Abstract

A lot of entrepreneurs are born and raised in Limburg, Belgium, and endeavor to stay here with their business. In order to not lag behind relative to other provinces with other resources, it's important that organizations in Limburg try to innovate. The region of Limburg itself cannot innovate for them, but it can support companies with the needed know-how, information and network. Innovation, oftentimes, is connected with failure because people experiment, try new things and search for opportunities. Failure can have financial, operational and/or process struggles. These failures occur due to the newness of things in combination with multiple other factors. Therefore, this master thesis examines how companies respond, learn and finally try to innovate from failure and if a failure-tolerant culture is beneficial for the innovation outcome/strategy. This master thesis collects further insights to existing literature on learning from failure by conducting semi-structured interviews. In total, fifteen interviews were conducted with companies who were connected with either failure and/or innovation. The interviews resulted in better insights of the process of handling a failure. Additionally, they provide the basis for a framework that companies can follow to intelligently react on failures and hence improve their innovation outcomes.

Lessons learned from the master thesis include that failure is always relative and should be analyzed company specific. The way of handling a failure is related to the organizational culture, created by the higher management and the traditions and history of a company. Next to the culture, employees play a crucial role in learning from failure. Further, it is shown that the operational strategy of companies is affected by failures. As for the reporting of failures, it's recommended for companies to use clearly structured guidelines or processes shared with the entire organization. Following to previous recommendation, it's profitable to use internal databases where the information is stored. The stored information can be useful for later projects. Lastly, failure is still seen as something gloomy in the organizational atmosphere by employees, although this is slowly changing which is positive for the entrepreneurial flow of innovative organizations. Failure has value, let it become valuable.

Keywords: *learning from failure, organizational learning, innovation, open-minded mindset, failure-tolerant leader, failure analysis, intelligent failure, failure handling, quality.*

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"Failure is a bruise, not a tattoo"
- John Sinclair, poet

1. Introduction

Limburg, Belgium, is developing their economy by a full regional innovation system (FRIS-model). This is part of the overall action plan by the Innovation Union (the European Union strategy to create an innovation-friendly environment) in which they ask countries to stimulate (regional) innovation (European Union, 2014). Limburg tries to create an eco-system where organizations can discuss and share relevant information with each other. Parts of the eco-system comprise funding and an incubation place. This can stimulate organizations' innovative endeavors and eventually lead to growth. Although Limburg is doing their uttermost best to support the firms in the region, the organizations themselves should also contribute to an innovation-friendly climate by innovating as well and they should not quit innovating/believing when they face a problem/failure. Organizations need to be aware that failure is usually costly and can harm the organizational reputation. To avoid the reoccurrence of failure, and so reduce further risks and costs, organizations should be able to learn from failure and at the same time improve their internal processes/products. Its no shame that organizations fail, but it would be pity that an organization fails because it failed to learn or innovate. A well know example of learning from failure and innovation, is the Post-it Note. Imagine that Spence Silver had never shared his flabby and weak adhesive among his co-workers. Arthur Fry wouldn't be able to invent the Post-it Note, the most successful product of 3M Company (3M Company, 2012). An opposite example, is the world famous Kodak. A Kodak engineer invented the digital camera in 1975. The reaction of Kodak's management was: "That's cute, but don't tell others", being afraid it would have taken internal resources from the big moneymaker. Kodak went (almost) bankrupt in 2012. The lesson learned from Kodak is that you should never neglect being innovative even, when you think, there is time enough[1].

Organizations face failures in their daily operations. Ranging from very small immediately solvable failures to failures from which they learn and larger more complex failures where the solution is very hard to find. The way organizations deal with these failures varies according to several cultural factors in the organization. The mission/vision, communication, and leader- and employeeship are proved to be direct links between a culture and effectively handling a failure, hence a failure tolerant culture (Martins & Terblanche, 2003). Organizations will have to create or preserve a culture where people feel safe when taking risk, experiment, innovate and/or eventually fail. Failure is not something to laugh with, but something to learn from. There are still organizations where the person who spearheaded a project that failed is pilloried and where their name will likely carry the legacy. But, when a project results in a positive outcome, that success is often shared among the team. This mindset is slowly changing, but to accelerate this process, managers need to know how to handle failures. Some companies solve a failure and some do not,

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[1] http://www.forbes.com/sites/johnkotter/2012/05/02/barriers-to-change-the-real-reason-behind-the-kodak-downfall/#2772bfd73698 accessed on the 4th of May.

persevering in solving a failure and effectively use it for organizational purposes (becoming more competitive, less costly, innovative) tells something about the organizational culture. It is important to know what kind of failures exists (preventable, unavoidable and intelligent), because not every failure should be concurred in the same way. Frequently written is that organizations should learn intelligently from failure to prevent failures next time (Cannon & Edmondson, 2005). They should identify failure, analyze and interpret it. Additionally, by deliberate experimenting organizations can already face failures in front. That's why some of the researchers call failure a 'by-product' or 'the foundation' of innovation. Several methods are explained how organizations can deal with failure and benefit from it if they learn intelligently from failure. Existing literature provided this master thesis with the pros and cons of failure for innovation. Culture and employees are one of the beneficial factors for innovation (Soken & Barnes, 2014). Another positive aspect is to actively search for ideas by employees. If they are open-minded because of the created culture this can, eventually, stimulate innovation (Douglas, 2014). Innovating from failure will not be the main purpose of an organization, but it may occur. Then, it's important to know how managers should stimulate this process. Embracing failure, and taking intelligent risks, will keep/attract top employees because they achieve personal growth and development by forsaking their comfort zone and experimenting. In sum, prior literature shows that handling a failure is still a thorny issue partly because employees are not completely familiar with sharing failures as many firms do not have a culture where failure is accepted. The question is if this failure tolerant culture stimulates innovation and how? There is a lot of research done about handling failure and learning from failure but there is not much written about how to effectively use failure, especially for managers. That is why I would like to investigate how a failure tolerant culture stimulates innovation and if solving a failure or preventing it can lead to innovation by effectively using it. In the existing literature, these gaps remain underexplored and in addition there is a lack of a guide/framework that assist managers to effectively use failure. Failure has value, but managers should be aware of the gaps to let it become valuable.

In the literature review, I will give an overview of the existing literature about learning from failure, innovation and a failure tolerant culture. In the findings section, I investigate by face-to-face interviews how organizations in Limburg, Belgium, see failure and how a failure tolerant culture stimulates innovation. After the face-to-face interviews I will conduct a within-case analysis describing the findings case by case and the cross-case analysis describing the findings across cases. I develop a framework for managers to effectively use failure, and how they can innovate from a failure. Failure, then, becomes valuable for managers. This framework can be used as a helpful tool when organizations face a failure. It will help organizations to overcome the gaps of handling a failure and the process to innovation. My master thesis concludes by answering the research questions as a final conclusion and by discussing the results with the existing literature. I will then provide implications for managers and future research.

2. Literature review

In the literature researchers often keep repeating the fact that people cannot fail enough: "if you do not fail often, you do not try hard enough to fabricate something that is good enough" (Cannon & Edmondson, 2005), *"it's not a disgrace to fail, failing is one of the greatest arts in the world"* was quoted by Charless Ketering (Richard & Ralph, 2002), "people can learn the most from the failures they survived" (Saunderson, 2012), "failure can be a better teacher than success" (Baum & Dahlin, Aspiration Performance and Railroads' Patterns of Learning from Train Wrecks and Crashes, 2007) and "failure is a good innovation engine" (Alexander, Berthod, Kunert, Salge, & Washington, 2015). Some of them go even further and say that rewarding and celebrating failure could be equivalent, or better, to rewarding success (Saunderson, 2012; Richard & Ralph, 2002) and companies without failures are losing their resilience and becoming too confident (de Graaff & Kramer, 2012).

Companies approach innovation in a different way due to the growing acceptance of failure (Richard & Ralph, 2002). According to Paul Schoemaker[2], research director at the Mack Institute for Innovation Management at Wharton, failure is the foundation of innovation and success is similar to 99 percent of failure. Thanks to failure people try to see things from another perspective and that's how they do stimulate innovation. Let's point out an example from Silicon Valley, were some of the startups are named as 'Failure Factories'. Startups in Silicon Valley try to 'manufacture failure' on a regular basis. They try, fail, bounce back and turn something that failed into something that is loved. If you are not willing to take the risk of failing and experience failure, you will not succeed finding the right path to success[3].

Don't get it wrong! Failure still affects companies' reputation, destroys profits, ends careers, wastes money and eventually could lead to business failure (McGrath, 2011) or even worse a firm's failure could ultimately end people's lives. During the BP's Oil Spill in 2010, the Santiago de Compostela derailment in 2013 and the clinical trial disaster of BioTrial in 2016 people lost their lives or were heavily injured. But, if failures are managed well (McGrath, 2011), people and organizations can still learn from these events. The purpose of this master thesis is not to analyze the negative consequences of failure but to provide companies with ideas on how to manage, moderate and learns from failures (titled by Sim Sitkin as '*Failing Intelligently*') and thereafter innovate from failure.

This section about failure discusses the different kind of failures that occur within companies, according to the existing literature. Starting from defining failure to seeking for methods on how companies can handle failure.

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[2] http://www.inc.com/paul-schoemaker/brilliant-failures/why-failure-is-the-foundation-of-innovation.html accessed on the 20th of February 2016.

[3] http://www.inc.com/eric-markowitz/brilliant-failures/why-silicon-valley-loves-failures.html accessed on the 20th of February 2016.

What is failure?

In many articles about failure, researchers use the definition by Cannon and Edmondson (2001) where failure is defined as the negative deviation from expected and desired results (de Graaff & Kramer, 2012; Alexander, Berthod, Kunert, Salge, & Washington, 2015; Saunderson, 2012) this comes together with the lack of success and state of not functioning (Oxford University Press, 2015). This fits within the definition of Argyris and Schön (1978) who described an *error* as the gap between results and expectations (Cusin, 2012). Others say that a product fails if the last purchase of a product is less than three years after its introduction date (Anderson, Lin, Simester, & Tucker, 2015). There are failures with varying degrees, like: avoidable vs. unavoidable, excusable vs. inexcusable, small vs. large, own vs. others, technical vs. personal, repeated vs. unique and even intentional vs. unintentional failures etc. According to Cannon and Edmondson (2005) failure also can be seen as a by-product of true experimentation.

Coleman (2015) visualizes *failure* comparing it with *iteration*. The last-mentioned arises if a first project of whatever swaps for a better/newer version. Failure, on the other hand, is going to another/second version, running out of money/resources and then having to end the project. Therefore, at first, there is a necessity of division of failure before knowing how to handle failure, but as it is failure is a unique experience that involves learning (Cusin, 2012).

According to Edmondson (2011) failures can be divided into three divisions:
- *Preventable failures in predictable situations*: these failures can be concluded badly. The reason for these failures is most of the time deviance, inattention or lack of ability at high-volume and standardized processes. Most of the times these failures are caused by humans (Potter, Murray, Lawson, & Graham, 2012). Having checklists in place are the best solution for these failures.
- *Unavoidable failures in complex situations:* a combination of needs, people and problems never occurred before on account of an inherent uncertainty at work. To prevent this organizations can follow each step in risk management and best practices for safety. Nevertheless, small failures cannot be excluded but identifying small failures at the beginning can help. Examples as running a promising start-up, where getting sidetracked by distracting projects, personal issues, and/or general loss of focus was mentioned 13% as a contributor to failure according to a study from CBInsights[4] of 101 start-ups, or incremental innovation can be assigned to this category.
- *Intelligent failures at the frontier:* this category is called intelligent failures because these failures provide the organization with new valuable information or learning advantage on the competitors. This will help the organization to grow. This situation occurs because it was never been occurred before. The failure is due to experimentation. New drugs, research settings, new businesses or disruptive innovation are examples where intelligent failures can occur.

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[4] Downloaded whitepaper from https://www.cbinsights.com/blog/startup-failure-reasons-top/ accessed on the 14th of March 2016.

'Intelligent failures' according to Sitkin (1992) in failure-driven innovation by Alexander, Berthod, Kunert, Salge & Washington (2015) and learning through failure chapter 9[5] have the following five characteristics: 1. thoughtfully planned actions, 2. have uncertain outcomes, 3. are modest in scale, 4. are conducted and responded to with enthusiasm, 5. take place in areas that are well-known or familiar enough to allow effective learning. For a better use of intelligent failures, managers have to practice often on how to this quickly and react on it. This means that the organization become more agile, better at risk taking, and more adapt at organizational learning (McGrath, 2011).

Furthermore, the three main types of failures can be divided along more specific characteristics/dimensions:

- *Small and big failures* (Cannon & Edmondson, 2005)*:* large and well-publicized failures argue for the necessity of learning from failure. To uncover and communicate the causes and lessons of highly visible failures organizations often establish task forces or investigative bodies. These regulations often come to late to learn from this failure. Small failures will mostly not have been identified because of the lack attention. These small failures are usually called 'the early warning signs'. It is crucial to be aware of these small failures, because moderate failures, according to Sitkin (1992), lead to organizational attention. This creates a problem-solving approach and motivates people to improve (Alexander, Berthod, Kunert, Salge, & Washington, 2015).

- *Technical and social failures* (Cannon & Edmondson, 2005)*:* the shortage comes from the design in a new machine (technical failure; e.g. product failure) and the shortage comes from personal experience (social failure e.g. not sharing ideas and insights).

- *Failure from younger and older firms* (Thornhill & Amit, 2003)*:* younger firms fail because of inadequate resources and capabilities. Older firms instead, cause failure because of a mismatch between resources and capabilities and industry factors. Although, this is not always true. The younger companies look at failures differently then mature companies.

- *Own and others failure* (Baum & Dahlin, Aspiration Performance and Railroads' Patterns of Learning from Train Wrecks and Crashes, 2007): organizations learn from their own experience when performance is near their aspirations and they learn form others' experience when performance deviates from aspirations. Learning from other's failure is defined as *vicarious learning*. This can be: internal vicarious learning, learning from other's failure in the organization, or external vicarious learning, where organizations learn from other organization's failure (Baum, Xiao Li, & Usher, 2000).

- *Excusable and inexcusable failure* (Farson & Keyes, 2002): this subdivision can be valuable for failure tolerant leaders. If, for example, a failure occurs because of launching innovation initiatives companies should not handle this failure the same as a failure due to sloppiness. Excusable mistakes are failures that should be examined, understood, and built upon (Farson & Keyes, 2002). Inexcusable failures (or incompetent failure) are the ones where people fail or lack of effort or competence in standard situations (InnoCentive Inc., 2013).

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[5] http://uk.sagepub.com/sites/default/files/upm-binaries/10989_Chapter_9.pdf accessed on the 22nd of February 2016.

All these previous categories have no meaning if companies fail in the most important aspect… learning from failure. If they fail in learning from failure, there is no clue in searching for different methods on how to handle failure or looking for opportunities reframing the company's mindset/culture. Ignoring failure can allow failures to be repeated, developing a smaller failure into a bigger one. One of the main reasons why companies fail is that they do not detect small, all day operational failures (Cannon & Edmondson, 2005). In sum, to stimulate learning it is important to discover these failures as quickly as possible, analyze them deeply and design experiments or pilots to test them (Edmondson, 2011).

Creating a failure tolerant culture

Learning culture vs. failure tolerant culture

Organizational learning creates, retains, and transfers knowledge within an organization. It is a process of improving actions through better knowledge and understanding. Going from individual level to group level and from this point to organizational level and visa versa. The core element of organizational learning is to acquire experience and knowledge (Tohidi & Mandegari, 2012).

"*Learning is not after-the-fact rationalization or a good story designed to hide failure. It's a process of demonstrating empirically that a team has discovered valuable truths about an organization's present and future business prospects.*" – Eric Ries, The Lean Start-up.

