sensemaking, and their relationship to innovation. We suggest further that a deliberate process of problem setting is needed at the team level for the kind of sensemaking that will drive successful innovation to fruition. The premise is that organizational inertia is a force that imparts its power too forcefully on the individual, and that a team level process is needed to overcome it. We have undertaken a preliminary and exploratory field work in the form of cases studies, and our tentative analysis shows that in highly consensus-driven organizations in particular, *pivotal failure* is the needed trigger for a *spontaneous* process of problem setting to be initiated that allows the team to engage in a *deliberate* process of problem setting. We will also identify the conditions that could increase the possibility of successful triggering. Together we believe that this is key to supporting the sensemaking and cognitive shifts required towards a successful innovation.

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FAILURE, SENSEMAKING AND PROBLEM SETTING IN INNOVATION

Although the link between sensemaking, problem solving and innovation is not always made explicit, the research literature on insight shows an effort in that endeavor, noting in particular the importance of changing the problem representation in order to overcome what are known as impasses (Knoblich, Ohlsson, Haider, & Rhenius, 1999). By doing so, an insightful way of problem solving can be devised, and by extension innovation can be created. Further, Wallinga (2010) asserts that “a certain level of failure seems to be necessary before solvers are willing to move on or release a strategy that was not productive” (Walinga, 2010, p.159). However, it is not clear from these studies how exactly problem representations come to be changed, and how exactly a specific failure, not any failure, triggers a rethinking of a previously implemented strategy.

Failure is important for effective organizational learning and adaptation for several reasons. First, failure helps organizations to discover uncertainties which are difficult to predict in advance (Sitkin, 1992). Second, the experience of failure creates a learning readiness and motivation to adapt which could not be obtained under normal circumstances. Third, experiencing failure leads to risk-seeking behavior (Kahneman & Tversky, 1979) that increases the willingness of organizations to experiment when facing complex problems rather than choosing the safer route of risk avoidance. This willingness to learn by trial and error offers them the opportunity to practice solving problems, which may also be useful for future unforeseen problems. Last but not least, failure acts as a shock trigger to draw organizational attention to problems (Van de Ven, Polley, Garud, & Venkataraman, 2008) and to stimulate the search for potential solutions which can lead to innovation (Cyert & March, 1963).

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These potential benefits of failure are positively related to organizational innovation. For example, the willingness to experiment leads firms to explore new alternatives and thus come up with innovative solutions. Furthermore, failure helps the organization draw attention to previously overlooked problems and conflicting norms, thus challenging the current procedures and practices, which is an essential step in change and innovation. It is not entirely clear, however, how organizations develop those alternatives or challenge their own procedures and practices by re-conceiving problems.

The process of developing multiple alternatives, and the reconceiving of problems, is discussed in the literature in various guises. Within the management strategy literature it is referred to as problem formulation, problem diagnosing, and problem definition (Jackson, Yen, & Mahoney, 2012; Lyles & Mitroff, 1980; Smith, 1989; Volkema, 1986), whereas within the creativity literature it can be found referred to as problem discovery, problem finding, and problem construction (Csikszentmihalyi & Getzels, 1971; Csikszentmihalyi, 1990; Mumford, ReiterPalmon, & Redmond, 1994; ReiterPalmon, Mumford, Boes, & Runco, 1997). Although within each literature stream models have been suggested that describe the process, these largely correspond to the front-end of problem solving, meaning, they are described as processes that are set in motion when there is a problem, or when a problem must be found or defined, rather than as processes for responding to failure. Problem setting, defined by Donald Schön as “a process in which, interactively, we *name* the things we will attend and *frame* the context in which we will attend to them” (Schön, 1983, p. 40), is a term that is appropriate and extends the concept further because it implies (“interactively” and “we”) that it is a team level construct, and also suggests that the context is not given but must be framed.

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Framing is about how individuals make sense of the events that take place around them (Weick, 1995). While Isabella (1990) develops a model of how managers interpret and frame organizational events in response to change, the changes discussed are not necessarily failures. A model is therefore needed that demonstrates how individuals, and subsequently teams, make sense not only of changes around them, but also of extreme changes at the project level as embodied by failure. In addition, while Maitlis and Lawrence (2007) identify triggers for sensegiving and find that a “perception or anticipation of a sensemaking gap” is a “general condition that triggers sensegiving” (Maitlis & Lawrence, 2007, p.78), they do not explicitly name failure as a dimension of that condition. Finally, Weick, Sutcliffe, & Obstfeld (2005) assert that “sensemaking is about action” and that “so-called stimuli for action such as diagnoses, plans for implementation, and strategies are as much products of action as they are prods to action” (K. E. Weick, Sutcliffe, & Obstfeld, 2005, p. 412 & 419). We shall build on this by making the theoretical linkage that sensemaking itself is “a prod to action” that is triggered by failure, and a “product of action” where the action is problem setting.

