

# ENGINEERING A CULTURE THAT PROMOTES INNOVATION

By

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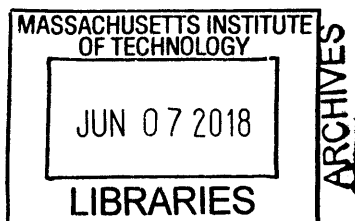
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Submitted to MIT Sloan School of Management on May 11, 2018 in Partial Fulfillment of the Requirements for the Degree of Master of Science in Management of Technology.

## **ABSTRACT**

In today's world, innovation has become a well-worn, sometimes over-used buzzword. Much of today's innovation is mainly linked with new technologies. Many companies talk about innovation using new metrics like "innovation premium," and they would like to be on the "Top 100 Most Innovative" list published by *Forbes* every year.

This thesis seeks to answer the following questions: Do the CEOs of the most innovative companies create a unique environment within their organizations? Do they create an internal culture that supports employees who have ideas for innovative products or services? What can a CEO do to influence the company's shared attitudes, values, goals, and practices which in turn promote innovation? What are the main elements that influence internal culture and make it more innovative?

To answer these questions, I reviewed the research literature by scholars and researchers on innovation. I also reviewed literature about the kind of organizational culture that promotes innovation. In addition, I interviewed nine leaders from several companies generally regarded as being innovative to inquire how they fostered an innovative environment. From this study, I identified three main elements that I think are key to creating a culture that promotes innovation. After determining the critical elements necessary for innovation, I interviewed 17 individuals from  $\beta$ -Automotive (a pseudonym). I asked them to discuss how their internal innovation culture relates to the three main elements. Based on what I learned from the research literature, the innovative leader interviews, and the case study of  $\beta$ -Automotive, I provide several general recommendations and several specific recommendations (for  $\beta$ -Automotive) for fostering an innovative organizational culture.

Thesis Supervisor: John Van Maanen  
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I would like to dedicate this thesis to my parents, who always taught me the importance of learning. They have supported me, and my sisters Titi and Maru, throughout our lives with their constant love. They have been the inspiration that drives me to follow my dreams.

*It is not the strongest of the species that survive,  
not the most intelligent, but the one  
that is most responsive to change.*  
—Charles Darwin



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# CHAPTER 1

## INTRODUCTION

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Innovation can be described in many ways. The word is heavily used in both the business world and in academia. Several companies have adopted it into their logos (see Figure 1-1) and as part of their mission statements and have invested heavily into the research and development of innovation.



Fig. 1-1. Mission Statements from Nissan and Ford

Sources: <https://www.nissanusa.com>, and [http://184.164.143.107/05\\_FordInnovation\\_Ad.htm](http://184.164.143.107/05_FordInnovation_Ad.htm).

Much of today's innovation is linked to high-tech firms. Researchers from renowned management schools study these firms to learn how they create and manage innovation. Often these companies began as startups offering new products and services that disrupted established industries. Every year, *Forbes* publishes its list of "The Top 100 Most

Innovative Companies.”<sup>1</sup> This list uses a metric called “Innovation Premium,”<sup>2</sup> a term created by Professor Hal Gregersen (MIT Sloan School of Management) and Professor Jeff Dyer (Marriott School of Management at Brigham Young University). The “Innovation Premium” is defined as the difference between a company’s current market value and the net present value of cash flows from the company’s current business. It may also represent the level of investors’ confidence that a company will develop innovative new products and services in the future that will provide a competitive advantage that enables the firm to excel in business.

What are the main differences between companies that are on this list and those that are not? Do the CEOs of these innovative companies create a unique environment with their innovation efforts? Do they create an internal culture that encourages employees’ ideas, which in turn lead to innovative products or services? The concept of *culture* in an organization is a broad term that can have multiple meanings depending on the company and the environment. The Webster-Merriam dictionary defines culture three ways:

**a:** the customary beliefs, social norms, and material traits of a racial, religious, or social group; *also*, the characteristic features of everyday existence (such as diversions or a way of life) shared by people in a place or time, e.g., Southern culture;

**b:** the set of shared attitudes, values, goals, and practices that characterizes an institution or organization, e.g., a corporate *culture* focused on the bottom line;

**c:** the set of values, conventions, or social practices associated with a particular field, activity, or societal characteristic.

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<sup>1</sup> Forbes website. <https://www.forbes.com/innovative-companies/#1032ed5b1d65>.

<sup>2</sup> Jeff Dyer and Hal Gregersen, “How We Rank the Most Innovative Companies 2017,” *MIT Management*, 8 August 2017. Available at: <http://mitsloanexperts.mit.edu/how-we-rank-the-most-innovative-companies-2017-jeff-dyer-and-hal-gregersen/>. Accessed 20 April 2018.

Since I am talking about culture in an organization, particularly a culture that supports innovation, I believe definition **b** most closely aligns with my research.

Edgar H. Schein, former MIT Sloan professor, brought notable developments to the field of organizational culture. In his 1992 book *Organizational Culture and Leadership*, Schein explains how managers in organizations speak about developing the right kind of culture, and how managers' intentions can influence employee values. He also said the concept of culture in organizations is useful because it helps to "better understand the hidden and complex aspects of organizational life."<sup>3</sup> Schein explains in some detail the close interaction between culture and leadership, and he clarifies the difference between leadership and management—the difference being that leaders change and create cultures, while managers adapt to existing cultures or live with them.

One of the main insights from his book is the intertwined relationship between leadership and culture. Schein describes it this way: "The bottom line for leaders is that if they do not become conscious of the cultures in which they are embedded, those cultures will manage them. Cultural understanding is desirable for all of us, but it is essential to leaders if they are to lead."<sup>4</sup>

Similarly, Jim Whitehurst, CEO of Red Hat, builds more detail into the intertwined connection between leaders and culture in an article titled, "Leaders can shape company culture through their behaviors" (Whitehurst, 2016). He believes that culture change starts when leaders begin to model the behavior they want others in the organization to emulate.

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<sup>3</sup> Edgar H. Schein, *Organizational Culture and Leadership*, 2nd ed. (San Francisco, CA: Jossey-Bass, 1992), 6.

<sup>4</sup> Schein, *Organizational Culture*, 15.

He provides examples of how leaders can change the company culture into a more innovative culture by first changing some of their own behaviors.

Another notable expert on organizational culture is Peter Drucker. He is called a pioneer of management theory and the founder of modern management. Drucker believed culture to be the most critical element in determining organizational success. One of Drucker's most famous quotes regarding the importance of culture is shown in Figure 1-2.