A failure tolerant culture has a positive perception of failure, where people feel comfortable for taking intelligent risks and causing failure. People are encouraged to share their mistakes and ideas. So they can, thereafter, learn from their failures together with the organization (Edmondson, 2011). Reframing the managerial mindset of learning is crucial (Cannon & Edmondson, 2005):

	Traditional Frame	Learning-oriented reframe
Expectations about failure	Failure is not acceptable	Failure is a natural byproduct of a healthy process of experimentation and learning
Beliefs about effective performance	Involves avoiding failure	Involves learning from *intelligent failure* and communicating the lessons broadly in the organization
Psychological and interpersonal responses to failure	Self-protective	Curiosity, humor, and a belief that being the first to capture learning creates personal and organizational advantage
Approach to leading	Manage day-to-day operations efficiently	Recognizing the need for spare organizational capacity to learn, grow and adapt for the future
Managerial focus	Control costs	Promote investment in future success

Reframing the traditional mindset into a learning-oriented mindset.

A failure tolerant culture is part of the overall learning culture of the organization, because without learning capabilities people rarely share their failures. It all starts with a learning culture. Both require communication, openness, tolerance and patience. Within this master thesis the focus will be mainly on the 'failure tolerant culture', in some literature written as 'failure intelligent culture'. This master thesis is not preaching that organizations should become 'failure cultures', but they should become more adaptive. This includes a higher rate for failure, de-stigmatizing it internally and eventually learning from failures to use this as a benefit for the entire organization and to find another/better course. Lindegaard calls it the 'Smartfailing Companies' (InnoCentive Inc., 2013).

A failure tolerant culture

Managers know what kind of failure could reach the surface, but then it's even more important that managers know how to stimulate a failure tolerant culture. Companies, teams or employees cannot come to a breakthrough innovation or improvement if managers are not willing to accept risk-taking and learn from subsequent failures (Richard & Ralph, 2002) or share their own mistakes (Cannon & Edmondson, 2005). Creating a failure tolerant culture is not a standalone perspective. It's start with the overall culture of a company, which can be simply formulated as 'the way we do things around here' (Martins & Terblanche, 2003) and then the manager should convey this culture of learning from failure to their employees and others (Richard & Ralph, 2002). A failure tolerant culture doesn't stop at the managerial level, it continuous with the mindset of employees all the way to bottom level of the company. If employees no longer think in terms of failure and success, but create a mindset of learning and experiencing this will lead to a more failure tolerant company where innovation, creativity and failure is stimulated (Richard & Ralph, 2002). As captain of moonshots for X (Google X), Astro Teller explains what they do to create a failure tolerant culture that leads to creativity and employees looking for the best: "*We will start with the project most likely to fail. When it allows us to fail, the project is not good enough and we quit. We reward failures, give bonuses to teams who fail and give them hugs. When managers yell at people or punish them, they will not share their ideas and live the cave life. Your dreams coupled to strategy will create the future.*" [6]

There are two mindsets relating to the perception of failure. Employees with a fixed mindset believe that failure is seen as a personal affront. If something goes wrong, they blame, withdraw, lie, and even avoid future challenges or risk. This group ignores, denies and disassociates themselves from their own failures (cf. social barriers of failure) (Cannon & Edmondson, 2005). Employees with a growth mindset see failure as an opportunity instead of a personal affront. If something goes wrong they quickly reassess, adjust and try something new. Reframing this mindset is crucial for every failure tolerant company and leaders [7]. Employees should dare to share

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[6] https://www.ted.com/talks/astro_teller_the_unexpected_benefit_of_celebrating_failure accessed on the 12th of May.

[7] https://www.teambonding.com/innovation-in-companies-reward-failure/ accessed on the 28th of February 2016.

their ideas and insights even if they fail. Only then it creates added value for the entire organization (Townsend, 2010).

This failure tolerant culture should not only be stimulated by the internal factors as mentioned above, but also by external factors like suppliers, networks and partners who have to support the company in their policy as well (Alexander, Berthod, Kunert, Salge, & Washington, 2015). A meaningful failure should be used as a learning process in the organization. To optimize the learning process, teams should "embrace failure" and systematically collect as many „failures" as quickly as possible (Singer & Edmondson, 2006). Organizations are inevitable connected with failure. Everyone makes mistakes, which is why organizations or rather managers have to create a culture where employees feel comfortable with and responsible for surfacing and learning from failures. It's about 'what happened' not 'who did it' (Edmondson, 2011). As people learn from failure, this behavior will become best practice in the company. People have to stimulate each other. Only then companies can create a supportive learning culture. Which encourages innovative ways of representing problems and finding solutions (Martins & Terblanche, 2003) through every discipline, process and level (Mat & Che Razak, 2013). Finally, companies should take into account the following nine dimensions for creating a climate for creativity, innovation and change: challenge/involvement, freedom, trust/openness, idea-time, playfulness/humor, conflict, idea-support, debate and risk-taking (Isaksen & Akkermans, 2007).

In what follows I will stepwise explain, based on the existing literature, how companies can create and stimulate a failure tolerant culture. Tolerance for failure, where a negative outcome isn't penalized, develops an organizational context that stimulates learning and experimentation. Together with decentralized decision taking, and cumulative knowledge (Cusin, 2012), they are critical for innovation (Hutchison-Krupat & Chao, 2013).

Failure tolerant leader

As written above the executives play a crucial role in creating a failure tolerant culture. They try through their words and actions, helping people to overcome their fear of failure and, in the process, creating a culture of intelligent risk taking that leads to sustained innovation (Farson & Keyes, 2002). Leaders are in fact the persons who have to change the processes into a more failure tolerant culture. Saying this doesn't mean it's simple. Culture is usually grounded on tradition and history. And that's why even managers have a hard time changing it. Yet, they have to take responsibility. Farson and Keyes (2002) studied several business leaders. For them a failure tolerant leader has the following capacities: being able to break down social and bureaucratic barriers, engagement at a personal level, preference for feedback over criticism, have nonjudgmental posture while interacting with their staff and last but not least admit their own mistakes. Besides these capacities, managers should try to invent a non-competitive, non-punitive environment and collaborative culture. Out of a survey of 103 companies conducted by InnoCentive Inc. (2013) 50 percent of the responding firms stated that the main cause of failure was due to the organization that operates in silos instead of team approach while facing innovation. Collaboration and teamwork is very important. Managers should be aware that internal

competition spurs performance (Tian & Wang, 2014) and infects coworkers with a desire to win rather than to solve problems and move projects forward (Farson & Keyes, 2002). Through personal animated conversations (or schmoozing) from time-to-time, managers can create a failure tolerant culture. Employees should get the feeling that they are working with their manager, instead for their manager. Managers, in failure tolerant cultures, act more as an effective coach of the employees with whom they work. Therefore, a leader or manager is coaching-minded, supportive, and has non-defensive responses to question or/and challenges. Individuals, who work with this kind of manager, are likely to feel that there is a safe culture for identifying and analyzing failure (Tohidi & Mandegari, 2012). Thus, genuine engagement with open-ended relationships can bring unexplored ideas to the surface, which can lead to more innovative outcomes (Farson & Keyes, 2002).

Learning from failure

Different perspectives are taken about how to learn from failure. In this section I provide several insights from different authors on how to learn from failure to come to an ideal step-by-step process based on the existing literature. In addition several examples are explained to easily adapt these processes in an organization.

Principles for learning from failure

McGrath (2011) explained seven principles how organizations could leverage their learning from failure. 1) Decide what is failure and what are success 2) convert assumptions into knowledge and try to overcome the *confirmation bias*. This bias occurs when people fall into the information they already believe. Thus, try to open borders to something new. 3) Fail fast to exclude lose of additional resources and pivot faster to your main goal and safe investments for later. 4) Fail cheaply, before launching a huge project, try to test it first with in a small experiment. 5) Limit the uncertainty. Don't try to experiment in areas not matching your capabilities. Organizations probably will not match their current knowledge of what they have found. 6) Create a culture that celebrates intelligent failure. 7) Codify and share learned moments.

Preferred organizational competences

Next to McGrath (2011), states Cannon and Edmondson (2005) that learning from failure is made up of three major competences, in which every other perspective fits. Number one is identifying failure, followed by analyzing and interpreting failure and finally organizations experiment to achieve controlled failures, which they can analyze (cf. deliberate experimentation). Cusin (2012) names this phenomenon as a learning-from-failure process, but adds two other phases: storage of knowledge and specific utilization.

Identifying failure

The important first step is that enterprises proactively and timely identify failures. Sometimes the small, unrecognized/unnoticed mistakes can easily become the worst. That's why all small failures are worth the research. These missed failures are mostly due to the *social barriers* (not reporting

failure but ignoring, denying, blaming and shaming for mistakes) and the *technical barriers* (not recognizing failure). A culture of 'shooting the messenger' should be reframed by the organizational and logical factors of the organization into a motivated culture of continuously seeking for failures. Managers have to be aware that a failure can have consequences either for the organization or the employees socially, financially and logically. Therefore, managers have to develop systems, procedures and a '*psychological safety feeling'* for identifying and learning from failure (Cannon & Edmondson, 2005). The key to ensure that employees learn from failure is do reduce their negative emotions (Shepherd, Haynie, & Patzelt, 2013) and create a shared belief that they are safe for interpersonal risk taking (Hutchison-Krupat & Chao, 2013).

Feedback seeking is one of these methods were companies can get useful information. This feedback can be generated from employees, costumers or others (Cannon & Edmondson, 2005). Early adopters are an important group of costumers who buy products in the very early stage. They most of the time have high expectations which is risky for companies if they do not reach them. This could lead to negative word-of-mouth and dissatisfied users. Interaction with this group can be important (Chiesa & Frattini, 2011). Although early adaptors are important, another group of early purchasers might be important as well. *Harbingers of failure* are a group of costumers who are more likely to buy failure products. Harbingers of failure can be identified by past purchases that failed or existing purchases that few others buy (Anderson, Lin, Simester, & Tucker, 2015).

Examples of methods for identifying failure are (Cannon & Edmondson, 2005): blameless reporting via intranet or other channels because the question is not who did it but what happened, penalizing people who are not reporting the failure within 24 hours (managers have to walk the talk and spread this rule clearly), celebrating a failure or presenting a failure as a playful but effective way for identifying failure, weekly a 30minutes 'feedback and answering questions'-sessions, Statistical Process Control (SPC) is a qualitative control method which uses statistical methods to optimally use the process. A more playful manner to share failure is 'The Failure of the Month'. This is a method in which employees can learn from other's mistakes, i.e. *vicarious learning*, by a presentation each month. Off course, managers should present their failures first.

To effectively use the information gathered organizations need systems that facilitate collection and analysis. Thereby, managers should communicate clearly what they expect from their employees in order to identify failures.

Analyzing and interpreting failure

Without analyzing failure organizations cannot learn form them, thoughtful analysis and discussion about failures are crucial. Organizations have to know what really happened, and this will be different for each company. An unfortunate experience has to be transformed into something that makes sense, only then organizations can create knowledge (Cusin, 2012). Effective analysis occurs if people speak up openly about what they know and if others listen, enabling a new understanding of what happened to emerge in the assembled group. Openness, patience and tolerance for ambiguity are required for analyzing a failure (Cannon & Edmondson, 2005). According to a study of Cannon and Edmondson (2005) managers blame outsiders or uncontrollable influences like the economy for major failures. Small failures are seen as an

outcome of experimentation. Analyzing failures is not just seeking what happened, but creating social and organizational benefits. The key of discussing and analyzing failure is that others, who might not have been involved, can learn from it. Secondly, others can bring new perspectives and insights different than those who have been involved in the failure (Cannon & Edmondson, 2005). Discussing and analyzing small mistakes, is often overlooked. But it can result in valuable learning information for organizations.

Some of the methods for analyzing failure discussed by Cannon and Edmondson (2005) are: After Action Reviews used by the US Army analyze *what* happened, *why* it happened, and *how* it can be done better next time, Cross-Functional Teams that sporadically collaborate and control other teams, Network Based Systems where control and feedback from customers/employees can exchange information in a network, Failure Mode and Effective Analysis (FMEA) is an inductive method (bottom up approach) for analyzing failure for this purpose it is important to understand the product/service design of each product used in the organization, Fault Tree Analysis is a graphical deductive method (top down approach) for analyzing failure, where first of all the fault has to be identified. Analyzing failure is not an easy operation for the organization, therefore it's preferable to develop or hire skilled facilitators (Cannon & Edmondson, 2005).

Item	Identification	Description	Failure Modes	Effects	Safeguards	Actions
1	Car Tire	-Supports Weight -Traction -Cornering -Smooth Ride	Flat	-Stranded -Loose Control	Spare Tire In Trunk	Acceptable as is

Failure Mode and Effective Analysis, Glansey, 2006.
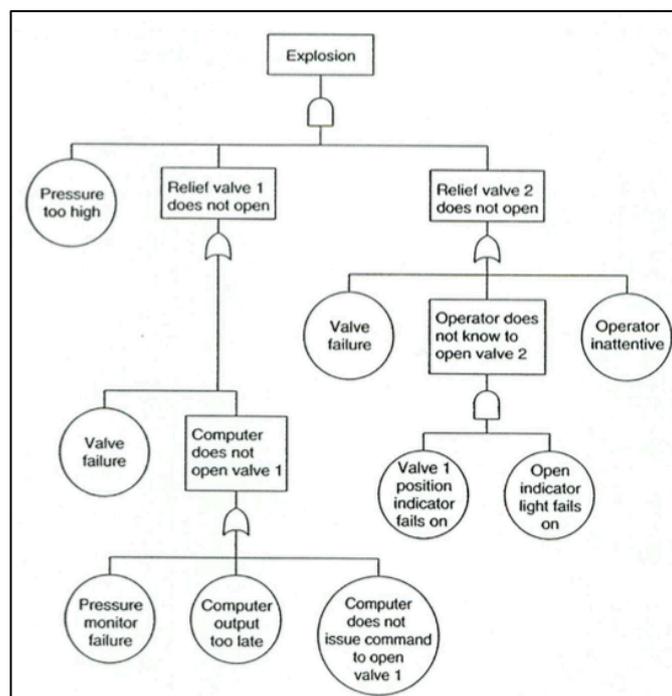
Fault tree analysis, Glansey, 2006.

Deliberate experimentation

Experiments are tests designed to expand knowledge. Organizations learn from these experiments, or at least they should try learning from it (InnoCentive Inc., 2013). Organizations can devote some portion of their energy and time trying new things. They actually seek new failures when innovating. The frequency of failure will increase because the organization doesn't know if the product will work or not. By this they open up the prospect of generating new solutions for existing/new problems. And maybe they come up with new ideas for products, services and innovations. New ideas are put to the test, but in a controlled context. An organization who experiments effectively, which is a resource of creative learning (Tohidi & Mandegari, 2012), is likely to be more successful, productive and innovative (Cannon & Edmondson, 2005). Some refer to this as 'Failure Adaptability', motivating people doing new things in a controlled setting and then analyze the failures (Alexander, Berthod, Kunert, Salge, & Washington, 2015). The eagerness to learn in the mindset of employees is crucial (Tohidi & Mandegari, 2012), organizations have to motivate people to try new things. Another crucial part in efficient experimentation is that managers understand the value of experimentation. Like said before, they should publicize both success stories and failure stories. Only then employees see that learning from mistakes is more than a saying (Alexander, Berthod, Kunert, Salge, & Washington, 2015). Although organizations have to experiment, March (1991) advocated that there has to be a balance between exploitation, refinement of an existing technology, and exploration, inventing a new one.

The deliberate experimentation methods technique is used by 3M Company (2012) where they set up goals like 25 percent of a division's revenue has to come from products that are launched within the last five years. This means that each division has to experiment to remain innovative. Some other organizations use '*the soft landing policy*' where someone who failed for the new job, after an amount of huge effort, can go back to his/her old place. Another initiative which each organization can benefit from is to create an 'Innovation & Development Team'.