Research Gap:

Having as a premise that triggering sensemaking and the cognitive shifts that come about as a result are the crux of learning and innovation, the research gap that we endeavor to fill is the link to the power of failure and the importance of a process of problem setting to drive that sensemaking.

We seek to answer the following questions: (1) How does failure serve as a trigger for sensemaking and problem setting process? (2) Under what conditions will failure be pivotal in igniting the process of problem setting / sensemaking?

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METHOD

Data collection

Given the nature of our inquiry and research questions our study approach entails multiple case studies (Yin, 2009). Our unit of analysis is completed innovation projects in which failure has occurred, and our preliminary sample contains four individual project case studies from three Norwegian firms. The three firms include one in the maritime sector, one in the industrial chemicals sector, and another in the plumbing and sanitary systems sector. Two projects pertain to this last company. Each case study entailed at least three semi-structured interviews of the primary team members, each lasting approximately sixty minutes.

Table 1. Summary of data collection

Project	Company	Number of Interviews		Type of interview	Other sources of data
			(Subjects)		
1	Balato	Maricom	5 (5)	In-person & phone-call	1 pdf document and 2 power point presentations
2	Catalo	Agricom	6 (5)	In-person & phone-call	12 pdf documents illustrating the progression of the projects
3	Vaculo	Sanicom	4 (4)	All video-call	Product catalogue
4	Perulo	Sanicom	5 (5)	All video-call	Product catalogue

Both first authors were present at all of the first round interviews. The second round interviews were conducted by one of the authors to clarify information that were not clear in

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the first round. In addition to the interviews, we were provided with documents that were either just descriptive or also explained the progression of the project, for each of the case study projects. In addition to the project-specific interviews, the authors had introductory meetings with representatives of each of the three companies prior to the start of any data collection.

Case selection:

We used replication logic (Yin, 2009) when choosing which innovation projects to study. To answer the first research question, “how failure triggers the sensemaking and problem setting process”, we chose two cases that predict similar results as a literal replication (Yin, 2009): Vaculo and Balato. The failures that happened in these two cases were followed by a sensemaking and problem setting process which resulted in changes of the companies’ strategic direction. To answer the second research question, “Under what conditions will failure be pivotal in igniting a spontaneous process of problem setting / sensemaking”, we compare those two cases with another two cases that have a contrasting result for anticipatable reasons to create a theoretical replication (Yin, 2009): Catalo and Perulo. In these cases many failures happened in the development of the project, however, there was no change in strategic direction because of a lack of sensemaking and problem setting processes.

Data analysis:

A brainstorming session by the authors of their first impressions of the field work and data collected resulted in agreement on a preliminary coding system for looking at the data more closely. We agreed that in all projects failures were a rather common occurrence, but that a certain type of failure was required to bring about sensemaking. The type of failure that we saw as triggering sensemaking (as evidenced by behaviors of spontaneous problem

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setting) was one which necessitated a change in framing and caused action to be taken. We call this pivotal failure, and from this we developed the according data relating to pivotal failure that will serve to study the data in a more focused way aimed at answering our research question.

Table 2. Main coding categories

Concepts / Constructs	Explanation (for coding)	Reference
Pivotal failure	Failure that changes the core assumption and the strategic direction	New construct
Sensemaking process	Interplay of interpretation and action	
Interpretation process	Includes: organizing flux, noticing and bracketing, labeling	
Organizing flux	Ongoing thoughts regarding what might have gone wrong	Weick et al (2005)
Noticing and bracketing	Realization of signs of trouble that occurred but does not yet have a name	
Labeling	Categorization of the experience in ways that suggest plausible acts of managing, coordinating, and distributing	
Problem setting	Action of a sensemaking process, including re-naming and re-framing activities	Schon (1983)

Other important concepts that emerge from our research questions are “sensemaking process” and “problem-setting process”. Referring to the extant literature, we build measures

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for these two constructs. The sensemaking process is about the interplay of two smaller categories: interpretation, which helps answer the question “what is going on here?”, and action, which helps answer the question “what do I do next?” (Weick et al, 2005). Problem setting, in our theoretical perspective, is the action part of the sensemaking process.