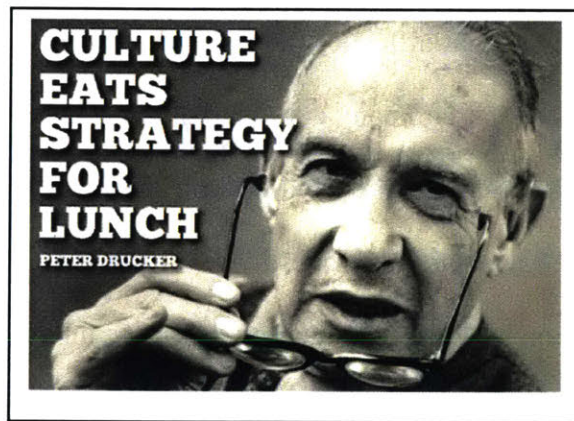


Fig. 1-2. Peter Drucker

Source: <http://www.bestsayingsquotes.com>

Paul Michelman, former executive editor of the *Harvard Business Review*, wrote an article titled, “How Great Managers Manage People.”<sup>5</sup> He states that there is one defining factor that differentiates good managers from great managers: Great managers boost the engagement level of the people who work for them. Based on his statement, it could be said that the top 100 most innovative companies are managed by great managers who boost their employees’ engagement level.

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<sup>5</sup> Paul Michelman, “How Great Managers Manage People,” *Harvard Business Review*, February 2008. Available from: <https://hbr.org/2008/02/how-great-managers-manage-peop-1>.

Schein, Drucker, and Michelman did not agree on all aspects of leadership and management. However, the one area of critical importance that they did agree on was culture, a topic that forms the core of my thesis. I discuss this below.

### **Thesis Problem Statement**

Schein explained that leaders can create and change internal culture and influence certain employee values. The question is: What can CEOs do to influence the set of shared attitudes, values, goals, and practices of their employees in order to promote innovation? What are the main elements that influence internal culture and make it more innovative? How can CEOs influence their company culture to make it more innovative? What are the elements that create a culture that fosters innovation? How can a CEO become an Innovation Architect? Answers to these questions will frame the recommendations that I make to  $\beta$ -Automotive on how to make their culture more innovative.

On January 10, 2018, Steven Nolan,  $\beta$ -Automotive CEO, gave an internal presentation at one of the company's R&D centers in France. I was in attendance. The presentation was about 2017 year-end results and future challenges. One of Nolan's final slides was titled "What keeps me awake at night?" In the text was the phrase "Missing the Next Technology Step." As the newly appointed CEO and leader of  $\beta$ -Automotive, Nolan's challenge was to ensure that the firm was a leader in innovation and technology. To him this meant not only developing future products, but also innovations affecting the manufacture of these products. Many would agree that the responsibility to create, change, or manage organizational culture belongs to its CEO. So, what can the CEO do to create a culture that fosters innovation? This thesis seeks answers to this question.

## **Research Method**

My research consisted of the following activities:

**Literature Search:** I reviewed and analyzed literature related to how an organization introduces and maintains a competitive edge through an innovative culture. Many articles linked critical innovative elements to an open and creative process. My reading focused on identifying the attitudes, values, goals, and practices shared by employees and leaders of companies that are regarded as highly innovative.

**Innovation Leaders Interviews:** Nine leaders from well-regarded, innovative companies were interviewed (see Appendix B for list of interviewees). Five of the interviews were formal face-to-face meetings, planned in advance and lasting approximately one hour. Four were informal and lasted approximately ten minutes. These interviews were done mainly after a particular speaker presentation at MIT. I approached the person and asked for a brief interview regarding the subject of innovation. The nine interviews were conducted between November 2017 and April 2018. My goal was to understand how top leaders influenced their company culture to make it more innovative.

The following questions were asked:

1. What are you doing at your company to promote innovation?
2. What are the main attitudes, values, goals, and practices that are encouraged in order to promote innovation?

**$\beta$ -Automotive Innovation Culture Interviews:** In addition to interviewing subject matter experts, I also scheduled internal interviews with employees from  $\beta$ -Automotive Company to gain feedback on the firm's culture.  $\beta$ -Automotive is a market leader in its field, and I am a former employee of this company. Seventeen employees agreed to participate in

interviews. They were selected from different hierarchical and department levels so as to provide a diverse representation of the firm. Those interviewed included top leadership (the CEO and his direct reports) and middle management working at their R&D center. Among the 17 interviews, 12 were conducted face-to-face at their corporate office and in the R&D center in Paris, France, during January 2018. The other five interviews were conducted via conference call during February and April, 2018. All interviews lasted approximately one hour. The goal of the interviews was to better understand the company's current culture of innovation.

Based on insights gained from the literature research and the interviews with innovation leaders, I asked five questions:

1. What are the main attitudes, values, goals, and practices that promote innovation?
2. Is the CEO directly involved in the innovation process?
3. How would you describe company culture regarding tolerance for failure?
4. Does the company have an innovation contest?
5. If yes, what are the categories?

Answers to these questions gave me a platform from which to develop recommendations for improving the innovative culture of this firm.

## **Summary**

In this chapter, I introduced a definition of culture, discussed innovative organizations, and the intertwined relationship between leaders and their organizational cultures. I found that culture in an organization can be defined as a set of shared attitudes, values, goals, and practices. I also outlined how I went about the research for this thesis.



In the next chapter, I explore what CEOs can do to influence the organization's culture and promote innovation.

## CHAPTER 2

### ELEMENTS THAT CREATE A CULTURE OF INNOVATION

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This chapter will identify the elements that help create a culture that promotes innovation. In addition to identifying various innovation elements through my literature search, the results of my interviews with nine leaders who seemingly help shape their firm's culture of innovation are discussed.

#### ORGANIZATION CULTURE

On March 7, 2018, Microsoft Chairman John Thompson participated in the MIT Sloan Innovative Leadership Series (iLead). During his presentation, Thompson talked about reasons why Satya Nadella was appointed Microsoft CEO. When Thompson became chairman of Microsoft in 2014, it was a “company with resources and credibility, but it had lost its way,” he said, noting that “some considered the culture toxic.”<sup>6</sup> Thompson explained how the Board wanted to transform the organization, and they saw in Nadella a leader with the right attitude of sincerity. Thompson went on to compare culture to an elastic band. If culture is somehow toxic, then the elastic band has one shape. One CEO could cause a culture transformation and reshape the elastic band. But if the next CEO does not bring the right leadership, the elastic band will return to its original toxic shape.

Another widely recognized innovative company is Procter & Gamble (P&G). On June 23, 2008, Alan G. Lafley, then Chairman and CEO of P&G, gave an interview to

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<sup>6</sup> John Thompson, MIT I-lead series, 2018. See: <http://mitsloan.mit.edu/newsroom/articles/heres-microsoft-chairman-john-thompsons-advice-for-mba-students/>.

Harvard Business Digital. Lafley was asked: “Is there one thing that stands out—one action, one attitude—that a leader needs to ensure that innovation remains a front-and-center activity?” Lafley answered as follows:

The leader has to be in the game. In my case, the CEO also has to be the CIO, the Chief Innovation Officer. If they are not taking ultimate responsibility for innovation, if they are not engaged in the process and with people who are responsible for innovating and commercializing the innovation, I do not think such a leader will make it happen.<sup>7</sup>

Lafley’s answer lays out the CEO’s leadership role in promoting a culture of innovation.