Before, during and after every process of learning from failure the knowledge gathered has to stick in the organizational memory. This is the potential of developing an organizational learning culture (Cusin, 2012). Probably an even more important factor is the specific utilization of the knowledge that is stored in the organization. If organizations specifically use their knowledge, they gathered from failure, to achieve gradual improvement, this can lead to a change in culture (Cusin, 2012).

In sum, to innovate, organizations have to learn and they do that through experimentation, some of which are destined to fail. But it's not the failure that drives innovation, but rather the learning (InnoCentive Inc., 2013).

"*Intelligent Fast Failure*" - theory

Jack V. Matson presents another approach of learning from failure, by his theory of IFF, Intelligent Fast Failure (Tahirsylaj, 2012). Explaining IFF, Matson came up with three concepts dealing with new ideas and tasks: namely STRAFE, CHAOS and Fast History.

Where STRAFE stands for 'Success through Rapid Accelerated Failure Engineering and Entrepreneuring'. This term is used to make organizations aware that only a few ideas will succeed, and the rest of them are used to learn from. It also implies that several ideas are tried out

simultaneously. Launching several projects/ideas at the same time is refereed to as 'Simultaneous Management', which will stimulate cross-fertilizations between groups (Farson & Keyes, 2002). If one idea/product is launched successfully and is used, the second concept, CHAOS, will enter into force. CHAOS is the abbreviation for Creating Havoc Accelerates Outrageous Success. Meaning that the product has to be refined, improved and redesigned so that competition does not take over (Tahirsylaj, 2012). The last concept is Fast History. Taking the term literally, it means that a product/idea can be history very fast. Nowadays, knowledge is outdated very fast in almost all sectors (Tahirsylaj, 2012).

Related to this Fast History concept is the term '*serendipity*', new ideas often come unexpectedly doing something else. Employees should look further than their actual interests and diversify into new areas they know nothing about, and then reconnect the knowledge back to what they know (Tahirsylaj, 2012). Stories like 'Post-it', 'Viagra' and 'Jacuzzi' are all born because they applied the product to another interest.

Learning loops for failure

The organizational actions patterns of companies have to change from single-loop learning to double loop learning and from local research to a broader research (Cusin, 2012). They act upon a specific problem and try to overcome/solve this problem. Ones they found a solution, they go ahead, store their information and move on. The initial problem is solved, but the underlying policies or the actual error, which may have caused the problem, are not. This action pattern leaves the firm vulnerable to similar issues (Cusin, 2012) and is defined by Argyris (1976) as *single-loop learning*. Thus, an organization solves a problem without asking what the actual problem is. Effective problem solving occurs when individuals are aware of all variables relevant to the problem (Cusin, 2012) and try to analyze more deeply into the problem supported by feedback and previous actions. This is referred to as *double-loop learning* (Argyris, 1976). Next to this, organizations have another problematic search model. A failure mainly triggers the organization to search around the symptoms and factors of the problem (cf. local search). They rarely search for cross sectional symptoms and factors that might cause the problem. The reason for this lies in the more difficult approach (Cusin, 2012).

Another learning cycle is invented by Good & Smith[8]. The 'Learning and Innovation Loop' is a four-stage learning loop starting from a failure and eventually resulting in informed risk-taking and innovation. This loop tries to conceptualize an intelligent failure. The figure shows that failure is inevitable. All organizations fail, even repeatedly. But building a failure tolerant culture where failure and learning allows growth is the key to take smart risks and develop innovations. Reaching this point of 'informed risk taking and innovation', where skills and practices from learning from failure can be beneficial for the entire organizations, is not simple. An organization has to overcome three exits. First, everyone involved in the failure should communicate openly to maximize the learning. Then, all the learning should be codified to the organization so processes, tools and practices can be improved. Finally, all learning should effectively be used to other iterations or changes.

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[8] https://failforward.org/if-loop/ accessed on the 13th of March 2016.
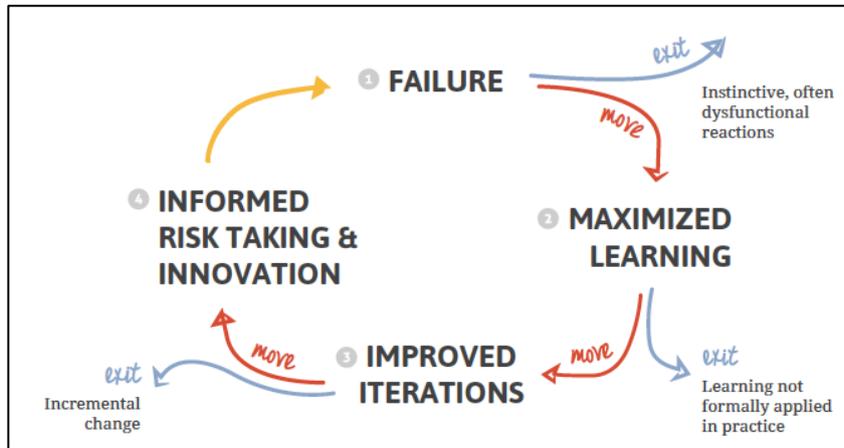
Ashley Good and Anna Smith, 2014: The Learning and Innovation Loop.

Learning from failure results, most of the time, in improved knowledge and understanding. Yet, it may not ultimately produce results that improve performance. Or, it can be even worse; learning the wrong insights of a failure can lead to a more rigid company (Cusin, 2012). For organizations it is important to do something useful with the information gathered from failures. In this master thesis the link between a failure tolerant culture and innovation is investigated. Although there is not much research done linking these two topics, I first of all try to figure out what already is written about this relationship.

From failure to innovation

> "*Innovation requires people to change and move beyond the status quo. Vision, motivation, focus, perseverance, and leadership guidance are required to achieve success.*" - Soken & Barnes, 2014.

In the previous sections failure, learning and the stimulating failure tolerant culture were explained. In this last section of the literature review innovation will be explained. More specific: what is innovation, what are the determinants of innovation and finally how does a (failure tolerant) culture stimulate innovation. Cusin (2012) and Cannon & Edmondson (2005) state that an organizational climate of psychological safety encourages decision makers to take risks that 'push the boundaries' and, eventually, lead to innovations. This is a direct link that a failure tolerant culture stimulates innovation. In the findings part, the explanation is given on how companies in Limburg (Belgium) do this.

Innovation is a very broad topic in the literature. Definitions of innovation used vary according to the level of analysis or context (Martins & Terblanche, 2003). In what follows I will guide the reader through several descriptions that are made: "*successful implementation of creative ideas within an organization*" (Gumusluoglu & Ilsev, 2009), "*optimizing the potential benefits embedded in an idea that is new to you*" or "*creating value and embrace something new*" (Soken & Barnes, 2014), "*something new that is designed to be beneficial for an individual, group, organization or wider community... and that leads to change*" (Martins & Terblanche, 2003). The above mentioned descriptions are all useful, but for this master thesis I will use a more general definition provided

by Schumpeter. He described innovation in the early nineties as: one of the following patterns: introduction of new goods, new methods of production, opening a new market, new supply source of raw materials or half-manufactured goods or new ways to organize business (Tohidi & Mandegari, 2012 & Gurkov, 2013). This definition includes all of the above descriptions of innovation.

Although, this is not the main topic of my thesis, I will describe shortly the different kinds of innovation. In the figure below ten types of innovation are shown:
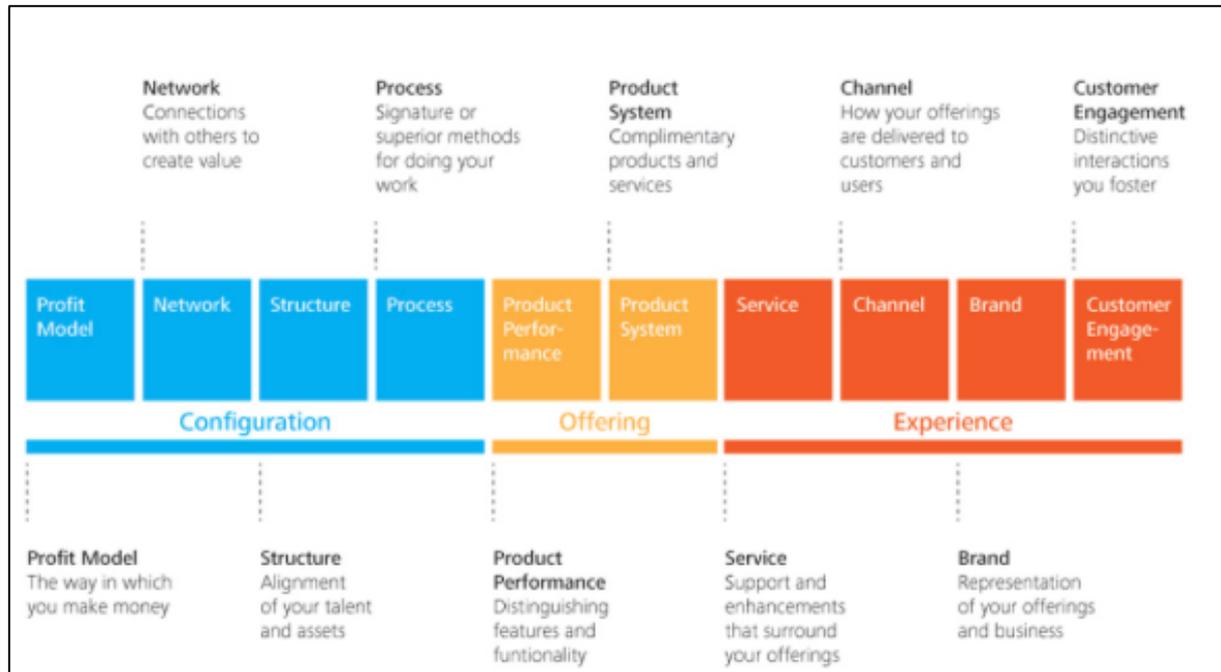
10 types of innovation designed by Doblin.[9]

As an organization it is possible to use more then one type of innovation while inventing something new. The "*Configuration"* part is focused on innovations of the internal mechanisms/processes of an organization and its structure. The middle part, "*Offering"*, is the core business of the organization. Here, innovations are based on the core product, core service of the enterprise or a combination of both. The "*Experience"* part mainly focuses on the customers. These kinds of innovation are based on elements that are facing the customers.

A lot of organizations say that they have an innovative vision. But do they believe this by heart? Organizations should live this conviction through deeds, not words. Putting innovation in presentations or communication is not enough. Successful innovation only comes when managers 'walk the talk' and create supportive values and behaviors that are consistent over time (von Stamm, 2009). For an organization it is difficult to just tell its employees to be more innovative, it rather has to inspire them. An inspiring vision to contribute to and a shared language around innovation are necessary to ensure that everyone walks the same path. According to von Stamm (2009) there are three phases in how managers can stimulate innovation: search, selection and implementation.

First of all, appropriate processes and structures are required. Managers have to stimulate

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[9] https://www.doblin.com/ten-types accessed on the 17th of March 2016.

the kinds of innovations they would like to see. And employees like to have a place where ideas can be captured, evaluated and developed. They need something against which to evaluate (benchmark) their ideas. Managers cannot just wait for ideas to be offered by employees or teams. They have to actively seek for new ideas, talk with their employees and listen what is happening in- and outside the organization. Finding ideas and spreading the word is part of it (von Stamm, 2009). If for example: an employee thinks he/she has a ridiculous idea, which he/she will not tell it to the organization. It is the manager's task to 'discover' this idea. An "*idea-box*" these days isn't enough. People are different in sharing ideas and thoughts. On the one hand, there are people that will put ideas in the "*idea-box*". On the other hand, there are people that keep ideas in their heads. Not knowing how to write it down or explain. In an article of the Harvard Business Review, Douglas (2014) explains which three questions managers should ask to stay updated with their front-line employees, especially when an organization is growing. Get out the office and ask the employees '*How can I help you*?' People are aware when a manager cares about them, has high expectations, is committed to solve problems, and wants to move barriers. Go out to the front lines employees and ask them '*Why are you doing it this way*?' This question is to learn not to criticize. And, "*Are we living into our values as a company in ways that support you*?' As an employee feels good and respected, this is beneficial for the organization. A manager needs to support the wellbeing and expectations of things employees consider necessary. These three little question, will make an organization better in performance, trust and while listening to everyone's answer; managers create an invaluable feedback loop[10]. Secondly, different innovations need different processes and policies: rather organizations are incrementally or radically innovating. If someone comes up with a radical idea, it would not be beneficial to apply the processes of an incremental idea. Additionally, the risks involved within each innovation are different. People, teams and the entire organization need to be aware of this. A clear communication of the idea is important, so that the discussion takers know exactly what to expect. Finally, implementing (radical) innovation comes with unexpected obstacles (scheduled time will change, costs will be higher and the acceptance of failure. Failure can better be seen as learning. This stems from decision processes that treat choices more favorably when they fit the timeframe and risk profiles that characterize on-going business.

Creating an innovative culture is not just flipping the coin. It comes with a lot of barriers, which the organization has to overcome. What factors is the death to innovation? Fear and punishment, lack of vision, not seeing someone makes a difference, no confidence, win/lose mentality, explicit and implicit reinforcement of a status quo, focus on uniformity, frustration, lack of flexibility and more… Out a survey of McKinsey, 94 percent of all executives concluded that culture and people are the most important factors in stimulating innovation (Soken & Barnes, 2014). Next to culture and people, other factors play a crucial role in supporting innovation: communicating clear purposes about innovation, practicing what is preached (the leader serves as an example for others), taking risk is inevitable, creating and sustaining a team, navigating the organization to success,

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[10] https://hbr.org/2014/05/3-questions-executives-should-ask-front-line-workers/ accessed on the 17th of March 2016.

measuring and rewarding innovation, busting boundaries (encourage customer interaction and understanding; an innovative product occurs when creativity is connected to the needs of customers that make their lives better) and finally focus on what matters (Soken & Barnes, 2014). Companies can approach innovation in three different ways: operational excellence, customer intimacy and product leadership (Traecy & Wiersema, 1993). First, the operational excellence approach where the objective is being leader in the market based on price and convenience (focusing mainly on the process). Second, the customer intimacy approach where the focus lies in shaping and tailoring the products and services to the customer. And finally, the product leadership approach where the organizational objective is continuously producing state-of-the-art products (Traecy & Wiersema, 1993). These approaches can create a clear vision that will lead the entire company, and stimulate employees to look at specific innovation in relation with these objectives. Martins & Terblanche (2003) divided the determinants of a culture stimulating innovation into five characteristics: strategy, structure, support mechanisms, behavior and communication. Although it was previously mentioned that competition is not good for a failure tolerant culture supporting innovation, Martins & Terblanche (2003) argue that within the determinant of behavior, a competitive culture could be beneficial for innovation. Managers should encourage debating ideas and create a constructive conflict that leads to information flow.