Interpretation is the core phenomenon while the problem-setting process (i.e. action) is the central focus (Lant, 2002; Laroche, 1995; Weick, 1993). Interpretation involves different activities: organizing flux, noticing and bracketing, retrospective labeling. The problem-setting process involves *re-naming* the things to attend to, and *re-framing* the context. These main coding categories are described in Table 2.

Our analytical strategy is to rely on the theoretical research questions, stemming from how and why, which is extremely useful in guiding case analysis (Yin, 2009). After coding the data into themes responding to the research questions, we conceptualize the process of sensemaking and problem setting that were triggered by the pivotal failure in the following parts.

HOW PIVOTAL FAILURE TRIGGERS SENSEMAKING PROCESS

Defining pivotal failure:

A preliminary analysis of the cases reveals that failures happen along the way of the projects, and that they are an effective source of learning for the project teams. However, only pivotal failures cause the project teams to return to the drawing board to regain an understanding of the problem. Based on data analysis and pattern matching, we define pivotal failure as a failure that helps change the core assumptions of the project teams about the problem, and thus initiates a change in strategic direction for the project. This change in direction decides the final outcome of the project, and the project’s outcome might lead to organizational learning and organization change.

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The innovation process is a nonlinear cycle of divergent and convergent activities that may repeat over time, and failure is an unavoidable by-product (Van de Ven et al., 2008). Failures, deviation from expected outcome, can happen many times during the process. Innovation teams use them to better understand the characteristic of the product or service, to transform tacit understanding of alternative conditions into explicit understanding, and to pursue possible actions afterwards (Van de Ven et al, 2008). Pivotal failures are different from normal failures in that they do not only help innovation teams understand the process but also serve as a trigger for changing the strategic direction of the project. The new strategic direction can be termination of the project or implementing a new approach that has never been considered before. Among the four projects, pivotal failures happened in only two projects, Vaculo and Balato. In the Vaculo project, the new product was launched in the market and received many complaints from customers as it stopped working after several uses. The innovation teams worked continuously to identify the problem and find solutions. They created a switch that can be plugged into the product to make it function properly. The switch became a great success and has been incorporated into new product lines for Sanicom. Thus, pivotal failure in this case is the failure of launching a new product. In the Balato project, the product was ordered by many customers although it was still in development. Maricom was the pioneer in the industry to develop such a product as a response to a future regulation change. The product passed the approval test of the industry regulatory association and was expected to be a success; however, it was stopped after 5 years of development. Pivotal failure happened when the project manager discovered that the product failed tests when performing in different conditions. He realized that the industry test was too easy and that passing this approval test did not guarantee the final performance of the product. After carefully analyzing pros and cons, Maricom decided to stop the project and accepted a huge financial loss. Yet it was not a total loss. The top management team returned to the drawing

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board, collecting all relevant information and analyzing why they failed and how such failure could be avoided in the future. Finally, they came up with a process model for innovation projects and applied it throughout the organization. This innovation process model was a great success and became a guideline for every innovation project at Maricom. Furthermore, at the industry level, this pivotal failure served as a wake-up call for the whole industry, alerting the industry regulatory body and all other players that the approval test was not designed well enough for such radical products. In the next part, we describe the process of how pivotal failure triggered sensemaking in the Vaculo project, the Balato project, and at Maricom. In the last case, the Balato project triggered a change in the organization's strategic direction and thus served as a pivotal failure for Maricom.

How pivotal failure triggers sensemaking/problem setting process

Sensemaking is the “process through which individuals work to understand novel, unexpected, or confusing events” (Maitlis & Christianson, 2014, p. 58). It is triggered by issues, events, or situations in which the meaning is ambiguous and/or the outcome is uncertain (Maitlis & Christianson, 2014). The process of sensemaking involves answering two questions: “What’s the story here?” and “now what should I do?” (Weick et al, 2005). Pivotal failure serves as a trigger for people to ask the first question about what is happening and how to interpret it. In particular, pivotal failure leads to three activities in which the first two activate the process of sensemaking and the third one is the result of sensemaking: Acknowledging, accepting & revising, and re-directing (Table 3)

Acknowledging:

Pivotal failure sends a clear signal to the project team that there is actually a problem. By acknowledging the problem, team members start to question themselves (“what is going on here?”) and begin to interpret the information related to the problem. Such questioning is

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the starting point of the sensemaking process. Without failure, team members would not recognize the error in their products and thus no sensemaking activities would happen.