During the interview, he offered some further thoughts about what is needed to create a culture of innovation:

Another part is to create this culture of innovation. You have to be open, and open-minded. Innovation is all about connections. It’s connecting part of an idea here, part of an idea there, to somebody who can make it a little better someplace else. You have to be able to work collaboratively. If you are not open, if you cannot make connections, if you are just not comfortable in a world where everything is a team effort and a collaborative effort, I think it is going to be very difficult to innovate successfully and to be sustainable over time.

Lafley provided some insights on how to create a culture in an organization that promotes innovation. He said “changing a company’s internal culture needs to be studied.” Schein (1992) argues that the responsibility to reshape organizational culture should be owned by the primary leader in the organization, its CEO.

Another example of who is responsible of organizational culture is given by O’Reilly and Tushman (2018) who studied Amazon, particularly its founder and CEO Jeff Bezos. In their paper, Bezos is quoted as saying: “Slow, steady progress can erode any challenge over time. I do not have all the ideas. That isn’t my job. My job is to build a culture of

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<sup>7</sup> <https://hbr.org/video/2226595885001/innovation-at-procter--gamble>

innovation.”<sup>8</sup> This is consistent with Schein’s view of the CEO role of creating or destroying a culture: “Organizational cultures are created in part by leaders, and one of the most decisive functions of leadership is the creation, the management, and sometimes even the destruction of culture.”<sup>9</sup>

Clayton Christensen, an influential management thinker according to Thinkers50 organization,<sup>10</sup> is best known for his work on disruptive innovation. In a 2008 article written with Stephen Kaufman, Christensen links the importance of culture to the process of innovation. The authors argue that many innovations fail not because of technological fault or because of market readiness; they fail because the responsibility for building them is given to organization units that are not capable of succeeding (Christensen & Kaufman, 2008). The authors also introduced the RPP framework (Resources, Processes, Priorities), which assesses an organization’s ability to develop innovations that are likely to succeed. The authors argue that processes and practices are established ways of doing things in companies and thus are important elements of the organization culture. The authors establish a clear link between process and culture, as seen in their description of processes:

Some processes are formal in the sense that they are explicitly defined, documented, and followed. Others are informal, habitual, routine ways of working that have evolved over time, which people adopt simply because “that’s the way we do things around here.” Still other methods of working and interacting have proven so effective for so long that people unconsciously follow them, and they become part of the culture of the organization. Processes that are formal, informal, or part of the culture all define how an organization transforms inputs into outputs of greater value. (Christensen and Kaufman, 2008:2).

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<sup>8</sup> Charles O’Reilly, and Michael Tushman, *Lead and Disrupt: How to Solve the Innovator’s Dilemma* (Stanford, CA: Stanford University Press, 2018).

<sup>9</sup> Schein, *Organizational Culture*.

<sup>10</sup> <http://thinkers50.com/>

The importance of understanding organizational culture is explained by the “Three Lenses on Organization Analysis and Action” framework developed by Deborah Ancona, Thomas Kochan, John Van Maanen and Eleanor Westney (authors and researchers at MIT Sloan School of Management), and Maureen Scully of Simons College Graduate School of Management. In their book, the authors present the framework this way: “You can think of these lenses as the three different levels of magnification that you could put on your mental camera in order to get different views of an organization you are trying to understand and change” (Ancona, et al., 2004: 2-4). The authors argue that in order to have a deep understanding of an organization, it has to be analyzed from three perspectives: strategic design, political, and cultural, which comprise what the authors call the “three lenses.” They explain that by applying the three lenses when analyzing an organization, the overall perspective becomes richer than if the analysis were done only from a strategic perspective. This framework also supports the importance that Drucker places on culture.

Catherine Turco is an Associate Professor in Work and Organizational Studies at MIT Sloan, and an ethnographer and economic sociologist who studies cultural dynamics in organizations. She wrote *The Conversational Firm*, which is an excellent example of studying and acquiring an understanding of a company’s culture. Turco spent four days a week at a company named TechCo (a pseudonym) over a period of ten months. She said: “My goal was to understand the organization’s culture from the perspective of its members, and my ethnographic fieldwork entailed ‘living’ inside the company for a period of time to observe its daily activities and to conduct interviews” (Turco, 2016:185). She promised TechCo’s top leadership that she would share her findings and hoped that her “observations

might be of some value, perhaps enabling the company to see itself in new or deeper ways” (2016:185).

TechCo began as a two-friends startup in the digital and social media field. “The two decided to build a company that would sell software tools and consulting services to help businesses market themselves and their products on the Web and through social media” (2016:15). Some years later, several hundred people worked at TechCo. The founders built the company culture around open and transparent communication. They saw bureaucracy as an enemy and tried to avoid it. Turco’s analysis focuses on how this openness of communication and lack of formal hierarchy and bureaucracy shaped TechCo’s culture. Perhaps most important was how the employees saw and engaged in these concepts. Turco concluded: “What we can take from TechCo’s experience is that, no matter the public rhetoric, corporate leaders should never assume they know exactly what any group of employees wants or what will make for an optimally productive workplace for them. Instead, executives should engage those employees in conversation to continually probe and decipher that.” (2016: 180). The TechCo example illustrates the importance of interest and willingness of a company’s top leadership to better understand their internal culture.

## **SOURCES OF INNOVATION**

At the beginning of this chapter, I discussed the importance of organization culture in achieving the company’s objectives. It is important also to discuss the concept of sources of innovation. An organization’s top leadership has to be aware of the source of any innovation that might lead to products and services that will sustain their business in the next decades. Creating an open and collaborative environment that welcomes inquiry supports innovation.

Eric Von Hippel is a Business Professor of Management of Innovation and Engineering Systems at MIT Sloan. His research focuses on exploring and understanding the development of breakthrough innovations and ideas. Von Hippel argues that leaders structure their organizations based on their assumptions regarding the sources of innovation. His research shows that not all innovations to an organization’s products or services are actually created within their walls. Table 2-1 shows the results of several years of research in different industries, identifying the actual source of the innovations.

**Table 2-1. Sources of innovation data**

<i>Innovation Type Sampled</i>	<i>Innovation Developed by</i>				<i>NA<sup>a</sup> (n)</i>	<i>Total (n)</i>
	<i>User</i>	<i>Manufacturer</i>	<i>Supplier</i>	<i>Other</i>		
Scientific instruments	77%	23%	0%	0%	17	111
Semiconductor and printed circuit board process	67	21	0	12	6	49
Pultrusion process	90	10	0	0	0	10
Tractor shovel-related	6	94	0	0	0	16
Engineering plastics	10	90	0	0	0	5
Plastics additives	8	92	0	0	4	16
Industrial gas-using	42	17	33	8	0	12
Thermoplastics-using	43	14	36	7	0	14
Wire termination equipment	11	33	56	0	2	20

<sup>a</sup>NA = number of cases for which data item coded in this table is not available. (NA cases excluded from calculations of percentages in table.)

Source: Von Hippel, 1998: 4.