Overall, there are clear similarities between a failure tolerant culture and stimuli of innovation. It all starts with the culture, the manager and the people. In both, they play a crucial role as anchors to create that kind of failure tolerant culture that is stimulating innovation. Next to this, or even more important, is the manager. A manager is responsible for creating a culture and for opening up the mindset to a more innovation company. Next to this teams, individuals, suppliers, externs, government and customers are part of this culture that promotes intelligent risk taking, learning and innovation. Without them, without communication, without listening and without collaboration a firm will not be able to innovate. In this literature review, I tried to give an overview of what is written about failure, learning and innovation. Now, I will look more into detail, on companies in Limburg, Belgium, and how they learn/ed from their failures, and which methods, policies, and visions they use to innovate from their failures. This leads to the question: 'Does a failure tolerant culture stimulate innovation?" This central research question is subdivided into the following more specific research questions based upon organizations in Limburg, Belgium:

1. What do they see as failure/understand as failure?

2. How do they create a failure tolerant culture?

3. How do they use a failure tolerant culture to innovate?

3. Research design

Method

The method of qualitative research employed in this master thesis consists of multiple case studies. Using this method was most suitable because the focus of my master thesis is answering 'how' and 'why' questions. The research is based on a collection of face-to-face interviews, using the methodology design advanced by Yin (2009). According to Yin (2009) case studies are suitable for exploratory, descriptive and explanatory research. Next to Yin (2009), the methodology provided by '*The long interview*' of Grant McCracken on how to conduct a semi-structured interview is used. Finally Eisenhardt (1989) is used as a basis for finding theories out of the data analysis. A cross-case analysis of 15 companies (of which eleven are B2B and four B2C companies) was undertaken to investigate the relation between failure, learning and innovation. The interviewees were carefully chosen so a prediction of similar results across cases or contradictions can be made. They provided me with situated insights, rich details and clear descriptions on how they feel about failure, learn from it and innovate. This design does not restrict interviewees with a theoretical frame and allows unprejudiced insights into the topic. They can respond with ideas that come to their mind more freely. Furthermore, it doesn't force them to follow a fully structured survey, with the benefit of deeper insights. The context of each interviewee will be different, although the main focus stays on learning from failure. This enables me to explore differences and similarities within and between cases. From this point of view, I achieved a better understanding of the innovation process due to learning from failure. For the purposes of this master thesis, the main advantage of this methodological approach lies in the possibility of thoroughly investigating an individual and his/her progression over time, within a real-life context. Conducting and analyzing a multiple case study was a very time consuming task, but the outcome is considered robust and reliable.

Before the start of the interviews, I developed a semi-structured interview guideline, see appendix, to guide the conversation. The interview guideline was designed to be finished within 60 minutes. The questions were divided by the research objectives, and the questions were all the same for each interview. Additional to the first interview, interviewee 1 went through my interview guideline to pretest my interview. We exchanged some ideas and questions that could be more beneficial for further interviews. I started with very open questions regarding failure, innovation, learning and culture. The interviewee could answer openly and freely to my questions. When the interview was in progress I probed into detail about what was relevant for my master thesis. The sampling procedure was theory-driven. At the end, the interviewee had the opportunity to ask questions to the interviewer. Almost all of them said I could call them for further information. In the following figure I structured the main topics of my interview guideline:

The interviews took place between the 10th of February and the 10th of March 2016. Different locations, such as managers' offices and business bars, were used. One out of the fifteen interviews was conducted via telephone. The interviews were recorded and transcribed with a total of 71 pages. The average duration of the interviews was 50 minutes; the shortest lasted 18 minutes due to a meeting of the manager and the longest lasted 75 minutes. All the interviews were conducted without further interruptions. The interviewees answered in their mother tongue, which was in Dutch. In the beginning of the interview, they were promised anonymity. They were also offered an individual analysis of my master thesis. Additional sources for data collection are used in order to strengthen my research. Documentation includes notes from the interviewees, company websites, companies' magazines, product descriptions and whiteboard writings copied by myself. Details about the organizations are shown in figure 2 p. 60, appendix. The most important characteristics of the participating organizations are covered.

In preparation for the data analysis, the taped interviews with an average duration of 50 minutes were transcribed and coded in English. MAXQDA12, a professional software for qualitative data analysis, is used to code the interviews. The software did not do any analysis for me, but it served as an able assistant and reliable tool (Yin, 2009). For the conclusion of my master thesis, relevant citations were used. During the transcriptions, the interviews were also anonymized and in further analyses the title of their function will be used (or the interviewee number). No personal or organizational name is used. For the data analysis, first of all a within-case data analysis is made. This will gain familiarity with data and preliminary theory generation (Eisenhardt, 1989). Then relevant patterns and relationships across them were searched and compared. Cross-case pattern searching consists of searching for similarities, differences or patterns across different cases. This forced the investigator to look beyond initial techniques impressions and see evidence through multiple lenses (Eisenhardt, 1989).

First of all, I set up some codes that were relevant to me while analyzing the cases (e.g. process/product innovation, small/big failures, learning from failure, collaboration, punishing failure, communication, solving failure, preventing failure, using others help, feedback…). These codes are based on the research question and the literature review with innovation, failure and learning as most important headings. After analyzing all the 15 cases, I used these codes to see what codes come back most often. The most repeated codes will be the main focus of my findings. Another important aspect from the codes was the relationship between cases. I looked for similar codes among cases, to find out what typifies a certain code. Informal communication for example comes back at the cases where fewer employees are working. Then, I bundled several codes to set up themes. Codes like small failure, daily failures, big failures, product failure… were bundled under the theme *failures*. Finding relevant themes was a challenging task, I had to open my creative way of thinking supported by the literature review. Discussions with my (co)promoter, to clearly group these codes, were done in advance. After finalizing 15 interviews, a clear point of saturation occurred and all the themes (failure, learning and innovation) are clearly filled with useful information by the interviewees. This is a necessary step in the process of building a theory from case study research (Eisenhardt, 1989). For the data processing, I followed the steps 'analyzing case study evidence' provided by Yin (2009). The goal of my master thesis is to uncover patterns, determine meanings, construct conclusion, build a theory and a decision making guide for managers. The different findings of the multiple case studies are placed in a table for a clear

overview, figure 6 p. 62-65. Different themes (groups of codes) are made on the company's different characteristics: size, sector, revenues, total employees, and place at lifecycle. Because characteristics of the firm can influence the frequency at which members of project teams are exposed to failure (Shepherd, Haynie, & Patzelt, 2013). Then, evidence is searched to look for the 'why' behind every relationship (Eisenhardt, 1989). Finally conclusions are made comparing them with the existing literature, both conflicting as similar literature (Eisenhardt, 1989). These conclusions are discussed with several independent individuals like: a high school teacher in marketing, a doctor in sociology and a institution about creative entrepreneurship. To strengthen my findings I will make them more observable with the help of a summarized framework. At the end I will give advice to managers on how to effectively deal/manage failure.

Research settings

As I try to gain deeper insights in the processes of organizations on how they learn from failure, I did not focus on a particular group of organizations. Given my interest in the link between failure and innovation, I contacted 23 companies. Out of these 15 companies were successfully contacted, followed by an interview. Figure 2 p.60 shows a complete and chronologic list of all interview partners and their functions. The eight companies that I contacted but were not interviewed was caused by: not answering repeated mails; not answering repeated phone calls; no person felt called to be appropriate; were not interested and asked to search for other companies and not finding the right contact person after being send forward different times. While there is no clear focus on a particular group, I make sure that the red thread running through my interviews focuses on learning from failure and the way organizations create a failure tolerant culture. The organizations were chosen based on several criteria and expectations of input.

Interviewee 1 was an expert and innovation advisor in the Innovation Center of Limburg. He recommended me also to read the 'Lean Startup' of Eric Ries, before I started my analysis. This provided me with insights about learning from failure and how cyclic innovation processes are an advantage for companies. Interviewee 1 connected me with four other interviewees from different companies: a Bio Tech start-up, two logistic companies and a company providing measurement solutions. The logistic companies were facing difficulties due to the refugees in Calais, deformation of trailers, quality of products and logistics. They both solve and prevent failures on a different way and their purpose of learning is completely different.

Two hospitals in Limburg, Belgium are interviewed because Cannon & Edmondson (2005) argue that failures were caused by the entire system rather than being the fault of a single individual. And additionally, medical errors tend to have multiple, systemic causes. I tried to get a better insight of learning from failure, based on this statement by Cannon & Edmondson.

Furthermore, my personal network has helped me to arrange six interviews. I already knew through them that those companies had all faced small and big failures in their daily operations. One interviewee is an Adjunct Engineer area northeast of the Belgian railways. He explained clearly what happens if a train driver passes a stoplight. This is the highest degree of seriousness under his qualification. Secondly, a sales manager of a metal processing company explained what happens when a trailer faced an unforeseen, never happened failure due to a liquid leak. My third personal connection was with the managing director of an energy company, which faced a major downturn in their electrical capacity. This decline in capacity was caused by a product failure

established on their solar panels parks. They applied "reverse engineering" to analyze the product problem, and made a disruptive innovative product that they are selling already. The fourth interviewee is a technical manager of an innovative building company. The innovation advisor stated that they are indeed one of the most innovative building companies in Limburg, or even Belgium. I asked him to talk about their innovativeness and their new product they are using to prevent failures on the wharf. They want to go to a zero fault percentage on the wharf using this product, and they are even making it better. The last interviewee has been resulted from my last student job. I contacted the general manager of the biggest leisure park in Limburg and beyond. They won the price of excellence (best park in 2015) and he changed the entire approach of managing, inventing his own methods and focusing on the wellbeing of his employees. He believes clearly that employees are the heartbeat of the company. According to Richard & Ralph (2002) and Cannon & Edmondson (2005) this is a crucial factor of changing the mindset of people and creating a failure-tolerant culture. The last interviewee arranged was due to a chat with a friend. He was telling about all the roadblocks they were facing making a new automotive tricycle. Via him, I contacted the mother company that is making powertrains for the automotive industry. They are so innovative that they face difficulties on a daily basis. The advanced development manager explained how they use failures to innovate, make better products and even teach new employees.

Via Internet, I encountered the following organizations because they all did something very innovative, or talked to managers about their process to their innovative product. These organizations were contacted by telephone and agreed immediately. The first one was an organization providing import services for companies. They won the 'innovation hero'-price thanks to their innovative product they made, namely a high quality summerhouse. This was totally beyond their comfort zone, and they were facing a smaller problem that they overcome by collaboration. Next to this, I contacted a system integrator in business to healthcare. They call themselves the 'Tesla of the Telecom'. They disrupted the market with their innovative system provider. While developing this product, and changing from seller to maker, they came across a lot of obstacles. They managed everything quit well, but the company has had a lot to endure.

Besides this, the preconditions for the interviewees have been that they had to operate in the higher management, and that they had spent at least three years in the organization. Excluding the managing director of a start-up I interviewed, they were only operational for two years. All the organizations were operating in Limburg, Belgium.

Subsequent to the previous section, this section will give more specific characteristics about the specific industrial setting of all the companies. The first interviewee is an expert in innovation consultancy for companies. His company helps small and big companies with their innovation processes. Interviewee 2 is a metal constructer in a very cost-based and weight-based sector where they make trailers. They have one huge competitor; thereby they try to lower the cost. It's a sector in which a lot of products are standardized. Interviewee 3 delivers qualitative products they have chosen in China, based on preferences of the European customer. They transport the good most of the time by water. Next to this they are manufacturing qualitative summerhouses, with witch they have won an innovation price. Two companies (Interviewee 6 and 9) are based in the logistics sector. This sector has become (especially after the crisis of 2008) a very cost-based sector. The logistic service is seen as a cost for each company, that's why both companies have

been innovating with the aim of lowering costs. Although they are based in the same sector, there's an interesting difference between both. One is focusing on a more problem-solving approach of innovation while the other is focusing on being an innovative partner for others and looking into the future creating their own opportunities.

Following the same approach of innovation, one out the two hospitals (Interviewee 4) is very innovative being a platform for potential start-ups in the health-care application. In contrast, the other hospital (Interviewee 5) is stimulating their employees (and doctors) to be more entrepreneurial to foster innovation. They are working more from the inside out. Still, both of them have a very strong organizational culture. Despite there first concern to care for patients, they are focusing as well on profits and being the best in what they do. The healthcare sector is always looking for the best devices and doctors, going along with the fast growing technology. Interviewee 7 is located in the competitive sector of telecommunications. As a system integrator they serve a B2Heathcare service. They are focusing on systems for the healthcare sector. Interviewee 8 is serving a specific niche market of test and measurement solutions for companies. They work with big companies worldwide. This industry and service is less competitive but investments are costly. The entire business is rest on trust, because they are working with all kind of companies that are close competitors of each other. Interviewee 11 is located in the construction industry. This industry is as well very cost-based. Strong disruptive innovation is rare in this sector, although companies keep looking for opportunities to improve their quality. Limburg has a strong construction industry and is employing a significant part of our population. Interviewee 14 is the only player in the Belgian railways industry. Being a government owned company with no other competitors, their main focus is serving travellers and ensuring safety. Interviewee 13 is market leader in the leisure parks industry. They have a few competitors but they are serving another level of the market. In Limburg, they are basically the only organization providing specific leisure services. Interviewee 10 and 12 are start-ups, the first one is active in the biotech industry. The product they provide is a very disruptive innovation. Bigger companies willing to buy their product have approached them but they continue doing it on their own. The second start-up is selling a product in the renewable energy sector. It's a worldwide market in which they try to target one percent of the worldwide solar panels affected by the problem. One direct competitor (with the same product) is competing in the same market. The last interviewee is a producer of powertrains. It's a very dynamic and fast moving sector worldwide, wherein technology and innovation are strongly present.

4. Findings

This section begins with a general introduction about the findings of the qualitative interviews and how this section will be build. Following this intro, a stepwise guide for managers will be presented: beginning from failure to innovation. Everything in between will be provided with crucial information, especially how organizations can learn and create a failure tolerant culture: Where to be attentive? Where to ask for help? Where gaps may lead to extra costs? Following guideline, processed out of my findings, is used:

Insert figure 1 p. 59 'from failure to innovation- a managerial guideline' here.

Thereafter in the discussion and conclusion part, different relationships between meaningful parts of the empirical and literature study will be drawn to answer the research question and to provide managers and researchers with useful recommendations. After the interviews, it's clear that operating an organization without failures is unthinkable. When asked about how the managers would define *failure* a series of descriptions is given. Going from wrong interpretations to major financial losses. All the interviewees state that they accept failure, under certain circumstances, and learn from it. Without exception, a repeated mistake by the same person is beyond the pale. This could lead to unpleasant consequences for the person in question, even the company stimulates an open-minded and failure-tolerant perspective:

> *"We once had a quality manager that is fired because he repeatedly made mistakes. Then, the company goes before the individual"* - Interviewee 3, Managing Director.

The way in which organizations handle failure differs depending on the characteristics of the organization and the features of the failure. For a clear overview of the failures and the way they handle these failure, insert figure 6 p. 62-65 here. This figure explains what kind of failure occurred, how each organization deals with it and how they innovate from it. As shown in figure 6, different methods in handling failure occur: working in teams, immediately solving, following a clear process, solving by others and collaboration. Besides the process of handling a failure, all the interviewed organizations (from now on this will exclude 'the innovation advisor' because they give advice to organizations) try to prevent and solve failures and finally learn from it (or/and innovate). Avoiding small preventable failures is most of the time done by several standard/norming methods[11]. If companies use standard norms, conformity/harmonization should be injured. On the website of ISO, they say that one benefit of standard norms is optimizing operations and therefore improve the bottom line[12]. In the literature is written that inexcusable (small) failures occur because of the lack of regularity combined with the human aspect of

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[11] ISO & DIN-norms, Lean and Mean, 5S-method, accreditation for hospitals, internal and external audits, SQS (Software Quality Systems), GDP (Good Distribution Package), GLP (Good Laboratory Practice), CE & TUFF-labels etc.

[12] http://www.iso.org/iso/home/standards/benefitsofstandards.htm accessed on the 29th of april.

attention (Alexander, Berthod, Kunert, Salge, & Washington, 2015). Interviewee 15 even said that they are trying to get an ISO-norm, not only for this, but then small failures in the daily activities could be lower: how to deal with deliveries, how to deal with packages, quality features… When all these procedures are standardized, clearly written down and methods are accessible this could lead to less (small) failures. Thereby it's important that employees still have space for improvement. Besides the *'good practices'* employees should have the opportunity to experiment next to following the procedures. Although organizations use these methods, using specific failure and risk analysis methods like FMEA, route cause analysis and fault-trees are rather rare.