In the Vaculo project, after selling 200 products, the service department received many complaints from angry customers since the product stopped working after a period of time. They repaired the product but the problem returned after two weeks. They tested the product in their factory and found the same problem. Then they went straight to the R&D department and told them about the product failure. Together, they figured out that the problem was that “we don’t have control over the pressure level. If the pressure is too low, the product stops working” (Interviewee 1).

In the Balato project, after outsourcing the technology to the third party, which got a successful approval test from the industry regulatory organization, the project manager was supposed to develop it into the final product. However, he recognized the problem: “This is wrong. We are missing something here” (Interviewee 2). The approval testing conditions were very limited and did not match the complicated conditions of actual use. After re-testing, the technological failure helped him to conclude that the product could not function properly in different conditions and that there were many weak points on the technical side of the system.

In Maricom as a company, the failure of the Balato project sent a message to the top management team that the market was not ready for such radical products in terms of technology and industry regulation. They acknowledged that “there was a judgment error” when investing in such products (Interviewee 3).

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Accepting and revising

After acknowledging the existence of a problem, innovation teams accept that their current solutions are not optimal due to wrong assumptions. By accepting that what they have done is not correct, they start searching for what the main cause is and which assumptions should be revised. They use retrospect to make sense of the puzzle (Weick et al, 2005) by organizing their flux of thoughts. Without accepting the faultiness of current solutions, they would not be able to challenge the core assumptions and revise them.

The Vaculo team accepted that “the pressure part was not well-done. The products don’t work properly” (Interviewee 4). After using the product for several weeks, the automatic pressure stopped functioning, which caused the product to malfunction. This was the first product of the automatic line, which was an innovation from the old manual product line. The Vaculo team found a new way to make the product automatically adjust the pressure according to the situation. Their core assumption was that the material tolerance would stay the same with the new solution. However, it seemed not to be the case. Without accepting that their new solution caused the trouble, they would not be able to figure out what went wrong.

The Balato team accepted that they quite underestimated the complexity of the technology. “We were blind. We trusted the supplier too much because they got the test approved” (Interviewee 5). The technology they got was working but not cost-efficient at all due to the complexity of the system. Their core assumption was that once the technology passed the industry approval test, it was good to go. However, real-life conditions were much more complicated than the test conditions. In order to satisfy the real-life conditions, they had to add more features and extra technologies that would become too costly for such a product.

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Maricom also accepted that this was the most expensive failure they had ever had. They assumed that the industry would apply new regulation in the near future since the regulatory organization had developed extensive guidelines for how to pass the approval test. They assumed that market demand was huge and by being a pioneer they could capture the first mover's advantage. Accepting that their judgment was wrong, they questioned themselves as to why they had held such assumptions for so many years and made enormous financial investments without realizing the problem earlier. They saw the need to revise their current resource allocation process and strategic decision-making.

Re-directing:

The main difference between normal failures and pivotal failures lies in the capacity of pivotal failures to cause a change in strategic direction. Once the core assumptions have been revised, the strategic direction changes accordingly. Normal failures help test assumptions in the innovation development process and increase learning incrementally. However, pivotal failures challenge the important assumptions that relate to the original strategy. This is the power of pivotal failures, and is a product of the interaction between interpretation and action in the sensemaking process (Weick et al, 2005).

The Vaculo group understood that their original solution strategy would affect the material tolerance that caused malfunctioning product. They needed to accept the nature of material tolerance and design a new solution that would solve the problem of pressure. More seriously, the Balato project manager refused to continue the project since it could only get worse. The core assumptions had changed to such an extent that pursuing the current strategic direction was now expected to result in more losses. Finally, they decided to stop the project despite extensive investment and compensation for early orders. The top management team at Maricom realized that their resource allocation strategy for innovation projects was

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Table 3: How pivotal failure triggers the sensemaking process