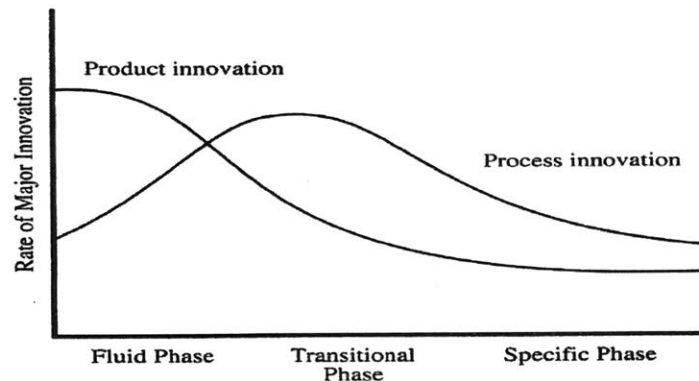
There are three main sources of innovation: user, manufacturer, and supplier. Von Hippel calls this dynamic the “distributed innovation process” (1998, p.6). He argues that sources that are different might have major implications as to how innovation managers organize their R&D (Research and Development).

I believe Von Hippel’s concept of a “distributed innovation process” is important. CEOs who try to foster innovation in their organization should have a clear understanding of

what the sources of innovation are in their organizations. Once the current sources of innovation are identified, new sources of innovation should be evaluated. Seeking new sources of innovation is part of fostering a dynamic culture of innovation.

## THE DYNAMICS OF INNOVATION

Many companies face two challenges: innovate the product, and innovate the manufacturing process of the product. James Utterback (1994), an author in the fields of management and innovation, developed a model that captures the dynamic innovation process over time. His model is called “The Dynamics of Innovation” (see Figure 2-1).



Product	From high variety, to dominant design, to incremental innovation on standardized products
Process	Manufacturing progresses from heavy reliance on skilled labor and general-purpose equipment to specialized equipment tended by low-skilled labor
Organization	From entrepreneurial <i>organic</i> firm to hierarchical <i>mechanistic</i> firm with defined tasks and procedures and few rewards for radical innovation
Market	From fragmented and unstable with diverse products and rapid feedback to commodity-like with largely undifferentiated products
Competition	From many small firms with unique products to an oligopoly of firms with similar products

Fig. 2-1. The Dynamics of Innovation

Source: Utterback, 1994: 9.



Utterback argues that the rate of major innovation over time for processes follows a similar path as the rate of major innovation for products. Both rates are interdependent. He divides the time dimension into three phases: fluid, transitional, and specific.

### **Fluid Phase**

Utterback states:

The fluid phase is one in which a great deal of change is happening at once and in which outcomes are highly uncertain in terms of product, process, competitive leadership, and the structure and management of firms. In the fluid phase of a technology's evolution, the rate of product change is expected to be rapid. The new product technology is often crude, expensive, and unreliable, but it is able to fill a function in a way that is highly desirable in some niche markets. (Utterback, 1994, p.92).

He argues that during this phase, there is a lot of experimentation among competitors.

“Process innovation generally takes a back seat to product innovation in this early fluid stage. Frequent and major changes of product design and specifications impede the development of linked process innovation” (Utterback, 1994, p.93).

### **Transitional Phase**

If the market for a new product grows, the industry may enter what could be termed a transitional phase. Market acceptance of a product innovation and the emergence of a dominant design are its hallmarks.... The focus of firms begins to shift from the inventor's workbench to the factory floor, where the large-scale production of innovative products must be worked out. (Utterback, 1994, p.96).

He argues that once the product is fully developed and goes to market and starts to sell, then the focus of the organization shifts to production efficiency. Companies invest financial resources during the fluid phase. Many experiments are expected, and not all of them will be successful. Once a successful innovation enters the market, revenue starts to

generate. Companies want to recuperate the investment made earlier and the faster they do it, the better for their financial results. This also motivates organizations to speed innovations in their manufacturing processes. This also supports Utterback's argument that companies focus their efforts on process during this phase.

### **Specific Phase**

The value ratio of quality to cost becomes the basis for competition. Products in the specific phase become highly defined, and the differences between products of competitors are often fewer than the similarities... The linkages between product and process are now extremely close. Any small change in either product or process is likely to be difficult and expensive and require a corresponding change in the other. (Utterback, 1994, p.96).

During this phase, the ratio of process innovation continues to be higher than the rate of product innovation, but both follow a similar trend toward a flat line. Utterback refers to the automotive industry as an example of this phase. He explains that once a car is mass produced, few changes to the car or the manufacturing process can take place due to issues of complexity and cost. He argues that the dynamics of innovation patterns will replicate each time there are major innovations in the industry and refers to new innovations as waves.

As a result of his research, Utterback identified significant characteristics that define the three phases of innovation (see Table 2-2).

Table 2-2. Significant characteristics in the three phases of industrial Innovation

	<b>Fluid phase</b>	<b>Transitional phase</b>	<b>Specific phase</b>
<b>Innovation</b>	Frequent major product changes	Major process changes required by rising demand	Incremental for product and with cumulative improvement in productivity and quality
<b>Source of innovation</b>	Industry pioneers; product users	Manufacturers; users	Often suppliers
<b>Products</b>	Diverse design, often customized	At least one product design, stable enough to have significant production volume	Mostly undifferentiated, standard products
<b>Production processes</b>	Flexible and inefficient, major changes easily accommodated	Becoming more rigid, with changes occurring in major steps	Efficient, capital intensive, and rigid; cost of change high
<b>R&amp;D</b>	Focus unspecified because of high degree of technical uncertainty	Focus on specific product features once dominant design emerges	Focus on incremental product technologies; emphasis on process technology
<b>Equipment</b>	General-purpose, requiring skilled labor	Some subprocesses automated, creating islands of automation	Special-purpose, mostly automatic, with labor focused on tending and monitoring equipment
<b>Plant</b>	Small-scale, located near user or source of innovation	General-purpose with specialized sections	Large-scale, highly specific to particular products
<b>Cost of process change</b>	Low	Moderate	High
<b>Competitors</b>	Few, but growing in numbers with widely fluctuating market shares	Many but declining in numbers after emergence of dominant design	Few; classic oligopoly with stable market shares
<b>Basis of competition</b>	Functional product performance	Product variation; fitness for use	Price
<b>Organizational control</b>	Informal and entrepreneurial	Though project and task groups	Structure, rules, and goals
<b>Vulnerability of industry leaders</b>	To imitators, and patent challenges; to successful product breakthroughs	To more efficient and higher-quality producers	To technological innovations that present superior product substitutes

Source: Utterback, 1994: 94

Utterback developed a model that helps CEOs understand the innovation process and its impacts on their products and manufacturing process. Because I am focused on how CEOs can create a culture that promotes innovation, Utterback’s list of characteristics is useful as a guide.

## **THE ROLE OF LEADERS**

Von Hippel (1998) and Utterback (1994) bring important insights to the management of innovation. However, they have little to say about the culture of innovation. In this section, I will use the information gained from my literature search, as well as the opinions of company leaders, to identify elements that create a culture that fosters innovation.