While preventing and solving a failure is mostly common sense, sharing it is still uncultivated land for most of the companies. Reasons for this are lack of clear storage, no clear policy and the mindset of people where 'no blame-no shame' is still part of the culture. Clear/transparent storage of information about the failures or knowledge is crucial. If every individual in the organization can benefit from it, sharing failures becomes part of the culture. However, companies are more likely to talk about their successes than about their failures. Nevertheless, this is slowly changing compared to previous years and organizations are working to develop an easygoing system to share their failure and to storage them, for example Intranet and databases.

Regarding the learning approach of organizations, which includes employees, it's no surprise that everyone learns. But learning is seen in different aspects. Organizations learn from failure/success, learn to stay up-to-date, learn from others stories, learn by trial and error and learn to get to know the company. A lot of organizations especially learn from previous projects, successful and failed projects, together with the culture of continuous learning. An interviewee said that there is a necessity of learning from learning, and that everyone in the company should take part in the learning process to be more innovative:

> *"Learning^2 (learning form learning) is learning how you learn and getting better in this is crucial (…) to be more innovative." – Interviewee 1, innovation advisor.*

While asking the interviewees about learning, they automatically relate this to measure. Out of all the organizations, twelve were measuring their improvements in all sorts of ways: experience curves for employees, knowledge matrix, and lessons learned platforms… This explains the importance of the quote shown above. Everything that has been done should be analyzed and interpreted even if it's a small project. The interviewees did not go into detail about how they learn from measuring or learning, but most of the time they would like to see improvement in the yearly reports of, for example, fault percentage. Using solving/prevention methods better or more efficient than before can be an example.

Concerning innovation, it's surprising to see for what purposes and reasons organizations innovate. In this section of my master thesis, the main focus will be on innovative projects caused by failures and the process, struggles and methods used turning failures into innovations. One major struggle in the process is the financial aspect of innovation. From start-ups to mature organizations, resources are one of the biggest obstacles. Except for companies that have built up a strong

financial buffer. They can take more measured risks than others. After having finished all my interviews it was clear that failure is clearly linked with innovation, and I will clarify this with real-life examples mentioned by the interviewees. When linking the fundamentally solved failures (solution found and effectively used) with innovative projects, there was a circa 75 percent relationship between them. On the other hand, when failures were solved temporary, there was only a 40% link with innovative projects. Next to solving failures, the role of customers and employees in the process of failure and innovation should not be underestimated. They provide the organization with crucial feedback, ideas and opportunities that stimulate innovation and preventing failure.

Failure: a perspective of companies in Limburg

In the literature failure is mainly defined as a negative deviation from expected and desired results (Cannon and Edmondson, 2011). At the end of this section, I will compare this definition of failure with the one from all the interviews. When the managers were asked to describe failure for their organization, a wide range of answers was given:

> Insert figure 5 p. 61 about "failure" here.

It's clear that the point of view from the managers regarding failure is very diverse. However, we can group the different understandings into more specific groups. Keep in mind that most of the failures did not affect the customers from the interviewed organizations. Failure is seen as financially related, the human factor strongly exists, a combination of factors that had never occurred before, has a negative image, lack of experience from new employees in the daily operations, comes in all seizes and occurs in all departments. More than fifty percent of the companies were facing process failures in their operational activities. Although, all of this, it is seen as a learning opportunity. Well, out of all this information, failure can be defined as '*a relative multifactor phenomenon with negative consequences*'. An explanation:

> Each failure is seen from a different point of view, in a different stage of the life cycle by different departments in different organizations. This is why each failure should be analyzed separately. Copying someone's solution to a specific failure is not eligible. But that does not mean that processes of handling previous failures couldn't be useful in categorizing, explaining and solving current failures.

> The multifactor part of the definition points out that failure is in the majority of the cases seen as a process of multiplied mistakes by the entire chain. Interviewees were saying that '*the entire system failed', 'every individual in the process is responsible', and 'the failure is due to an accumulation of smaller mistakes or a congestion of unforeseen things' and 'there is not only one single person involved in the failure, but a whole chain*' in stead of pointing out to a single individual. Only by repeated failures organizations will point out and punish a single person.

> Every failure comes with negative consequences (failure still has a bad side, next to all the learning opportunities) for the organization, the individual or externals. The negative outcomes can be related to financial losses, loss of time, dismissal, structural unemployment, no ROI… actually everything that costs a company money. Interviewee 2, a sales manager, for example answered:

'actually everything that costs us money (…) this includes research, (in)direct working hours, materials and more…'. Finally, the failure should be visible. This doesn't mean that there will be a solution for the failure, but at least someone is aware of the failure. Without noticing that you made a mistake, you cannot learn from it. Failures occur on a daily basis. Although, there is a difference between 'a wrong calculation, interpretation, decision' and 'a train driver passing a sign with hundred of travellers", organizations should learn from all of them. The first mentioned can be solved within five minutes by the person or team itself, but some others are forced to communicate with the entire organization. The following part will explain how companies act upon failures.

Handling failure – a learning approach

According to the interviewed advisor of the innovation center, organizations should approach failure more quickly and fail smaller. This is parallel with the change in the innovation paths. Before, innovation was approached more linear. Nowadays, innovation is more cyclic. You try, evaluate, learn and then either continue or stop. The goal is to keep your failure as small as possible. *'The gap of your failure should not be too big, this will tackle the entire entrepreneurial flow."* is an expression of interviewee 3, in which he was very clear for saying that companies should ensure not failing too big. Out of the interviews, I can conclude that organizations try to act fast after a failure appears and if they recognize the failure as such. This is one manner of keeping the failure as small as possible (after it occurred) and it's done in several ways. The most mentioned (73%, 11 out of 15 interviews) is that they will immediately try to solve failures if this is a smaller failure and learn from it, especially the persons directly involved. They try to solve it on their own, with the group they working with or together with the team leader. As a leader it's important to know that failures occur and be solved immediately. Why? Still, one third of the interviewees mention that failure is something not completely safe to talk about. People will not talk openly about their failures, they are reframing their mistakes and older people are more fixed minded than younger people. Taking into account different personalities. A response of an interviewee, asking about handling a failure:

> *"The culture in this company is that everyone tries to correct their mistake. But no one will tell you: 'Hey, I made a mistake'. They will try to solve this problem, within their group or with their team leader. And especially, if they can do it on their own, they will (in matter of chance). If the failure is too big, or overarching, then the failure will end up at our desk." – Interviewee 2, sales manager.*

Analyzing this example, gives us more insights about some of the pain points of a failure: one, people are likely to solve failures on their own because of the bad image. Second, if managers do not communicate with their team leaders, supervisors or others failures end up at their desks. Maybe it would be too late already. Overcoming this will be discussed in the section about creating a failure tolerant culture and communication, knowing it's an important aspect how managers are present in their organization.

Solving failure

An interesting representation of the used analysis can be drawn. I will shortly describe every method use by the interviewees:

- Ad hoc solutions (solving problems as it comes): the failure is analyzed by a group of individuals (managers and related people) and they try to solve this failure. First of all, the most crucial questions were asked: the cause and the consequences. Then, scenarios are evaluated but most important a solution should be found. In all the cases this was the most important issue, together with the wellbeing of the customers and employees. Interviewee 2 did not use a real structure, and finally they did not find the real problem (and solution) and spent a lot of money and time. Nevertheless, they fixed it using a temporary solution. What they learned is that they should locate the hours and money spent on solving this problem to a specific department, aka activity-based costing. In a later stage, they were able to analyze the improvements. They had to make the decision in continuing with solving the problem or stopping it due to the huge amount of money absorbed by this problem. They decided to stop because no added value was guaranteed when finding the real cause or solution.

- Using structured analysis methods:

• Quality improvement plans (PDCA): plan, do, check and act. When interviewee 3 faced a problem, '*our first step was to check what went wrong, what is the real problem (analyzing the real situation/problem) because it could make a huge difference'.* A certain circle will be evaluated beginning with the problem and ending with looking what has to be changed. Together with this, the manager approaches the persons involved on a human friendly way to talk about the failure, combined with a more business minded approach to prevent this next time. Derived from this, and frequently used by organizations using a lean-management (6sigma) approach, is the A3 Lean Method.

• 'Swiss Cheese model': this method of accident causation is frequently used in risk analysis, including the healthcare sector. They use this model to analyze each layer of the process, so they do not individualize a failure. Different layers lie between beginning and end, but if all these are aligned a failure can occur. They try to analyze all of them.

• FMEA (Failure Mode and Effects Analysis) & Fault-Tree analysis are used by a few organizations (33%). The FMEA is used to '*ensure that nothing, or at least that's what we're hoping, goes wrong in the building process and the software'* and the fault-tree analysis is used '*when people come up with a problem, we try to analyze what happened. We are setting up fault-tree.'*

- Using external brains: 53 percent of the interviewees used an external brain in the process of handling a failure. Reasons are: '*I try to do my best with everything our core business is making money with. And everything that is not will be outsourced'*, '*we didn't have the experience for this, so we hired someone for 6 months (…) solving a problem (…). We're actually buying knowledge."* and *"we were end of story finding a solution"*. One of the companies combined the recruitment of a temporary brain, with the training of their employees. They let one (or two) employees walk with the person. They can bring this knowledge into the company. Hiring an extra person (not specific for an unsolvable problem) because a failure occurred that has to be repaired quickly was another

reason for an interviewee. To often, especially SME's, organizations use too less external brains to accompany them.

- Precisely formed groups: 73 percent of the interviewees were saying that they use groups to solve problems. Out of this percentage, less than half is using precisely formed groups to solve and act upon the occurring failure. Interviewee 8 explained how they use a 'Guru System Scan' to search for the right employee. If a problem occurs, they enter a specific capability into the system (based on a database where people can enter their and others capabilities) necessary solving the problem. According the COO of interview 8, the '*Guru scan is good to find people"* especially when organizations are working on different locations. The 'Guru System Scan' is, as well, used to see which capabilities are missing relating to the company. The organization can search more specifically for new employees. Interviewee 11 let groups work during their actual working hours, at their specific failure or problem: '*We're putting the people of this failure process together and then we try to let them (as quickly as possible) solve the failure (…) sometimes this is just a 30 minutes solution, or a series of 30 minutes or maybe even 5 minutes.'* They are doing this, because from the company's point of view the system failed. This will stimulate employees to talk about their failures more openly.

> "*Because safety is crucial, they go all the way until it's a conclusive case."* – Interviewee 14, Adjunct Engineer, about finding solutions.

Additionally to these failure analysis methods, the methods used by the Belgian railways are very orderly and gradual processed. Well, passing a sign is a very serious failure. First of all, the train driver is set on active reserve. Then, different persons will investigate the failure in all its aspects. While this process is ongoing, the train driver gets personal assistance. He needs to retake every exam, gets some time off, has to be evaluated again and the feedback is send back to the organization and stored in a database. While this is a serious failure, everything is done to support the train driver in this process of analysis. Finally, a research team investigates everything which may have caused the failure related to organizational settings (infrastructure, light tension,…). When this would be the case: a group of engineers and developers will try to solve it. When a solution is found, it will be used at other places. That's how further failures can be prevented.

Preventing failure

Directly linked with the solution of a failure is preventing the next one. Getting to solve this failure, will teach you how to prevent it next time. Using this information by coding it to specific other failures, projects, departments or organizations can be beneficial. Over 80 percent of the companies mentioned that failure is caused by multiple smaller failures or a combination of different factors. Preventing failure (or identifying) so starts with analyzing every (small) failure. Out of the interviewees, the conclusion can be made that there are different methods for failure prevention. Generalizing prevention methods is not preferable, because each failure and company is different. But by coding and using it efficiently, it can guarantee competitive advantage.

The first one, probably the most common, is *continuous measurements* (similar to continuous improvement). Key performance indicators (KPI's), for example, are used by almost

half of the organizations. These KPI's are important factors in the organization crucial to the strategy and the progress of the organization. The most mentioned KPI's are financially (sales and profits), customer related (percentage of clients) and two organizations used a failure-percentage as a KPI. Using financial KPI's is most of the time based preventing '*loss of money or wrong investments'.* To get an overview of all these KPI's organizations can, for example, use the 'Traffic light system'. Green is achieved, orange not yet and red not reached. Additionally to this, organizations are aware that they continuously need to measure, learn, improve and look for opportunities. Preventing such kind of failures (very small, and most of the time not yet crucial) will mostly result in process innovation. For example: too much negative feedback by patients (hospital), too many faults at one trailer (production) and too many costs for transport (transport) were reasons to check the processes and to improve them. By doing this further failures were excluded or declined.

Secondly, the interviewees are using standard procedures to prevent failures[13]. More specific to hospitals, an accreditation is pursued. This is an audit by an independent organization to get recognition of competence or expertise. The reason why some of the organizations (27%) did not use standard procedures, was because they saw no added value. 40 percent of the companies are using a lean management philosophy to maximize their customer quality focusing on reducing waste. In this way they overcome smaller failures occurring during there operational processes. For example, they can anticipate on unnecessary costs and time, which are basically one of the combined factors that can lead to failure. These standard procedures and management approaches however, ensure that preventable mistakes could be avoided. FMEA and fault tree analysis could prevent failures as well. Although, no research is done about this relation I believe that these standard norms can prevent the small failures. Why? I can lower the inaccuracy just by saying how something should be done correctly to achieve the demanded quality or to focus on waste.

Another method used, by interviewee 15, to prevent failures in a high-risk project is the 'tollgate methodology'. This method divides the project into phases. After each phase, there is evaluation in which the company decides to go further, stop or go back. Organizations very busy with R&D, had clearly mentioned that failures in high-risk projects should be limited to the minimum compared to projects in the developing stage. Prototyping and experimenting are specific methods used by organizations developing new products. While doing this, they could face possible failures and prevent them. One interesting element was giving by using this method. While controlling each phase, organizations can discover a more useful method for the process (that's for example better, more innovative, less costly) but the project is already in a too far advanced stadium. It's then very important to clearly store this 'element' and do something with it: sell it, use it later or drop it when it isn't valuable. Communication is crucial at this stage.

Almost every company is sure that the time spent in advance of a project is beneficial for further development. Asking the right questions, discussions, communication with employees, customers

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[13] International Organization for Standardization (ISO), Deutsche Industrie-Norm (DIN), Software Quality Systems (SQS), Good Distribution Practice (GDP), Good Laboratory Practices (GLP), Service Level Agreement (SLA), Standard Operating Procedure (SOP) and Non Conformance Report (NCR).

and external partners can lead to more information/feedback about the project. Actually, organizations should raise awareness in front, focusing on the potential dangers by answering and asking questions. Again, the leader/management plays a crucial role in stimulating the employees to be curious, open and helpful. On of the two hospitals uses inter-organizational groups (based on departments). They are controlling each other on a regular basis to prevent failure. They do this by analyzing and listing the 'pain points' of their operational processes. When they come back, these 'pain points' should be eliminated. Interviewee 7, making a very innovative product in the B2healthcare sector, asked for advice in advance and they were thankful for it. Companies should put the '*HOW BEFORE THE WOW*' to prevent failures in the future:

> *"They asked the right questions: you are making this, and what will it cost, what are you making out of it and what are you markets? (…) this provided us with very useful information and insights (…) everything was questionable."*
> – Interviewee 7, putting the how before the wow.