TRIGGERING EFFECTS OF PIVOTAL FAILURE			SENSEMAKING PROCESS			
Acknowledging	Accepting	Re-directing	Interpreting "what is happening?"		What's next?	
Acknowledge the problem and start interpreting what is happening	Accept that the current solutions are not optimal and revise original assumptions	Change the strategic direction based on the revised assumptions	Flux: Sensemaking starts with organizing flux	Noticing & Bracketing: Sensemaking starts with noticing and bracketing	Labeling: Sensemaking is about labeling	Problem-setting process
<p>We got complaints from customers. Many angry people.</p> <p>I came to do customer service, fixed the product and waited for 14 days. I came back again and tested it to understand the problem. I tried the product we had in the company and found the same problem. Then I went to the R&D department and told them.</p> <p>The problem was that we don't have control over the pressure level. If the pressure is too low, the product stops working.</p>	<p>We didn't get the pressure at the right place after a period of time using the product.</p> <p>The pressure part was not well done. The products don't work properly.</p>	<p>Prior to this, there was no way to automatically adjust the pressure in different conditions. It has to be done manually. We found the way to make it work automatically. However, we didn't notice the material tolerance was affected by our solution. Now we need to accept the tolerance issue and design a new solution to take care of it.</p>	<p>There were many parts that can go wrong. The system is complex. We tested our product very thoroughly, and it worked very well. It worked just as we expected, what as we hope, at the right level of pressure. We were confident, and put it into the market. Then we got complains from customer. We brought the technical part of the product back, and no it didn't work.</p>	<p>Then we realized that we have some of the valves in the products and they have different tolerances. We didn't see that actually. We didn't expect it. We didn't touch it. The tolerance difference is quite normal for the old product, but it created problem for the new product. Our design concept was not good enough. Bad construction.</p>	<p>We had to find a solution that copied the old system. We had to look into system and try to find out how we can copy it.</p>	<p>How can we copy the old system?</p>

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TRIGGERING EFFECTS OF PIVOTAL FAILURE			SENSEMAKING PROCESS			
Acknowledging	Accepting	Re-directing	Interpreting "what is happening?"		What's next?	
Acknowledge the problem and start interpreting what is happening	Accept that the current solutions are not optimal and revise original assumptions	Change the strategic direction based on the revised assumptions	Flux: Sensemaking starts with organizing flux	Noticing & Bracketing: Sensemaking starts with noticing and bracketing	Labeling: Sensemaking is about labeling	Problem-setting process
I said, "This is wrong. We're missing something here."	<p>Because we underestimated. I can say that, it was because we underestimated this totally.</p> <p>We were blind. There was not enough due diligence on the technical side. We trusted the supplier too much because they got the test approved.</p>	<p>I went to my boss, then to the top management team and said, "I cannot take on the responsibility anymore to develop this, because I know so much about the system now. If we continue, I think it will be a huge disaster. There will be 50 more contracts waiting for signing. They will just get worse."</p>	<p>That's just the test results of what you have, but how was the parameters set in the system? Was it full load or at low level? High temperature, low temperature?</p>	<p>We didn't know the limitation, the minimum, maximum flow, the temperature, the organic matters</p>	<p>I'm proud of making this. I created the categorization of testing conditions with different combination. This explains where the approval test conditions are and what other combinations are missing.</p>	<p>I raised a question, "What to do now?"</p>
The problem is that in different testing conditions, the product could not function as it performed in the approval test.	Of course, all of these technology that we have here, yes they're working, but the way they are installed and the combination of the system are not cost-efficient at all.	The challenges are not only for us, but they are what the whole industry is facing.	How did you set the control system to achieve that result? How much current did you need?			
A lot of weak points on the technical side of the system.		We are not mature yet, we need to really think about this and that, more and more.				

alato

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TRIGGERING EFFECTS OF PIVOTAL FAILURE			SENSEMAKING PROCESS			
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I think the main problem is that there was not yet the availability of technology or system in the whole industry for this.	I think this project is definitely the most significant and expensive failure we've had.	There is no real value to share this failure, but it is more worth sharing about the methodology and how you actually work with innovation projects	The project is so far away from the rest of the organization in day to day business. There is not really any value for us to share the lessons ... But there should be transparency. You can not sit in your desk and hide from your manager, your colleagues and try to do something that have a consequence to the company. You are more or less forced to share that with your colleagues and managers.	We were in lack of something. If there were specific criteria for each stage, we would probably go as far as we did.	Timeline depends on the category. If the projects are in category one and two, it is quite simple and you can bypass many stages. But if the project is in category three and four, we must deal with it in a rigid way. We need to see the complexity and how big the investment is.	We were lacking something. What would it be?
	We thought the industry regulation would come into force soon, yet it hasn't come yet, even until now.	The market is not there yet, and instead of being an early developer, it's better for us to wait				

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problematic and their innovation process suboptimal. They understood that they needed to change the routines for implementing innovation projects in the companies.