The role played by leaders seeking to create an innovative culture was investigated by a group of researchers from MIT and Harvard (Hill, Brandeau, Truelove & Lineback, 2014). This group interviewed 16 leaders from different industries, all of whom have been involved with organizational innovation. The researchers did a detailed study of 12 of the leaders, all of different nationalities.

One of the main findings of their research was the critical role played by the leader of the organization. The authors argue that successful innovation in the organizations was not because of the great ideas or genius of the leaders. Rather, these leaders are able to create an organizational culture where employees' ideas contribute to the overall success of innovation. The authors describe the role of the leader as follows: "Leaders of innovation create organizations where people are willing and able to do the work of innovation, where everyone has the opportunity to contribute his or her slice of genius to the collective genius of the whole" (p. 45).

The authors argue that in order for employees to face the challenges of innovation, they should feel part of a community that supports "we" versus "I", a community where each one feels a sense of belonging and identity. This community provides a safe environment that allows them to engage in the risk-taking aspect of innovation. According to the authors, the leaders studied "innovative, collaborative communities built around a

compelling mutual purpose that people already considered important and that they would strive collectively to fulfill” (p. 92). The authors argue that an important part of the role of the leader is to build such communities where innovation can flourish. And, they argue, such communities must be built with a sense of shared purpose, values and rules of engagement. Figure 2-2 illustrates this objective.

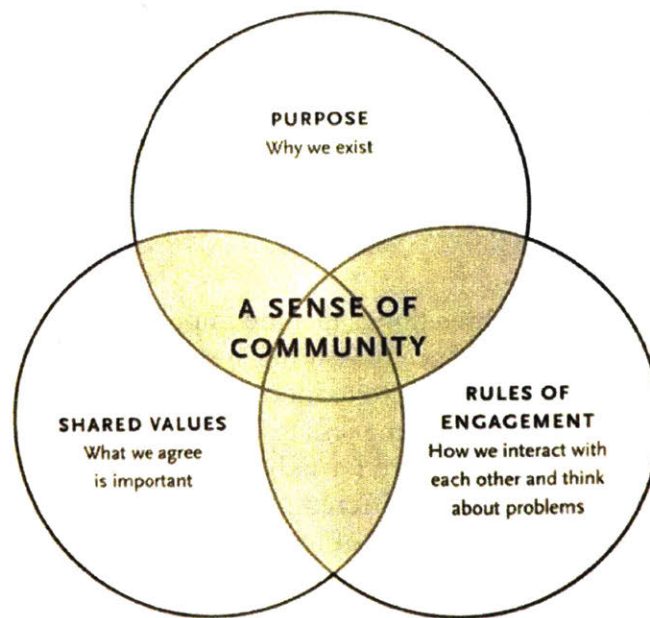


Fig. 2-2. The Willingness to Do the Hard Work of Innovation.

Source: Hill, Brandeau, Truelove, and Lineback, (2014)

## **TOLERANCE FOR FAILURE**

“If my innovators are not failing, then they are not trying hard enough. If they do not fail, they are only focusing on small incremental improvement but not on next- generation technologies. I expect them to fail at least 90% of the time.” These were the words of Michele Ostraat, head of Aramco’s R&D Center in Boston spoken during a presentation to

the MIT Sloan Fellows in April 2018 about Aramco's tolerance for failure (Ostraat, 2018). She explained that tolerance for failure is an extremely important characteristic of a company culture that supports innovation.

Vijay Govindarajan, an expert on innovation strategy, and Jeff Immelt, GE's CEO, wrote a 2009 *Harvard Business Review* article emphasizing the importance of a tolerance for failure as the key to innovation. Subsequently, Govindarajan was interviewed by Harvard Business Review Digital on April 6, 2009. The topic of the interview was "creating an innovation mindset." He was asked: "What advice do you have for managers who are trying to bring about change but run into resistance within the organization?" He answered:

There are three things that are important for overcoming resistance to change: (1) a performance measuring system. If you want employees to behave different with regard to innovation, the performance measuring system must change; (2) a willingness to collaborate, and (3) creating a culture that includes a tolerance for failure. Innovation, by definition, means you are doing something different, something new. This means you are not going to succeed 100 percent of the time. If we do not tolerate failure, people will not push the envelope.<sup>11</sup>

In another interview for the Harvard Business Review Digital, Govindarajan gave the following example to illustrate the power that experimentation has in the process of innovation:

In the 1990s, IBM wanted to create a computer that would be a thousand times faster than the fastest computer available at that time. IBM knew that speed in computers comes from microprocessors. They could have developed a powerful microprocessor. Instead they decided to slow down the speed of microprocessor, try to connect thousands of commodity chips, and by connecting them find the speed they were seeking. At the time, IBM did not know how many chips would be necessary, so they decided to conduct small experiments. They started with two commodity chips, then doubled to four, then doubled to eight, then to sixteen, and so on. As they did this, they

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<sup>11</sup> <https://hbr.org/video/2192249931001/creating-an-innovation-mindset>

monitored the machine's speed. They wanted to know at what number of chips the actual speed of the machine would begin to decline. The end result was the computer called Blue Gene, which had 64,000 commodity chips. This example again illustrates how small experiments may be necessary in order to support greater innovation. The IBM engineers knew their experiments could fail. However, since there were a small and low-cost experiments they could take the risk, thus embracing the concept of spend a little, learn a lot. (Govindarajan, 2010).

On the same topic of tolerance for failure, consider the following excerpt from a list of “Insights on Innovation” provided by a top executive at Xerox Corporation, a highly innovative company in the 1980s:

Empowering employees means allowing them to fail forward. It means not shooting the person who takes a risk but applauding him/her for having done so – no matter what the outcome. Risk-taking requires a lot of courage by both management and employees. Too many of us have been raised in families that tell us that “safe is better” and so we do not want to be disapproved of or yelled at. We do not want to risk being fired. Consequently, we play it safe. But “safe” is not what brings the best results. “Safe” creates suboptimal results.

It is hard to leap off the cliffs, it is hard to reach out and stretch. Some failure is bound to happen sooner or later. But the manager who has built a climate for innovation is the one who says, “Go ahead and try it,” and he says – should the project fail - “We worked on this together.” (Caroselli, 1994).

Another company that has seemingly adopted a tolerance for failure is Tata Group, an Indian conglomerate with yearly revenues of almost \$100 billion, a market cap of \$130 billion, operations in more than 100 countries, and 695,000 employees. Tata supposedly embraces a tolerance for risk throughout the company and it demonstrates this commitment by its Annual Innovation Award and its innovation movement called Inovista.

Tata Inovista was started by Tata Innovation Forum (TIF) in 2006 to recognize and reward the innovative and entrepreneurial spirit of Tata employees. Inovista showcases innovative attempts, big or small, that happen within Tata Group. Inovista started with the

objective of helping to foster a culture of innovations to instill self-confidence among Tata managers:

- Inspiring and motivating the innovative and an entrepreneurial spirit of encouraging innovations in companies.
- Showcasing and recognizing teams for their successes and struggles.
- Building a culture of appropriate risk taking.
- Being a source of new ideas and initiatives for other Tata companies (cross-company collaboration). (<http://www.tatainnovista.com>, 2018).