Despite companies try their utmost best to prevent failures, as long as firms are working with human beings failures will exist. '*Humans who aren't making mistakes, aren't humans*' but a manager, while discussing their methods of prevention, said 'we're fine-tuning our process continuously to diminish the failure percentage.' For example, working with coaches and learning curves. As a coach or/and the learning curve declares that the employee is not at the expected level of knowledge, actions have to be taken. These actions differ with each individual. This could be extra training, online lessons, and/or extra exams. When this does not fit the organization, employees can be fired or placed back at basic level. So, organizations can prevent failure, but they will never be able to exclude them as long as the human aspect is involved. Previous sections about analyzing, solving and preventing failure are all part of the overall (failure tolerant) culture of the organization, which is at his part directly linked with communication. Without an open communication, a failure tolerant culture will never exist. In what follows further explanation is given.

Two crucial moderators for culture and innovation
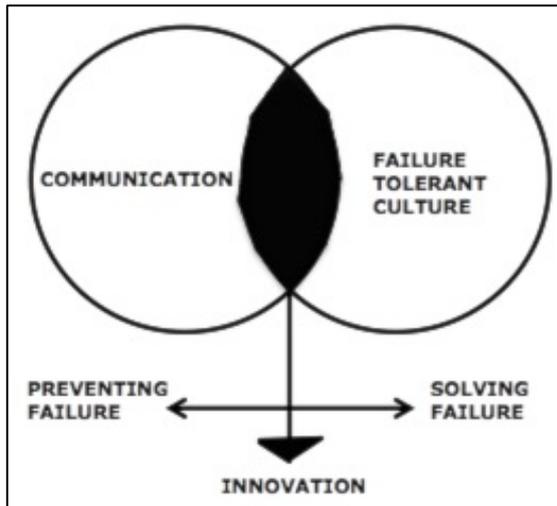
Although, *communication* and *a failure tolerant culture* are separately analyzed, they complement each other in efficiently solving and preventing failure that can lead to innovation.

Communication and a failure tolerant culture need to interact. They both are needed to efficiently solve or prevent failure, which can eventually lead to innovation. I believe after my research none of them can stand separately in the process from failure to innovation.

Communication

The methods used to communicate a failure are quite similar. But, smaller companies (in quantity of employees) are communicating failures differently than bigger companies. As we compare the three companies with less than 15 employees, they act similar facing a failure. They are communicating their struggles with each other, in a more informal way. They will meet each other as well but, less than in bigger companies. Continuing on this, three interviewees said that while growing, their storage of information becomes more important. They were busy with storing their information in a database or Intranet. They said that a huge amount of information, gathered in the heads of every organizational member, could be used more efficiently. Interviewee 15 works with a 'Lessons Learned Platform'. Every employee can access this platform and share their failures or things they have learned (this can be used to prevent failures as well). Comparing the larger organizations in my research, they all meet monthly to talk, with a group of managers, about the different problems/failures occurred in the past month. After the meeting, the managers will communicate the crucial information with their direct co-workers, as they further spread the information to the frontline employees. Other methods for spreading and receiving information are: monthly meetings with the employees (2/15), giving presentations about the way the companies is working for new employees (1/15), working with a closely connected trainer (aka a coach) (2/15) and surveys (8/15). A short line of communication (managers-employees), due to a family business, flat structure or a specific culture, is listed as an advantage in communicating failures. One company said that failures were spread by informal contacts between employees in the corridors. Stories about failures could end up as rumors. This is negative for creating a failure tolerant culture. Although no research about this relation is done before, I strongly believe that there will be a link between those factors. Interviewee 4 confirmed this by saying '*we decide to communicate before the rumor spreads*' and another interviewee said that there is social control in their company but employees then cultivate a quilt feeling. So communicating before guilt feelings and rumors are spread is better.

Communication is an important factor in general (internally and externally), but it's very useful as well solving/preventing failures, creating a failure tolerant culture and stimulating innovation, for example: sharing failures, discussing in front what you're expecting and listening to everyone in the organizations are several communication methods used by the managers to prevent failures. Communication can be seen as a moderator for preventing failures, analyzing them and finally innovating out of them. Several case studies confirm this relationship. Communication is one of the features that can stimulate innovation, but how? Via direct and open communication managers can access crucial information about what's going on: thoughts, ideas, doubts and other point of views form every individual is valuable. This relation is very specific related to younger, smaller firms (interview: 3, 10, 12) and organizations that are into R&D (8, 15). Via internal created rules they regulated this communication. The 'headphones'-rule is a rule where no ears, one ear or two ears covered means I want to talk, busy but I can talk and do not disturb. Another rule set up internally, is the '2 minutes conversation'. When, people go grab coffee somewhere they can have a chat for two minutes or can disturb someone. This might not be efficient but it creates an open culture. Larger companies have a more structured way of communication. They communicate by levels, because direct communication with management is not preferable although it can happen.

Finally, it's the crucial task of the manager to effectively use this form of information. Actively listening, talking, stimulating and being among your employees is invaluable.

A failure tolerant culture

Coming back to the definition used in the literature review, a failure tolerant culture is a learning organization being more adaptive to failure where people (with an open-mindset) feel comfortable taking intelligent risks and causing failure. This includes a higher rate for failure, de-stigmatizing it and eventually learning from it (Edmondson, 2011). Regarding the interviews held there are differences in how organizations create or hold a culture. An overview:

Insert figure 3 p. 60 about "culture" here.

Out of the interviews four strongly existing factors, are defined: employees, culture, collaboration and a clear future. Employees are mentioned, by over 90 percent of the interviewees, as crucial factors in the daily operations of an organization. First of all, I will systematically explain how employees contribute to the organization and why positive minded employees are one of the most important resources. It's clear that when employees feel good, safe in whatever they do, being heard and useful… they will contribute to your organization. Important to this, and said by 70 percent of the managers, an open culture should be managed by a structured team. Interviewee 3 explained this nicely in their philosophy by saying that everyone is at the same level based on personal relationships, but functional hierarchy comes natural wise.

The mindset of employees is a vital factor, cited by a sales manager: *"Open-minded people are the ones pulling the car".* However, one cannot be considered as another. Frequently said by the interviewees is that the mindset of people (and the way failures are dealt with) differs to each person and department (and organization). Although, getting to know your employees is the basis.

As said before, 8 out of 15 interviewees are using surveys. They try to acquire information from their employees, like their wishes, (dis)pleasures, thoughts and more. As manager, it's therefore important to do something with this information. Employees, then, feel appreciated. Let's point an example. There were two companies who changed to self-steering teams. One succeeded and the other did not. Despite, they work in different sectors, and were little different. The successful organization changed to self-steering teams because the employees would like to have more responsibility mentioned in a survey. The unsuccessful organization changed it because they thought is would be beneficial. Well, it was not. This example makes clear that listening to your employees or knowing them is important additionally to a certain culture. Creating this kind of culture is difficult, and it's not built in one day. It follows your process of development and everyone should add value to it.

> *"A lot of CEOs do not know what's going on, on their work floor and then you will take the wrong decision."* – Interviewee 10, saying his employees are the heart of his company. *"Every employee is working on something, but together on everything."*

When a manager (and the company) is paying attention to their employees by training, development, flexibility, listening, asking feedback and involving them… this can be a huge benefit for the organization. Developing employees with training, workshop, E-learning, coaches, group sessions were mentioned by the managers. An organization, which includes employees, should learn as well from their employees. Give employees 'time to do things', aka let them experiment. They hammer on the fact that their employees are the heartbeat of their organization, and that's why they are happy to say that their employee satisfaction is that high, said together with an 'our company'-mindset. But they all manage it well by putting effort, time, money, passion … and even 'thank weeks' in the management process. They believe that only then the entire organization is walking the same path, and the biggest part of this process starts at the top of organization. If the higher management is not stimulating risk taking, self-support, failure tolerance or initiative taking the entire chain will sputter. Whenever the relation between employees and their managers (or management) is not good, the culture will neither be good. A manager even noticed the change in management when the sons replaced their dad, because the sons know the company well but the contacts with the front-line employees were less. A manager is influencing the company by its contacts with employees.

This brings us to the part were a (failure tolerant) leader plays a crucial role. Around 50 percent of the managers were explicitly saying that the higher management stimulates their employees to be innovative and to think along with the organization. The employees confirmed this where organizations have kept surveys or meetings. Saying this indirectly means that, when something goes wrong, it will be tolerated more easily. Nevertheless, all the managers were in a unanimous agreement that they have to stimulate a 'What happened approach' to failures instead of a 'Who did approach'. Punishing failure (when it aren't repeated mistakes) is not beneficial. Real leaders take responsibility for what they do, can meet employees face-to-face when crucial changes have to be made and share theirs and others successes. The general manager of a leisure park was giving away responsibility. He made every other team member (8 members) responsible for one KPI and he was responsible for the missing link. So he invented his 'Atomium Model', 9

balls for each KPI of his company based on the monument of Brussels. Besides this, sharing others' failures can be of similar importance to sharing success, only when learning from failure is applied efficiently, like discussed before. Managers did not focus on their personal failures, but the overall attitude was that "it's better doing something that can fail than doing nothing". And this is something that mangers gave their employees as advice as well.

Organizations/managers focusing on internal marketing are more likely working with more satisfied employees. Although this cannot be generalized, out of the interviewees (4/15) using internal marketing, it felt that the employee satisfaction was higher than others. Internal marketing is used by organizations employing significantly more employees (+500) than others. This way of targeting their employees is done by Intranet, Facebook, weekly newsletters, monthly magazines, meetings or strictly chosen campaigns. Managers said that when they keep their employees up-to-date about the organizational novelties, they are likely to contribute more added value to the organization. When asking what they share, the answer was most of the time the innovative projects, the new things, the changes and the successful stories (or employees). Never besides one, the failures were highlighted. Employees should search them on the Intranet of databases (if companies are using this). When attending a conference, called 'FuckUp Nights'[14] in Hasselt where entrepreneurs talked about their failures, someone told that they are sharing (successful) stories about companies in Limburg on their website[15]. The remarkable fact is that the most read articles are the one dealing with failure. This confirms, once again, the fact that sharing failure is important. When we start doing this, the fixed mindset where (failure is seen as something bad) will start shifting to an open-mindset. To end this section about the human aspect of a culture, I would like to show you some expressions given by managers to create a failure tolerant culture:

> "*We are building a learning, improvement culture (…) where the entrepreneurial vision is stimulated (…) and where 'doing your hours and I'm gone' is changed to 'doing your hours and I contribute' – interviewee 5*
>
> "*I would call us the Tesla of the telecom (…) we're making next generation products" – Interviewee 7*
>
> "There is a hierarchy, but let us say that we hammer the hierarchy down every day (…) I put on the fire, but my employees are the cooks." – Interviewee 13

As an organization it's something difficult to know if your culture is good. Some try to measure it, or try asking employees how they are feeling. But according three managers, one good method to see what kind of culture you have is the *staff party.* Managers saying they have a good culture mentioned simultaneously that their staff party is a representation of their culture.

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[14] http://www.unizo.be/limburg/activiteiten/fuckup-nights-hasselt_14-04-2016

[15] http://www.madeinlimburg.be

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There are already two topics discussed that can create a failure tolerant culture: employees and leaders/management. These were the two main factors of creating a failure tolerant culture. At the same time, there were two other frequently mentioned topics: a clear plan for the future and collaboration (whereas networking is a part of) that are linked to a (failure tolerant) culture.

A clear plan for the future is mentioned frequently (60%) as one of the factors influencing the culture and the mindset of people. When your goals are not reachable, they will affect your culture. Interviewee 3 said that they rescheduled their targets due to the crisis, affecting their culture or company otherwise. Six out of the fifteen are using a '2020' plan for their company; they adjust their policy and strategy based on this. Or they use it to encourage people working with the company, achieving their goals. "*As a manager it's important to create a vision for your organization and employees, only then people bring added value to your business*" was said by another speaker on the FuckUp-nights. Clear plans are not just based on the entire organization, one interviewee, is using a plan to overview their growth: planning investments, trainees, new employees are all part of a clear future plan. As we look at the table, it's seen that the visions of innovative organizations are: entrepreneurial, being innovative, thinking about the future, growth, and development. While talking to the managers, they strongly believe in these missions. And try to pass this believe on to the organization. This only works when managers believe in the mission, creating a failure tolerant culture begins with a clear and SMART[16] organizational vision/mission.

Collaboration can be seen as working in groups to realize shared goals. These goals can be either be solving failure and/or innovating. The majority of companies (73%) collaborate with others, going from: employees, schools, customers, external innovation centers, competitors or partners. Collaboration can have many occasions. Financial benefits come with sharing cost in a similar project or buying products together to achieve economies of scale knowledge. When companies would like to bring out a product or enter a market whereof they do not know many about, they work together with either friendly competitors or external partners/suppliers. Another reason why organizations collaborate is to generate ideas, which is most done by schools or an overarching group of a sector. Collaboration with schools is more often seen as an opportunity to gather data, insights and thought from another point of view. This can, eventually, used on a later project. But real collaborations are rather rare. When it comes to innovation, being a platform for innovation is done by two organizations. They let others use their resources to both benefit from it. It's a simple way for organizations and other to experiment or gain knowledge.

All the previous mentioned factors in a failure tolerant culture are seen as stimuli for the innovation process of an organization. Innovation is something wherein everyone has to collaborate. It's not related to a single person, department or organization. Creating a failure tolerant and open culture stimulates people to do, to undertake, to believe and to share their ideas, thoughts and failures. This can lead to innovation.

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[16] SMART: specific, measurable, attainable, realistic and timely.

The innovation process from failure

A series of definitions is given to innovation. In the literature, the definition of Schumpeter is used to describe innovation. Introduction of new goods, new methods of production, opening a new market, new supply source of raw materials or half-manufactured goods or new ways to organize business… is defined as innovation (Tohidi & Mandegari, 2012 & Gurkov, 2013). The way managers think about innovation in their organizations, is shown in the following table:

Insert figure 4 p. 61 about "innovation" here.

In this section will be explained why companies are innovating, what factors are stimulating innovation and which are not. Again, all the managers are 100 percent sure that innovation cannot come without failure. They all say it, but not all can handle failure effectively to do something beneficial with it. For the definition of my master thesis, failure is defined as 'a relative multifactor phenomenon with negative consequences'. But to cope with the negative consequences organizations should try to innovate. If they solve a serious problem and use it effectively (and maybe try to market it), they can become innovative. It's clear that not a single organization has the purpose to innovate from failure. But if a failure occurs and a solution is found, that is beneficial for the organization or/and others, organizations are innovating. For my findings about innovation and the relation with failure and organizations, I will use the figure about '*the 10 types of innovation'* from Keely Larry, p. 23.

One important factor of innovation is relevant advantage: doing better than previous product/service. This can be in fewer costs, less storage, improved interface, less time used or even more productivity. As manager, it's therefore important not to focus on innovation that can make your company *the most innovative.* It can be of much more value for your organization to focus on becoming innovative within your company. This is mentioned by almost over 80 percent of the managers I interviewed. They try to innovate, but they do this as well becoming more efficient in whatever they do, and not solely for others. In the literature this is called the 'configuration' part of innovation. It's for sure that organizations are focusing on the process (methods for doing work) part of innovation. This can be derived if we take a look at the way organizations see innovation for their company (see table). The most are saying saving cost and improving their way of work to get better.

Before organizations innovate they should consider the following information as useful. As said before, involve every individual possible to innovate. Many souls, ideas, point of views will give your organization a wider view of what to expect. Out of the experience of the innovation advisor (dealing with a lot of companies), when not everything is under control, innovation is more likely to fail. This goes from financial to cultural resources. A certain level of professionalism has to be reached. Next to this, struggles will reach the surface. While asking the interviewees about innovation, they answered the following reasons why they innovate: future related (4x), market related (5x), solving problems (4x), cost based (7x), not standing still (3x), proving processes (4x) and quality (9x). The sum is bigger as 15, because more reasons per person were given.