This re-directing stage is a product of the sensemaking process triggered by the acknowledging stage and the accepting stage. The sensemaking process was in the form of interpreting “what is happening?” This interpretation process is a combination of several activities: *organizing flux* of ongoing thoughts regarding what went wrong; *noticing and bracketing*, which refers to realizing the signs of trouble that occur; *labelling* - the process of categorizing the experience in order to suggest plausible acts of managing, coordination, and distribution (Weick et al, 2005). Details of the interpretation process at Vaculo, Balato and Maricom, which serves as a signal of the sensemaking process, are elaborated in Table 3. The result of the interpretation process is a change in core assumptions that leads to the third effect of pivotal failure: change (re-directing) of strategic direction. This change poses the second question in the sensemaking process, “what to do now?”, which lays the ground for the problem-setting process to happen. The process of how pivotal failure triggers sensemaking and problem setting are illustrated by the following framework (Figure 1).

In the Vacula project, the R&D team concluded that they needed to copy the mechanisms in the old system which pressure was activated manually by inserting a magnet switch in the new system. The magnet switch helped to activate the pressure automatically when needed. This solution came from reframing the old manual mechanism into new context which required automatic mechanism. The cognitive shift originated from the new framing and solutions emerged from formulating alternatives. In the Balato project, thing they needed to attend to changed from the completion time to the production feasibility, the context changed from managing production to managing company reputation. This cognitive shift brought up several alternative problem formulations. At the end, they chose to stop the project

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right away in order to prevent bigger loss in the future and preserve the trust of customers in the company who considers itself an honest solution provider. In Maricom company, thing they needed to attend to were not the project failure anymore, but how to filter the right initiatives. The context had changed from managing loss to creating a process model to prioritize the right initiatives and monitor the resource allocation. As a result, they came up with a new innovation process model that could be applied to all the projects inside company. Tremendous learning were derived from the whole sensemaking and problem setting process.