In Tata's Annual Innovations awards program, one category is called "Dare to Try" (see Figure 2-3). It awards teams and individuals who dared to take risks but their ideas did not turn into actual products or services.

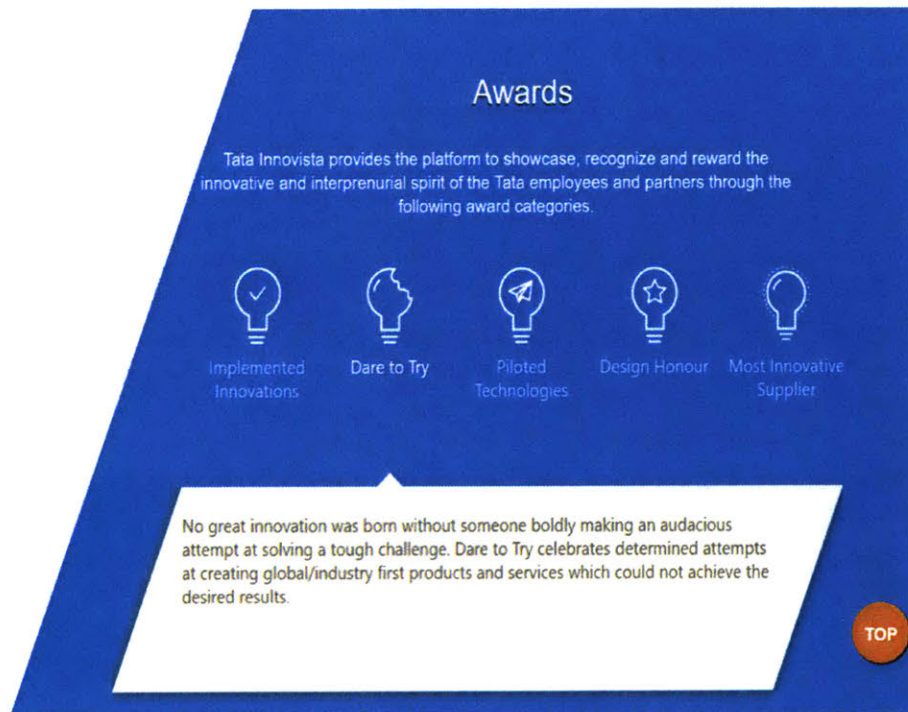


Fig. 2-3. Tata Innovista awards categories

Source: <http://www.tatainnovista.com/#abouttata2>



As the Tata example illustrates, recognizing innovations that fail is as important as recognizing innovations that are successful. Rewarding successful innovation is key, although rewards are not always in the form of money. For example, Westin Hotels recognizes its innovators with a five-day exotic trip each quarter (Kaplan, 2017). Haier, a Chinese manufacturer of home appliances, names its innovative products after the employee(s) who came up with the innovative idea (Kaplan, 2017).

Another leader, previously mentioned, embracing risk taking is Jeff Bezos. When asked about the role experimentation plays at Amazon, he responded:

Experiments are key to innovation because they rarely turn out as you expect and you learn so much . . . . We've tried to reduce the cost of doing experiments so that we can do more of them. If you can increase the number of experiments you try from a hundred to a thousand, you dramatically increase the number of innovations you produce. (Dyer, et al.,2011:136).

Bezos also realizes that many experiments will fail. In a discussion with Jim Whitehurst, Bezos said: "If his people have a 1-in-10 chance of making a 100-times return on an investment, he wants them to make that bet every time. But that means that to reap the reward Amazon needs to be willing to tolerate someone failing 9 out of 10 times" (Whitehurst, 2016).

CEOs like Bezos see opportunity in experimentation. According to Gregersen (2015), experimentation is one of the most important factors that differentiates innovators from non-innovators. In a 2015 article in *Fortune*, Gregersen states: "Becoming a master experimenter requires consciously approaching work and life with a hypothesis-testing mindset."<sup>12</sup> Again, Amazon is a good example, with its 2017 purchase of the natural and organic food chain, Whole Foods, for \$13.7 billion (Turner, 2017). Many are skeptical of

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<sup>12</sup> <http://fortune.com/2015/09/17/amazon-founder-ceo-jeff-bezos-skills/>

this purchase. An article published in *Business Insider* on January 18, 2018, indicated that several Whole Foods stores were facing food shortages.<sup>13</sup> But Bezos insisted this was largely because Amazon had implemented a new inventory management system called order-to-shelf (OTS) (Hoffman, 2018).

I believe this purchase is an expensive example of Amazon’s tolerance for failure. The corporation invested billions of dollars to purchase Whole Foods. Is the purchase a failure? Or is Amazon experimenting with new ways of doing business? One thing is certain: Whether or not the Whole Foods purchase is a success, Amazon will undoubtedly gain insights and learn from this situation. Table 2-3 shows Amazon’s innovations from the time it was founded until 2005. Innovations labelled “Exploit” are those that are intended to further current business at Amazon. Innovations labelled “Explore” are experiments, intended to test new (i.e., innovative) business lines (see, O’Reilly and Tushman, 2016).

Table 2-3. Amazon’s Explore/Exploit Innovations

INNOVATION NUMBER	EXPLORE / EXPLOIT	DESCRIPTION
1994 – 2000		
1	Explore	Internet bookstore
2	Exploit	Offer reviews to help customers make decisions
3	Exploit	Establish warehouses to handle increased volume
4	Exploit	Invest technology in fulfillment
5	Exploit	Affiliates program for marketing
6	Explore	SWAT teams – for music and DVD sales
7	Exploit	Partner with others to store and ship their products from Amazon warehouses
8	Exploit	More sophisticated technology for distributions of a broad array of products
9	Explore	Auctions to compete with eBay
10	Explore	Investment in do-coms (e.g., Pets.com)
2000 – 2005		
11	Exploit	Opening the platform for other retailers

<sup>13</sup> <http://www.businessinsider.com/whole-foods-employees-reveal-why-stores-are-facing-a-crisis-of-food-shortages-2018-1>.

12	Exploit	Decision that fulfillment was a core capability; enhance fulfillment capability; fulfillment available to other retailers
13	Explore	Amazon Prime – free shipping to members
2005		
14	Explore	Subsidiary A9 in Palo Alto (search engine)
15	Explore	Advertising service (ClickRiver)
16	Explore	Crowd sourcing (mTurk)
17	Explore	Lab 126 in Cupertino to develop consumer products
18	Explore	Video streaming (Amazon Instant Video)
19	Explore	Developer platform (elastics cloud computing, EC2)
20	Exploit	Simple Storage Service (S3)
21	Explore	Cloud computing (Amazon Web Services) – a combination of EC2, S3 and other programming
22	Exploit	Acquisitions to expand product categories (e.g., Zappos, Diapers.com)
23	Explore	Movie and video production (Amazon Studios)
24	Exploit	Mayday – new customer service modality
25	Explore	Amazon smartphone – the Fire

Source: O'Reilly & Tushman, 2016.