Additionally to the stimuli of innovation already mentioned before, the managers summed some other characteristics. Reacting fast on the reaction of early adapters is beneficial as well. A

promising start-up (interviewee 10) explained their early steps of the innovation process. They asked feedback from feedback, so there will never be the same feedback. They conclude that if customers are saying what they want, entering a market can be easier. As organization, it can be beneficial to work with an innovation manager. This manager can either work for the company itself, or can be used by several organizations in the same/different business. They share and collaborate with each other. This goes either for competing as for non-competing companies. The non-competing companies can share insights of innovation from their complementary products and learn form each other. The competing companies can try to innovate to reach a higher level in the sector. Clear appointments will have to be made and kept in mind that innovation is specific to each company:

> *"A Ferrari is not made for riding the field"* – interviewee 8, company specific innovation.

There're a lot of struggles during the process of innovation. The most related to my master thesis was where open-minded employees of a company were blocked by the financial consequences of innovation, so they stopped innovating. These stories damage the mindset of people. Thinking that their input will not result in output, even when the organizations try. Money stays an important factor in the process of innovation. You either have a financial buffer, or you should get funded. Interviewee 10 said that they had to make each dollar worth three dollar, for them this was 'financial innovation'. The government declined the funding for a hospital. With fewer budgets, they still would like to innovate and improve. They will have to be creative with existing things, and doing things with meager resources (often referred in the west as '*Jugaad Innovation*' [17]). When the innovation was successful, around 70 percent was funded by an external organization. This goes from private investors to government. It's clear that innovation is not completely carried by the organization itself. Some managers were saying that they struggle because they never did it before. To be an innovative company you should get out of your comfort zone and experiment. And being aware that something will fail. Other struggles in the innovation process are: time to market, the use of IP's, not the right time, not the right market, the gap between inventing and commercializing, entering a conservative market and rules/laws.

As we take a look at the companies that innovate from failure, figure 6 in the appendix, there are clear similarities: a clear vision is present, the leader is stimulating innovation and employees are mentioned as important resources. Nevertheless, there are different handling procedures for each company and department although they are failure tolerant. As we take a look at the 'managerial guideline" three sort of real problems occur. These problems should be distinguished when it comes to different departments or underlying purposes. The interviews reveal that when it comes to standardized procedures, humans' lives or trust issues the tolerance for a failure (and the failure percentage) is very low/not existing. The form of innovation, here, lies in the prevention of failures by better processes or/and products. As manager, it's then important to motivate/stimulate your employees encouraging them to always share positive (when new things come up) and negative factors (when something is not working optimally). Out of this information innovation can follow.

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[17] http://jugaadinnovation.com, accessed on the 25th of April 2016.

Occurring failures that are not directly followed by negative consequences for the company can be tolerated more, they will follow again but they are solved. For example: road accidents, laws/rules, wrong interpretation by designing, human mistakes… It's crucial to handle these failures with an open mind. Organizations should consider them as extra information by improving their service/product. Failures that are damaging the core business of an organization have to be solved fundamentally. Out of these failures, innovation occurs for over 70 percent. As organizations want to innovate from failure the following procedures should be taken into account. When a failure occurs, it's preferable not to focus on a single person, but to fundamentally solve it, share it and learn from it (by solving or preventing) and efficiently using it. Analyzing a failure when it occurs should be done in groups. Most of the times, organizations solve failures by the group that is involved. Working with cross-sectional groups can benefit the way organizations learn from failure. They also need to get rid of the idea that sharing is only useful when it's done to the group directly involved. When a failure occurs, the organization (in it's entirety) failed, so sharing it should be done with the entire organizations, even when it's small.

Linking failure and innovation can be done in several ways. First of all, out of my interviews, most of the organizations try to solve a problem or try to overcome a failure. The process accomplishing this or the solution itself can leverage the company to innovation. So, the solution for a problem here is seen as an innovation. Let's take the blood rack problem of one of the hospitals. An employee faced a problem while hanging the blood bag at the rack, and tried to find a solution. He/she found a solution, communicated it with the hospital to make a product out of it and so this specific solution became the innovation for the hospital. Another link between failure and innovation appears while experimenting, testing prototypes or making new products. If a company, for example interview 15, sees that something failed during the testing. They might face a better way of doing things next time. Even when they cannot change it in this phase of development, they will use it for next testing. So, this failure is linked to innovation as an improved iteration. The following link is called serendipity. This occurs when another employee relates a failure or solution to his/her capabilities (remember Post-it Notes). Communication and sharing failures failure plays a crucial role in terms of serendipity and finally coming to an innovation. Finally, one organization, interview 10, used a failure (lack of operational efficiency) of someone else to come up with an innovative product. So other one's failure can be used to be innovative as well.

To end, innovation can benefit organizations and this is clearly pictured by interviewee 15, manager of a very innovative company. He said that because they have a clear roadmap for innovation, customers are more likely to choose them. Innovation stimulates customer acquisition. Customers see what's coming and they believe in the innovative projects. This works with suppliers as well. Sometimes, they enter a project not yet convinced by this product… but in hope benefiting from it later. Innovation can be used as a positive argument in sales!

5. Discussion and conclusion

This master thesis starts from the observation that managers should embrace a failure tolerant culture to learn from failure and innovate to concur the negative consequences of failures. The findings in this master thesis emphasizes that the culture is (mostly) a factor that is directly related to innovation. Together with this culture, communication is the second (or shared first) factor that's crucial becoming innovative and failure tolerant. That's why both of them are located at the side of the managerial guideline for innovation, fig. 1 appendix. An innovation process can be scheduled but following the strict execution is harder. Also, comparing the innovation process of an start-up and a mature organization vary widely. The guideline is developed for managers and how they can handle failure efficiently. Communication and culture will intervene in every process from *failure to innovation.* A (failure tolerant) culture is seen as a culture where a manager stimulates shared leadership backed by a clear organizational vision/mission and where everyone is working together on their own. This shared leadership expresses oneself by their employees. As employees are willing to make extra efforts to contribute in every possible way to the organization, innovation is more likely to occur. It's therefore important that managers dare to share responsibility and ask for ideas, thoughts and solutions for problems (aka *information sources*). This personal relationship and open communication with employees will have a retroactive effect when it comes to sharing failures. It's then the manager's tasks to efficiently use these sources of information and make them accessible for everyone in the organizations by databases, Wiki's, platforms or even weekly newspapers. Only then innovative solutions or preventions can be found.

Edmondson (2011) explains that failure can be divided into three categories and that companies have to learn from these failures. My research points out that it's hard for organizations to locate their failures into categories. The intelligent failures occur more in departments where the focus is on R&D, experiments or collaborations with others. The preventable failures occur more in standardized production, where the human factor is mainly the main cause combined with other factors like: pressure of time, lack of control, poor communication or no clear standard methods used. The main purpose for organizations is not to divide failures into categories, but the efficiently learn form failure. Organizations should be aware that not every failure is the same, and should be handled different. The complex failures, at their part, occur because of the involvement of several factors that are not used to work together.

In the literature is written that organizations should not punish failure or/and that managers should not create a punitive culture (Farson and Keyes, 2002) and that's true! Still, there are degrees in failures. But punishing failure doesn't create a failure tolerant culture. It's the organizational objective to always look for solutions (open culture) either to look for punishments (punitive culture). It's therefore, the management's task to focus on the problems, and how to prevent them along with their employees. It's clear that a managerial failure tolerant mindset will create a safe feeling by their employees (Tohidi & Mandegari, 2012) but this is where the culture and communication, again, play a crucial role by personal interactions.

When managers are focusing on their employee satisfaction, employees will be more likely to share responsibly and solve/share failure. Employee satisfaction is created by initiative taking, involvement, non-statutory benefits, being useful and personal recognition (because one isn't

another). Satisfied employees will contribute more to the organization, and therefore innovation is stimulated. As written to be one of the factors from a learning process, (deliberate) experimenting can contribute to innovation as well to preventing failure (Cannon & Edmondson, 2005). Several interviewed organization experiment at either their own way. R&D organizations experiment by inventing prototypes or testing on reliability. Other more mature (service related) companies test/experiment by being a platform for innovation and being open-minded in working together with projects in which they think are beneficial.

Failures do affect organizational strategies more in general and not specific to innovation. A company was affected by a high failure percentage; it changed their strategy from customized production to standardized production. Another, retargeted their customer focus from a 80-20 percentage on automotive to a 50-50 approach due to the financial crisis. These examples raise attention for learning from failure, because it can lead to organizational damage. It's therefore important to adapt fast, react fast on opportunities and not stand still. Solving failures fundamentally is related to the culture (and financial resources) or help. Argyris (1976) explains that double loop-learning search for the fundamental cause of a failure. An organization is more likely to search at the local level from the failure. Sharing failures and cross-sectional communication between several departments (or externals) can overcome this problem by using different points of views that can eventually lead to innovation. Additionally to this, the 'Learning and Innovation loop' (Good & Smith, 2014) perfectly explains the found results of this master thesis. Every company with a failure tolerant culture and sense for innovation involves their employees (step 1), adapts this information to the related department or specific group (step 2) storage of information is crucial and finally all the information gathered by solving or/and preventing a failure can be used to innovate or iterate (step 3).

Although, there is no clear process of innovation, organizations should involve every employee in this process. Without 'good' employees, your organization is not optimally using their capabilities because only 'good/motivated' employees will bring the best out of your organization. It's therefore, not to underestimate what kind of impact a failure tolerant culture can have on your organization complement with an open, personal communication. Even when the culture is not failure tolerant, the way people act is directly related to their relationship with the managers (management).

In sum, failure is seen as '*a relative multifactor phenomenon with negative consequences*' in which organizations try to solve or/and prevent it with a failure tolerant culture approach. This culture is created by the relationships with leaders-employees and organization-customers together with taking organizational responsibly by saying that the organization or system failed and by solving it together. It is beneficial that a failure tolerant culture is invigorated by a clear mission/vision for the future; it will lead the entire organization over the same path. As communication for me is complementary to a failure tolerant culture, the ideas and thoughts given by the employees (or actively searched by a manager) are factors creating a failure tolerant culture. By using a failure tolerant culture, organizations stimulate their employees to take initiative, experiment and be open-minded for everything (included failures). Punishing a failure will only have the opposite effect. Organizations should never punish failure, if they want that their employees think along with them to be more innovative.

Out of this approach, combined with using the information stored from failures and thoughts from employees, organizations try to innovate. If they do so, the focus will mainly be on improving their internal processes to optimize their competitive advantage.

Each manager thinks it's important to learn from mistakes. Therefore it's important that managers create a failure tolerant culture, and overcome the moment accusation combined with sharing failures. Most of time, it's not about the processes or commitment that's lacking, but about the mindset of the people. As for managers I recommend that they should try to create an organizational culture where failure is tolerated together with an open communication, figure 1 p 59. Give your employees the feeling that making mistakes is tolerated or even allowed. Even more, that's crucial to keep improving and innovating. This is the base for solving and preventing failure and eventually innovating from it. First of all, it's important to understand what kind of failure you're dealing with. Then, it's crucial to see what happened. Therefore, it's important to analyze the entire story together with every failed layer in the process. Doing this via face-to-face communication is most beneficial. If more people are involved, an external moderator can be useful to lead to group discussion. While discussing the failure it's important to write down, or record, everything that can be useful for further projects. After what happened, managers should see what kind of failure it is. This is necessary in the way managers can approach solving and preventing failure. Not every failure is the same. Solving and preventing failures are the two main effects when a failure occurs, next to learning from it. For operational purposes solving the failure as fast as possible is crucial. Managers should then sometimes think outside the organization, to gain a solution. Finding a solution cost money, but I recommend finding a fundamental solution. It will give you competitive advantage to others, and eventually lead to innovations. Keep in mind that not everything goes right from the first touch, how smart or careful we are. This doesn't mean that employees have a safe conduct making failures. After all, failure is not something you establish yourself as a target. But it means being open to a well-designed iterative process of testing, experimenting and evaluation, supported by good data and discussions. Whether you are working in an R&D department or as PR manager.

6. Limitations and further research

This master thesis provides several interesting settings for future research by academics. There is no clear evidence that one sector is more tolerant for failure than another. Also, I believe that standard norms (like ISO-norms) can prevent the smaller failures in an organization. To clarify this intuitive thought the focus should be on preventing failures by standard norms. Out of the managers' insights, I can state that a failure tolerant culture stimulates innovation. However, a more quantitative study by measuring the impact of a failure related to innovation could provide academics with targeted information. Regarding the degrees of failure, it should be useful to analyze what impact a specific failure has on different departments of an organization. As managers talk about their experience in one department, this can be different in another department. For example: should a specific failure handled differently in a high security department than in a production department? Therefore, analyzing the relationship between 'different failures in the same department' and 'one failure in different departments' of an organization can add value to the intuitive saying that each failure should be handled differently according to his degrees of seriousness.

While this master thesis has many interesting findings, several limitations exist. The interviews were conducted in Limburg, Belgium, only. To generalize these findings, further research has to be done in a wider surface and with more organizations. The possibility to interview more managers from other organizations was voided by time restrictions. Whilst, fifteen interviewees from fifteen organizations are interviewed biases will exist because not every manager in an organization will have the same thoughts about a topic. Next to this, there was no clear defined group that is been interviewed, a more general approach was chosen. Although their willingness to talk about a failure in their organization, it was clear that managers preferred to talk more about their organizational successes. It may also be needed that there is further empirical research done on the intuitive findings that I made out of my research.

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Figure 1: from failure to innovation

FROM FAILURE TO INNOVATION
– A guideline for managers

FAILURE TOLERANT CULTURE : MISSION – LEADER – EMPLOYEES – CULTURE

COMMUNICATION : IDEAS – THOUGHTS – EMPLOYEES – RELATIONSHIPS

SPECIFIC TO ORGANIZATION & DEPARTMENT

FAILURE

What happened?

What is the real problem?