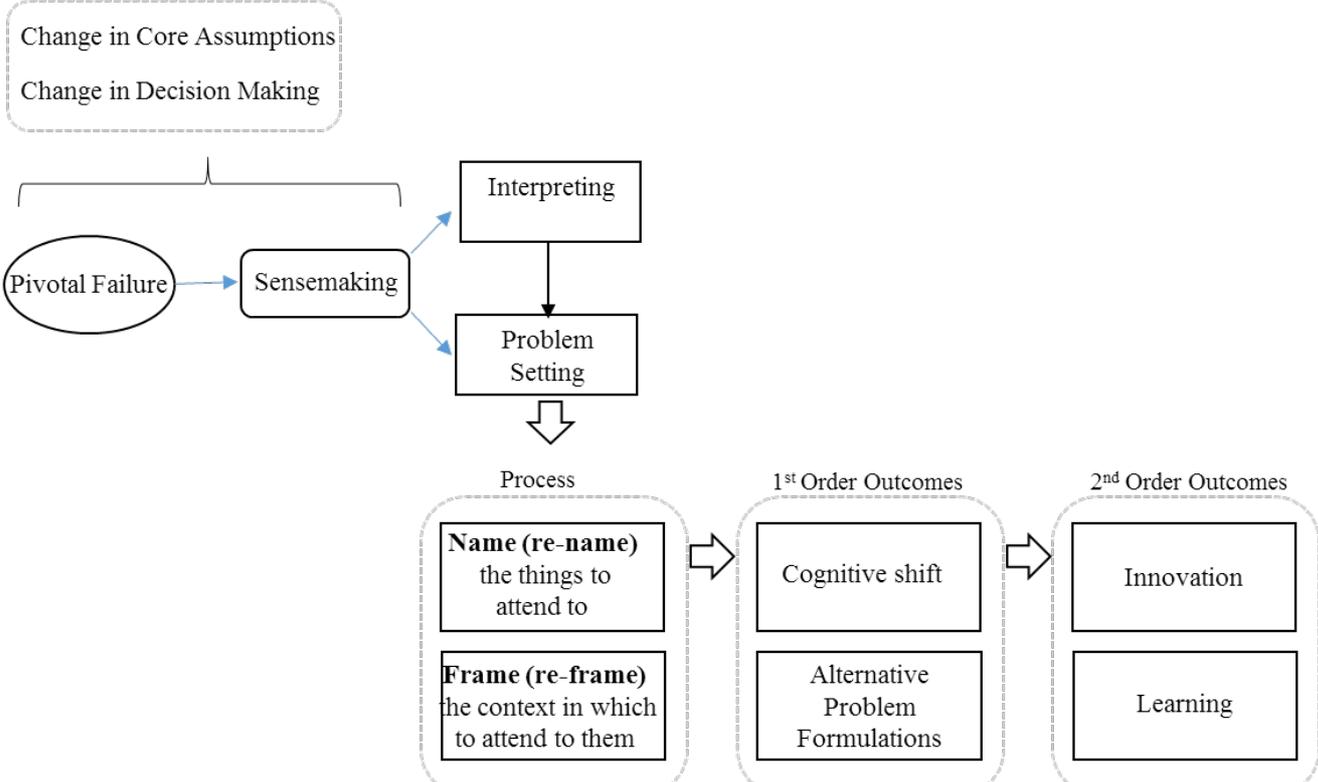


Figure 1. Pivotal Failure-Sensemaking Framework

CONDITIONS FOR A FAILURE TO BE PIVOTAL

To identify under which conditions failures become pivotal in our cases, we compare two sets of cases: one set with pivotal failure (group 1) and one without (group 2). Our first step is identifying the key factors involved in the triggering process in group 1. Next, we search for those key factors to see whether they are present in group 2. The second step is looking for constraints that impede the sensemaking and problem-setting process in group 2. Then we check if these constraints exist in group 1. By comparing group 1 and group 2, we hypothesize the conditions that make a specific failure become pivotal.

Before comparing, we briefly describe the cases in group 2: Catalo and Perulo. Catalo is an innovative project aimed at designing a whole system solution for dealing with air pollutants. The project group includes members from three different parts of the company: business, R&D and innovation. Catalo's innovation concept is business-driven and requires a complex technology that has not been available before in the market. Due to this technological complexity, several setbacks occurred along the way. In addition, the targeted market was changed by the business side, resulting in a change in the project scope, which complicated the technology development even more. The composition of the team also changed for various reasons. As a result, Catalo has been in development longer than expected. After four years, the technology was successfully developed; however, the project has not been commercialized since the business opportunity is no longer as attractive as it was initially. The Perulo project is another innovative project aimed at designing a new sanitary product system combining exclusive design, attractive styling, low noise and easy functionality. The system involves several new technologies that require major investment. The project has been running for almost ten years but has not been able to deliver a product that satisfies the original objectives. The developed products have been plagued by technical issues that are costly to fix.

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After coding and comparing, we describe two groups of factors that create the conditions for a failure to be pivotal. Success factors are present in group 1 but lacking in group 2. Barrier factors exist within group 2 but are resolved or absent in group 1.

Success factors:

Innovation champion: Champions are important for (Day, 1994; Howell, 2005; Kelley & Lee, 2010) as they have the capability to materialize their ideas. The project managers in both Vaculo and Balato spent extensive time studying the complicated problem and searching for potential solutions. They had a deep understanding of the technology and dedicated their time and effort to solving the puzzle. To reach their objective, they were willing to confront the organization's resistance and accept the associated risks, a characteristic of innovation champions (Burgelman & Sayles, 1986; Howell, 2005). The Balato project manager knew he would face resistance when trying to persuade the senior management team to stop the project because of the enormous cost associated with cancelling the early order. Yet he believed it was the right thing to do and that it would preserve the company's reputation and the trust of its customers.

Therefore, we hypothesize that: *The greater the involvement of innovation champions, the more likely it is that a failure can become pivotal and trigger the sensemaking process* (H1).

Involvement of top management team: The influence of the top management team (TMT) on firm performance has been studied extensively in management literature (Certo, Lester, Dalton, & Dalton, 2006; Hambrick, 2007), which is largely based on upper echelons theory (Hambrick & Mason, 1984). This body of literature explains how characteristics the TMT explain the way organizations perform, or put another way, an organization is a reflection of its top managers (Hambrick & Mason, 1984). The involvement of TMT in innovation strategies is critical (Talke, Salomo, & Kock, 2011). TMT provides the direction

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for new product development and the innovation implementation process (Elenkov, Judge, & Wright, 2005; Harmancioglu, Grinstein, & Goldman, 2010; Yadav, Prabhu, & Chandy, 2007). In the Vaculo project, the vice president of R&D actively involved in the brainstorming process and problem solving stage. In the Balato project, the top management team keenly examined all the pros and cons of continuing or stopping the project. In Maricom, the CEO and senior managers had several meetings to discuss what the organization had to do in order to prevent such failures from happening in the future. They came up with a model for prioritizing innovation projects and for managing the innovation process. This model was a product of TMT involvement in analyzing failure and learning from it. In the Perulo case, the project was supported by TMT, but in a different way. TMT was not interested in analyzing the difficulties and challenges happening to the project; they simply ordered the team to continue the project because it was considered a symbol for the company. They did not consider the implication of failure and thus were not involved in the solution searching process.