## PROMOTING CREATIVITY

Creativity is similar to innovation. It is about creating something new; it is about developing new ideas and applying them to solve a problem. In this section I present two examples of how creativity can be promoted with the objective of creating innovative organizational cultures. One is based on a company's practice, and one is based on research.

The first example comes from a question I asked Ken Washington, Chief Technology Officer of Ford Motor Company during an MIT lecture on the subject of Ford autonomous vehicles on September 12, 2017: "How is innovation being promoted at Ford?" Washington explained that an important activity at Ford's R&D center is promoting creativity. He said: "One technique we have implemented is called 'Tech Talks.' James Hackett, Ford's CEO, has been a major promoter of Tech Talks. Every week all employees at the R&D center gather during lunch hour. Someone, a Ford employee or an external speaker, presents a topic that has nothing to do with cars." He gave the example of the previous week when they had Tech Talk from a Ford employee who was an eclipse

enthusiast. Washington said that this kind of internal event helps Ford employees “think outside the box.” Learning about solar eclipses might unlock an idea that someone in the company could use.

Relatedly, Dyer, Gregersen, and Christensen (2013) explain that one of the most important cognitive skills for an innovator is association: “Innovative thinkers connect fields, problems, or ideas that others find unrelated” (p. 23). The authors argue that leaders who search for new and diverse information through questioning, observing, networking, and experimenting have well-developed associational skills that help them make connections between ideas. The authors interviewed 80 innovators and approximately 400 non-innovating executives. The research data helped them identify behavioral patterns in the innovators versus the non-innovators. The authors then developed a model for creativity using the set of behavioral patterns and named it “The innovator’s DNA model for generating innovative ideas” (see Figure 2-4)

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## The innovator's DNA model for generating innovative ideas

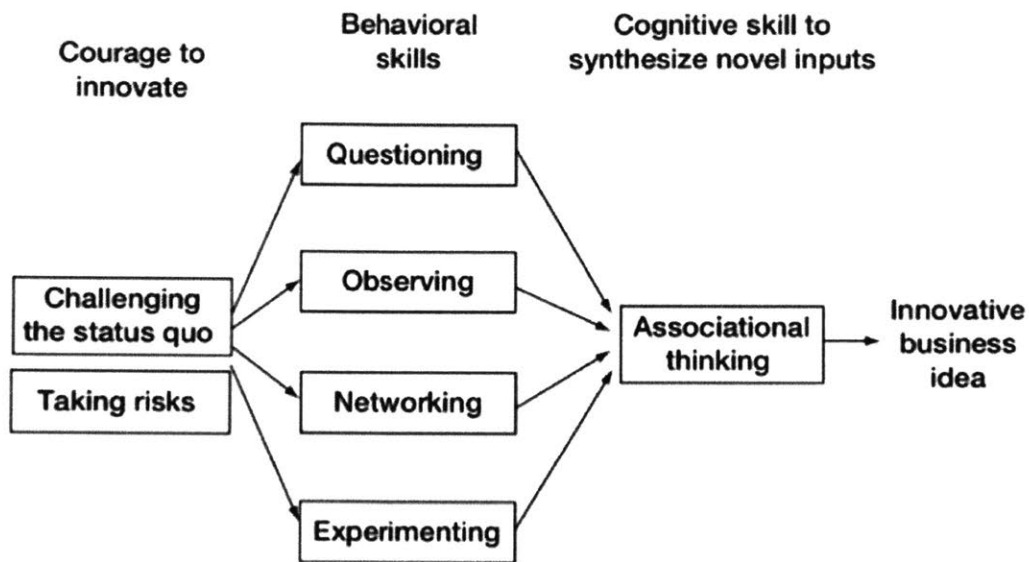


Fig. 2-4. The Innovator's DNA model for generating innovative ideas

Source: Dyer, Gregersen & Clayton, 2013.

The authors talk about two sets of skills that differentiate innovative leaders from less innovative leaders. One set focuses on discovery skills: Questioning, observing, networking, and experimenting. The other set concerns delivery skills: Analyzing, planning, detail-oriented implementation, and self-disciplined execution. Discovery skills could also be named Creativity skills since discovery is close to creativity. The authors put together an Innovator's DNA assessment of a sample of high-profile innovative entrepreneurs (founders and CEOs of companies on 2012 *Business Week's* list of the top 100 most innovative companies) and a sample of non-founder CEOs (executives who had never started a new business). They plotted both results on the same graph. The results can be seen in Figure 2-



5. The authors found that the more-innovative leaders score higher on discovery skills, while the non-innovative leaders score higher on delivery skills. The authors also identified a “sweet spot” or high balance area, which would be optimal for leaders with high scores on discovery and delivery skills. The authors suggest that the skills of discovery relate to the *Explore strategy* and the skills of delivery relate to the *Exploit strategy* (concepts that were discussed in Chapter 2).

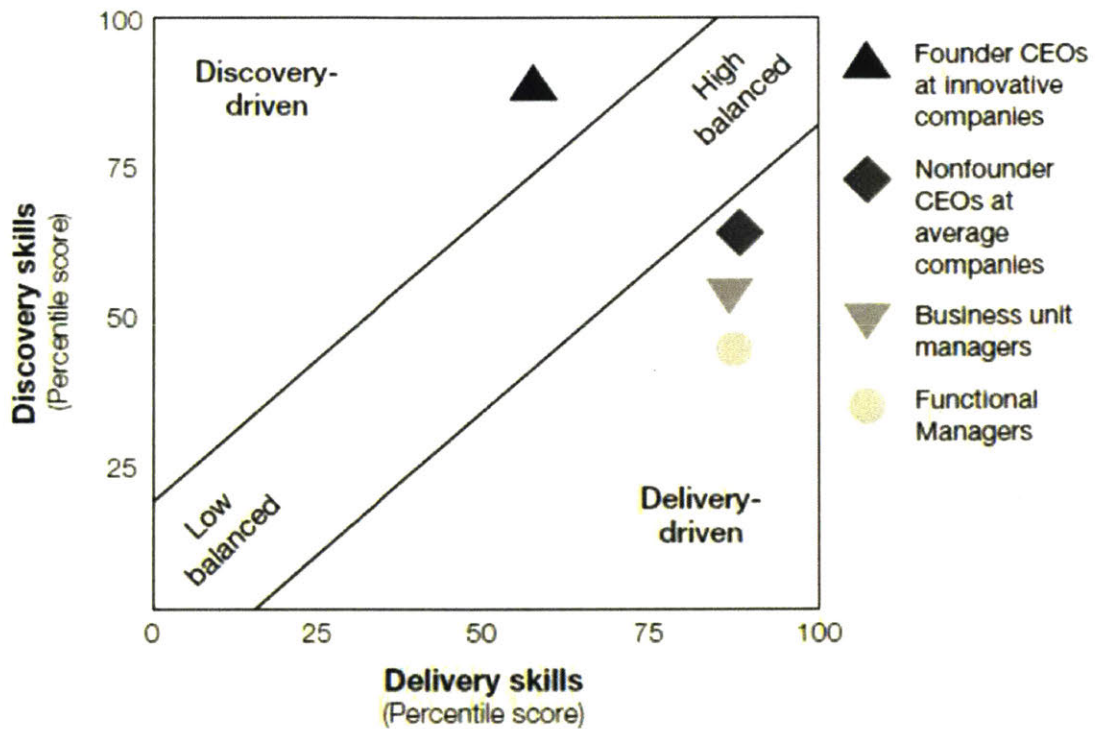


Fig. 2-5. Discovery-delivery skills matrix

Source: Dyer, Gregersen & Clayton (2013)

Innovative leaders often learn from new and unique experiences that make them more creative. According to Kurt Blazek (2016), Jeff Bezos used to take apart his grandfather’s Caterpillar tractor. Steve Jobs took calligraphy lessons in college, which may

have the inspiration for the typography on Apple word processors (Jobs, 2005). For both CEOs, creativity came from new and unique experiences.