Inexcusable failure

Excusable failure

Intelligent failure

PRESENT

FUTURE

SOLVING

PREVENTING

FS

TS

INNOVATION
PROCESS
PRODUCT

MONEY   TIME   LUCK   MARKET   P&S

FS: fundamentally solved: failure never occurs again: 75% chance of innovation
TS: temporary solved: failure can occur again: 40% chance of innovation
P&S: product and service

Figure 2: details from the interviews
(Details can be a little different than real data)

Interview	Title	Core business	Duration	Employees	Revenues	Operating countries
1	Innovation Advisor	Support in innovation	53m	11	#	1
2	Sales Manager	Metalconstructer	54m	420	80 million	7+
3	Managing Director	Import & Export	57m	8	4,5 million	6
4	Communication Manager	Health care	1h 2m	3400	343 million	1
5	Strategy Manager	Health care	50m	3000	350 million	1
6	Sales Manager	Transport/Logistics	40m	1650	570 million (Holding Group)	17
7	Managing Partner	Healthcare software	18m	120	28 million	14 +
8	Chief Technical Officer	Test solutions	1h 6m	106	15 million	Worldwide
9	Strategic Manager	Transport/Logistics	45m	4500	480 million	14
10	Managing Director	BioTech-startup	40m	12	#	Europe
11	Chief Technical Officer	Building manufacturer	43m	300	72 million	#
12	Managing Director	Renewable energy	1h 3m	4	#	Europe, China
13	General Manager	Leisure park	1h 15m	570	23 million	1
14	Adjunct Engineer Limburg	Railways	1h 2m	31000	2 billion	1
15	Strategic Marketing Director	Supplier of powertrains	1h 12	1200	200 million	Worlwide

Figure 3: the organizational culture in each company

Interview	Organizational culture
1	"cultural resources should be on point when innovating"
2	"hierarchy based where managers take discisions"
3	"open on a personal level, where functional hierarchy comes naturally"
4	"open culture where employees have a family feeling and love to work"
5	"open culture where entrepreneurship is stimulated and a family feeling is present"
6	"family based,semi-open culture with informal contacts"
7	"see theirselves as the Tesla of the telecom"
8	"open-door culture where everyone know each other"
9	"open culture, trying to keep a family business feeling while growing"
10	"start-up culture where everyone works together"
11	"family business with a flat structure and short communication lines"
12	"start-up culture, friends making fun and money"
13	"very employee-stimulating culture, with a 'we can do everything' mindset"
14	"hierarchy based where managers take discisions"
15	"very open where the management stimulates this very much"

Figure 4: how managers define innovation

Interview	Definition of innovation
1	"adding something new", "doing something totally new", "new market, technolgy, process,…"
2	"process", "Incremental, cost based on existing products"
3	"business model", "process innovation", "something totally new with no boundaries"
4	"stimulating others via us", "using new technology", "better products"
5	"improving products and services", "using new technology"
6	"internal/external cost based", "something totally new that can be rolled out to others"
7	"product", "cost based and staying in front of your competitors"
8	"applying new methods of technology and knowledge"
9	"three levels: internal new or incremental products/processes, small things that improve, making new products or services"
10	"internal: doing things that positively change your business", "external: bringing out a qualitative product with a good cost based model"
11	"being/staying first", "problem solving"
12	"making a product was totally out of our comfort zone", "product"
13	"efficient use of network", "being creative"
14	"process: targeted and stepwise improvement of our operational process"
15	"doing something new for the organization", "use of new technology"

Figure 5: how managers define failure

Interview	Definition of failure
1	"relative understanding","extra time and costs","a process that collapses"
2	"daily failures: small and big", "every mistakes in each process and department"
3	"financial and operational shortcomings"
4	"process failure (with patients)"
5	"process failure (with patients)"
6	"failures can never be excluded as long the human aspect is involved", "operational barriers"
7	"wrong investment","roadblocks of innovation","not finding a supplier","time to market"
8	"repeated mistakes"
9	"three levels: road (traffic jams, accidents), warehouse (human mistakes) and software (data integrity)"
10	"conservative mindset of the market, "money"
11	"everything that costs us money", "everything that can be improved"
12	"not reaching your targets"
13	"when customers aren't happy", "when we do not reach our targets"
14	"Failure has two main aspects: what happened and how can we solve it", "most of the time person related"
15	"Failure is seen as a challenge", "Finding something better when it's too late to restart the process"

Figure 6: Overall findings

The following pages represent the overall findings of my thesis.

Part 1 A-B: the interviews 1 till 9 should be read from left to right.
Part 2 A-B: the interviews 10 till 15 should be read from left to right.

Part 1A:

Interview	Sector	Characteristics of a failure tolerant culture that stimulates innovation for each company (based on literature review)					Company faced a failure (NO=0, YES=1)	What kind of failure (based on literature review)?
		Vision/mission	Culture	Employees	Leader	Communication		
1	Innovation adviser	IRR	IRR	IRR	IRR	IRR	0	IRR
2	Production	Cost based & standardized quality	Hierarchy based	Do their job (still fixed-minded)	Descision taker but open for input	Semi-open (most of the time one way)	1	Never occurred before in normal process
								Preventable
3	Transport & production	Being innovative, delivers quality & personal relations	Very open on personal level, natural hierarchy, flat structure	Open-minded but blocked by money	Open-minded, innovation hero	Direct, open in all directions	1	Small failure in developing a new product
								Never occurred before in normal process
								Preventable, repeated & inexcusable
4	Healthcare	Innovation, being an expert, stimulates start-ups	Open, 'family-culture', employee satisfaction	Open-minded, happy to work here	Good relation with management board, communicator	Stepwise till right person, very open	1	Process failure in complex situations
5	Healthcare	Entrepreneurial, innovation, 'do it'- vision	Open, very 'family-culture', believe in themselves	Being entrepreneurs, contribute, happy	Stimulates innovation and entrepreneurship	Very open, listening, structured	1	Process failure in complex situations
								Production failure: functionality of product
								Production failure: functionality of product
6	Transport	Cost based	Family business, open,	Doing their job, contribute sometimes	Listening, knows what's going on	Semi-open, relevant information	1	Small failure, can end big
								Never occurred before in normal process
								Operational malfunction
7	Healthcare service Telecom	Thinking on the future	"Tesla of the Telecom", innovative	Not mentioned	Innovative, entrepreneur	Fast, open, structured	1	Never occurred before because change in strategy
8	Production	Top quality products, trust and knowledge	Open door culture where everyone knows each other	Good know-how, deliver the quality of organization, social, open	Open, coaching, stimulating	All directions, open door	1	Small operational failures
9	Transport	Cost based, customized, thinking on future	Open, trying to be flat but are growing, family business	Contribute to the organization, open-minded	Stimulator, open-minded, networking	Structured, short lines, intranet	1	Small unpreventable
								Small operational failures
								Process failure in complex situations

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Part 1B:

Characteristics of failure	Solved	How they deal with failure?	Innovation from failure (No=0; YES=1)	Does the company innovate? (No=0, Yes=1)	What kind of innovation?	External factors
IRR	IRR	IRR	0	0	IRR	IRR
Big, technical (leak of liquid)	NO (only temporary)	Not tolerant about quality based failures, and repeated failures + communicating only relevant things	0	1	Incremental: cost & weight based	
Interpretation	YES (but can happen again)		0			
Small, technical (design of a screw)	YES	Fired employee by repeated failures, open-minded, failure tolerant, try to solve it cheapest way together with client, clear appointments with client	1	1	Business plan + product from B2B to B2C ('innovation hero'-price)	Help from innovation center
Big, technical (fault with codes by shipment)	YES (but can happen again)		0			
Human mistake (repeated quality mistakes)	YES (but can happen again)		0			
Process of handling a patient	YES (still in progress)	Not tolerant when it comes to patient's quality, try to communicate and solve the failure	0	1	Process, incremental: buying new machines + innovation platform	Innovation platform with others: app developing + funding by government
Logistic failure between locations	YES (still in progress)	Failures were solved by employees, structured failure solving, clear methods, whole process failed	0	1	Process	Funding by government
Small, technical, product (blood rack)	YES		1		Product	
Small, technical, product (patient's door)	YES		1		Product: 'innovation in healthcare'-price	
Deformation of a trailer	YES	Communicate relevant failures more informal but can end up as rumors, some clear processes	1	1	Incremental: cost based + problem solving	Funding by IWT
Refugees in Callais	YES		1		Incremental: problem solving	
Software program	YES		1		Process	
Small & big (development + suppliers)	YES	Market related failure solved by changing strategy and making it by themselves	1	1	Disruptive	Funding by IWT
Small, technical	YES (but can happen again)	Solve failures team-related, or with externals, use of database	0	1	Incremental: failure prevention	
Small, operational (On the road)	Yes (but can happen again)	Not failure tolerant at certain departments, otherwise structured analysis of failure and storage	0	1	Future related + process + incremental	Funding by IWT + investing in potential successes
Human mistakes	YES (but can happen again)		0			
Data overload (Software)	YES		1			

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Part 2A:

Interview	Sector	Characteristics of a failure tolerant culture that stimulates innovation for each company (based on literature review)					Company faced a failure (NO=0, YES=1)	What kind of failure (based on literature review)?
		Vision/mission	Culture	Employees	Leader	Communication		
10	Software service	Growth, quality product	Start-up culture: open, hands-on, work together, have fun	"The diamonds"	Asks employees to add value and do it when it's better	Direct with everyone	1	Never occurred before because of start-up: financial problems Never occurred before because of start-up: mindset of customers
11	Construction	One-stop shop, quality, staying innovative	Family business, very flat, open	Do their job, open-minded	Stimulates, innovative, open	Direct, small lines, open	1	Small preventable
12	Production	Growth, quality product	Start-up culture: open, hands-on, work together, have fun	A group of friends making money	Does what he wants together with others	Friendly, direct, open	1	Never occurred before in normal process
13	Recreation	Create best experience for customers	We can do everything, flat	"Are the heartbeat of the organization"	Very into customer satisfaction, passioned, stimulates others	All directions, open door	1	Small but indirect financial losses (=big)
14	Service	Safety	Hierarchy based	Doing their job, fixed-minded	Controlling, managing	Stepwise, structured	1	Big unexcusable failure preventable process
15	Production	Developing & innovating, quality product	Open because of management	Innovative, open-minded, good know-how, teams	Stimulates, innovative, open	All directions, stepwise, open	1	Never occurred before in normal process because R&D
Total							14 out of 15 companies faced a failure	25 (relevant) failures were discussed

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Part 2B:

Characteristics of failure	Solved	How they deal with failure?	Innovation from failure (No=0; YES=1)	Does the company innovate? (No=0, Yes=1)	What kind of innovation?	External factors
Big operational failure	YES	Solving failure when it comes together with everyone.	0	1	Disruptive	Funding by several organizations
Small operational	YES		0			
Human mistakes (before and on the wharf)	Yes (but unexcludable)	Solving failures group-related, and storage	1	1	Process (product) Incremental	Funding by IWT + stimulating small projects
Product, technical (degradation of energy)	YES	Solving when it comes, no clear structure	1	1	Disruptive	IMOMEC & IWT
Technical (result: visitors who do not pay)	YES	Solved by employee, failures are more not reaching goals, no clear method… preventing by stimulating	0	1	Product Incremental	Funding by government for one project
Human mistake (passing sign)	YES (but unexcludable)	Very structured process	0	1	Process (product) incremental: safety	Government owned
Lack of attention (humans)	YES (but unexcludable)		0			
Technical, small, productrelated	YES (but can happen again)	Failure will be solved by methods, or when it could be useful fot the business: outsourced or sold.	0	1	Product + incremental	Leader in european project for students
	Fundametally solved: 52 % (13 out of 25)		Innovation from fundamentally solved failures: 70% 77% (9-10 out of 13)	14 out of 15 companies innovate		
	Solved but can happen again: 48% (12 out of 25)		Innovation from failure: 40 % (10 out of 25)			

Interview guideline

General information

Name:	Turnover/Sales:
Company:	Function:
Most important product/service:	Lower/middle/higher management/other:
Sector:	Working in/for the company since:
In how many countries does the company operate?	Date:
	Place:
Employees:	

Interview

Introduction

Hello, my name is Klåss Clerkx, Master student in Applied Economics and Sciences at the University of Hasselt. In advance, I would like to thank you for your time and for making this interview possible. For my Master Thesis I've been working on the topic "Learning from mistakes" and I particularly investigate how companies deal with major errors and try to innovate from them. I'm looking forward getting to know your company better and how your company deals with innovation.

Aim of the Master thesis and research question

The purpose of this interview is to receive information from your point of view as a manager as well as from the perspective of your company. After having finished the data collection and my thesis the research results will be provided to you – either in written form or during a presentation.

Interview process

The interview starts with some general questions about how you would define some key points of my thesis, like innovation, failure, and learning. In what follows I will subdivide my questions into more specific areas.

The interview will take about 45 minutes approximately. This semi-structured interview includes intentionally open questions, which address your experience, opinion and cognitive mindset. These questions should allow deep qualitative insights into your experience. Please answer freely and add experiences and thoughts you have spontaneously.

Confidentiality, privacy and anonymity

Before we start, I would like to ask you if this interview can be recorded? This recording will be used for my research and scientific purposes only. The recording will be transcribed for further analysis. Furthermore, your information will be treated confidentially and anonymously.
Do you have any questions before we start?

1. General questions

(These questions are the most important aspects of my thesis, they will give me a more broadly view of the companies and the meaning of these import key points)

    1.1. Could you explain what you and your company understand as innovation?

    1.2. Could you explain what you and your company describe as failure?

    1.3. Could you explain what you and your company understand as learning?

    1.4. Can you please tell me about the company's culture and structure?

    1.5. Why according to your opinion would people want to work for your company?

2. Company specific questions

    2.1. Where would you place your company in your sector: market leader, etc.?

    2.2. What were the latest success stories of your company?; this can be a new product/technology, a deal with a big client or even recruitment of a lot of people.

        2.2.1. Do your reflect those success stories and do you take advantage of them in the future?

    2.3. Do you see your company as a learning company? If so, can you give me at least 5 characteristics/explanations to prove your opinion?

3. Market specific questions

(Related to the market, questions will be answered differently)

    3.1. Is there need for innovation in your sector? And why?

    3.2. Is there a fast moving product cycle in your sector?

    3.3. How does the technology change in your sector?

    3.4. Is there strong competition in your sector?

    3.5. Do you and your competitors exchange information about products/services?

    3.6. In which stage of development is your sector? (here you should mention the life cycles stages of sectors, such as growing, mature, etc.

4. Innovation specific question

    4.1. Does your company have an innovation/R&D team/department

        4.1.1. Does your company use any external innovation teams?

    4.2. Did your company innovate over the last 5 years?

        4.2.1. If Yes, see questions 4.2.2 – 4.2.4. What kind of innovation(s) did your company develop?

        4.2.2. Was the project a collaborative process, or did those involved resist useful input from colleagues or fail to inform interested parties of their progress?

        4.2.3. What were the obstacles in developing the innovation?

        4.2.4. Which barriers do you think can block your opportunity to innovate?

    4.3. How does your company stimulate innovation? Where does your company obtain their ideas for innovations?

    4.4. Did your innovation affect your culture, strategy or decision taking?

    4.5. Were past experiences, negative events or any other unusual situation used to improve your processes/products/services?

        4.5.1. If yes, which one and how did you do this?

        4.5.2. If no, why didn't you use them?

        4.5.3. Do you think it could improve your process/product/service?

5. Failure specific questions

    5.1. Did your company encounter any unusual experiences, errors, and failures in the past 3-5 years? If so, could you elaborate on that incidence?

        5.1.1. Is your failure related to a product, service, contract, management or organization?

5.1.2. And how would you categorize these: preventable failures, unavoidable failures or intelligent failures where you can learn from?

5.1.3. What were the consequences of these failures? Regarding costs, employees, strategy, and punishment…?

5.2. Could the failure have been prevented with more thorough research or consultation?

5.2.1. If no, what went wrong?

5.2.2. Where the mistakes made repeatedly?

5.2.3. Is your company using any 'Risk Analysis or Failure Analysis' like ISO14971 (risk analysis) and DFMEA (failure analysis).
(DFMEA: Design Failure Mode and Effect Analysis)

5.3. Do you think your company has learned from an experience, failure or rare event in the past years? If so, how?

5.4. Did you use the failure intelligently? Did any failure experience result in any change or adaption of processes? Did failure lead to any good outcome (new product, service, process)? Please describe the change, product etc.!

(Did you communicate with the employees, did you saved all the details to learn from in the future, and did you make a reconstruction)

5.5. Does your company also learn from others (competitors, other companies, media…) failures?

5.6. Are employees/colleagues generally open-minded about their failures, do they reflect?

5.6.1. Do you think your employees/colleagues are worried about their reputation if they make a mistake?

5.6.2. Are their any social/technical barriers within your company, which block the ability to learn from failure?
(Social barriers: they are worried about the personal reputation and   Technical barriers: they don't know what they did wrong)

5.6.3. Do your employees/colleagues contact their supervisor directly if they have problems?

6. Learning specific questions

6.1. Can every individual reflect his or her ideas?

6.2. Is their room for thought in your company? Can employees have their own projects?

6.3. What do you think about the difference between 'What happened vs. who did it'?

6.4. Which conditions does your company provide for efficient learning?

6.5. Does learning stimulate innovation? Is innovation the outcome of a learning process?

6.6. Which sources of inspiration does your company consult in order to develop new ideas for products/services/processes?

6.7. Which sources does your company use to learn?

Auteursrechtelijke overeenkomst

Ik/wij verlenen het wereldwijde auteursrecht voor de ingediende eindverhandeling:
From failure to innovation: a case study of companies in Limburg Belgium

Richting: **master in de toegepaste economische wetenschappen-innovatie en ondernemerschap**
Jaar: **2016**

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Clerkx, Klass

Datum: **26/05/2016**