H2: The greater the involvement of TMT in analyzing failure and generalizing the lessons, the more likely it is that a failure can become pivotal and trigger the sensemaking process.

Barriers:

Inability to define the outcome as success or failure

In both the Catalo and Perulo projects, there were mixed answers to the question of whether they considered the project a success or a failure. The Catalo team said: “I would say that it is close to 100% successful in terms of technical performance. Yet what seems to be happening now is that this business is being hit a little bit by the prices falling. That the margins are not as attractive as they looked a few years ago. So, businesswise, I don’t know”.

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They are uncertain in their interpretation of the outcome of the project even though it has been put on hold for a year. The Catalo team has no clear conclusion and does not take action to change the status quo. The Perulo team responded: “I think the product itself will be a success. But you consider (the effort for) research they spent here and the time, it is a terrible project”. They accepted that the final product might be successful, but everyone in the team expressed negative emotions toward the project: “For me, it's a never-ending story. This is really not good for me”, “I wish that I had stopped this project four years ago”, “They are still bleeding money”.

Thus, the core assumptions and the strategic direction are kept unchanged in both cases as a result of the inability to draw a conclusion about the project outcome. The final decision-makers - the project manager in the Catalo case, who belongs to the business side, and the CEO of Sanicom in the Perulo case – made no announcement about the ultimate status of the project. Instead, ambiguity prevailed regarding the attitude of the final decision-makers toward the project. The ambiguity prevents the team from explicitly announcing, “This is a failure. We need to do something about it. What has happened and what should we do now?”

H3: The more explicitly a failure is accepted, the more likely it is that the failure can become pivotal and trigger the sensemaking process.

Lack of project evaluation

Project evaluation is a key tool for project management. It comprises three types: (1) pre-project evaluation to choose the project that is best suited to the overall strategy of the company; (2) ongoing evaluation during the project life cycle; (3) post-project evaluation to assess the completed project, and especially to develop a profile of lessons learned that can help the managers of other projects in the organization (Cleland, 1985). The Balato project

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and Maricom had conducted the project evaluation process thoroughly, and the reports were very well documented. In the reports, objectives and desired outputs as well as rules of play were described carefully and logically. The lessons learned were comprehensively identified, with conclusions about strengths and weaknesses, what to repeat and what to improve. There was not such effort in the Perulo project as far as we can observe. The Catalo project was well evaluated during the process, however, there was no update on the market conditions and no according revision of strategy. As a result, core assumptions regarding feasibility (Perulo) and clients (Catalo) were kept intact. Thus there was no trigger for a sensemaking process and consequently the strategic directions were untouched.

H4: The more thoroughly the project evaluation is conducted, the more likely it is that a failure can become pivotal and trigger the sensemaking process.

DISCUSSION

Our study contributes to organizational behavior and management theory in several ways. First, problem setting is suggested to be a spontaneous process that is driven by sensemaking, and in doing so a link is made between the theories of sensemaking and of problem solving in general. Second, we have called attention to the need to further understand the power of pivotal failure to trigger *spontaneous* problem setting, but also to drive the need for *deliberate* problem setting. Finally, we seek to de-demonize failure in the context of innovation, and demonstrate its unique power to drive a process that is all too important in sensemaking and its resultant learning and knowledge creation.

We also acknowledge the limitation in this study. The research context is in Norwegian companies - where failure is not a “badge of honor” like in other context (US for example) but rather a stigma that need to be avoided in organizations. Therefore, the

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conditions for failure to be pivotal might be different in other settings. There are huge potential for research studying in-depth such conditions empirically. Other factors such as psychological safety (Edmondson, 1999), attribution bias (Weiner, 1985), negative emotions (Shepherd & Cardon, 2009), superstitious learning (Levitt & March, 1988), shared mental model (Denzau & North, 1994) would be beneficial to explore their roles in making a failure pivotal.

Ultimately, since failure will likely not cease to be painful and costly, and it is rather unreasonable to expect that it become an operative tool of strategy, then the following question will remain:

If pivotal failure is the primary trigger of sensemaking, how can organizations create an artificial trigger that serves the same purpose, or else identify the signposts indicating that a deliberate process of problem setting should be carried out?

Future research can look into this question and study it in innovation context. Creating an artificial trigger for sensemaking process will benefit innovation activities and consequently, organizational performance will improve.

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