There are perhaps few individuals in the world who have matched the creativity of Walt Disney. One could say that Disney exemplified creativity. He was a filmmaker, an artist, and an inventor. “He invented the theme park by raising the amusement park to an entirely new level” (Vance & Deacon, 1995). Vance writes about an anecdote involving Walt Disney:

Mel Melton, president of a Disney subsidiary, told of a humorous episode that took place as Walt was traveling with a group of his executives. The six executives were assembled for breakfast in a hotel dining room, waiting for Walt to join them. They decided to delay placing their order until he arrived. He eventually walked into the restaurant, sat down and asked what they were waiting for and why they had not ordered. One of them told Walt they had been waiting for him to arrive. The waitress asked Walt what he wanted to start with and he ordered fresh figs. She asked the six other men at the table what they wanted to start with and they all ordered figs. As the story goes, Walt leaped to his feet and explained, “I hate figs! I hate people who like figs. I hate people who copy other people who say they like figs. In fact, I hate you guys, too.” He walked out on them and flew back to California on the company plane, leaving his surprised executives stunned. This story has long been legend among Disneyites as an example of Walt’s loathing for people who copy other people instead of exercising their own creativity. (Vance & Deacon, 1995)

In this chapter, I introduced the role of the leader who creates a culture that promotes innovation. I presented the Hill, Brandeau, Truelove and Lineback (2014) model for leaders who want to create a sense of community as the first step to creating this culture of innovation. Once a sense of community has been created, the authors suggest that the next step is to improve the employees’ creativity in solving problems encountered during the innovation process. The authors argue that it is the responsibility of the leader to support

employees as they acquire the capabilities needed to foster collective creativity (see Figure 2-6).

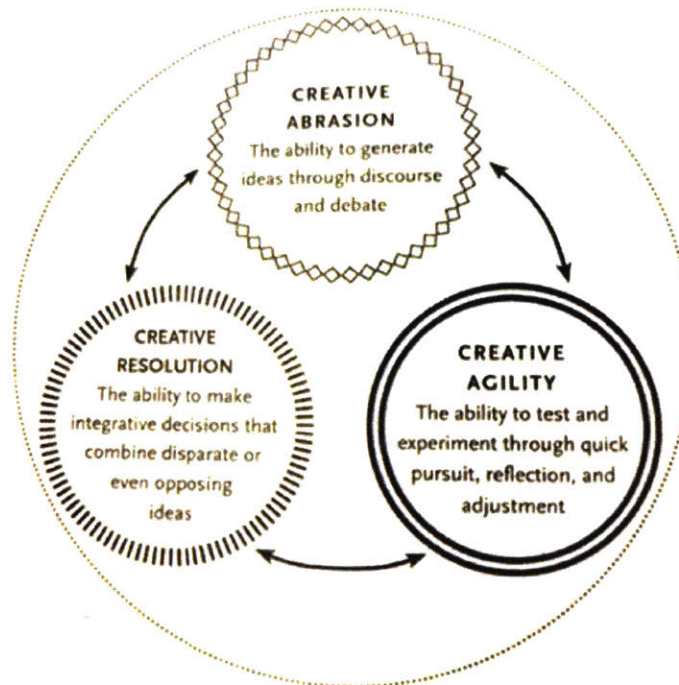


Fig. 2-6. The Ability to Do the Hard Work of Innovation

Source: Hill, Brandeau, Truelove, and Lineback, (2014)

This collective creativity is formed by three capabilities: creative abrasion, creative agility, and creative resolution. These capabilities have to be exercised by employees at all levels in order for innovation to flourish in the organization.

In this chapter, I also presented two frameworks for the management of innovation supported by years of research. Both frameworks, Von Hippel's Sources of Innovation (1998) and Utterback's Dynamics of Innovation (1994), provide detailed guidelines for helping leaders to manage the process of innovation within organizations. These frameworks identify where and when innovation usually happens. I then presented examples of leaders managing innovation and their views on creating a culture of innovation. In the next chapter,



I present a case study of  $\beta$ -Automotive. This case study describes how innovation is seen by management in a large and, to date, successful automobile supply company/

## **CHAPTER 3**

### **CASE STUDY: A CULTURE OF INNOVATION AT $\beta$ -AUTOMOTIVE**

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#### **BRIEF HISTORY AND BACKGROUND**

$\beta$ -Automotive was founded 75 years ago by an entrepreneur who, after finishing his engineering studies, bought several plastic injection machines and began manufacturing products for the automotive industry.  $\beta$ -Automotive's history resonates with success stories as it moved from a small start-up to one of the top suppliers in the industry. Further,  $\beta$ -Automotive was first company to supply its customers with a variety of products: interior parts, exterior parts, and drive-train components related to the delivery of liquid fuel to the engine.

Currently,  $\beta$ -Automotive is a market leader with 20% market share, €8 billion (US\$ 9.3 billion) in revenue, 33,000 employees, 127 production facilities in 31 countries, and 24 R&D centers serving 78 automobile brands worldwide. Its growth is based on technological advances in the automotive industry, developing safer and lighter products that provide value to customers and end users. Through internal and external innovation, joint ventures, and outright purchase of other companies,  $\beta$ -Automotive has attained its current market and financial position. By 2017, vehicle production was at a historic high of 93 million units produced worldwide.<sup>14</sup>  $\beta$ -Automotive has been part of this growth as a market leader.

The automotive industry has seen many innovations since the internal combustion engine was invented in the early 1900s. However, liquid fuel--the energy source that powers

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<sup>14</sup> <http://www.oica.net/category/production-statistics/2017-statistics/>

vehicles—has not really changed for almost 100 years. During that time, however, internal combustion engines continued to evolve, with a special focus on fuel economy and efficiency. New sources of energy to power vehicles have been explored: biofuels (e.g., ethanol, bio-alcohol, bio-diesel, bio-gas), compressed natural gas, hybrids (electric and gasoline), nitrogen, and electrical. With the rise of Tesla Motor Company, as well as other major car manufacturers that have been working nonstop for the last decade to develop electrical vehicles (EV), a potentially disruptive technology for powering vehicles is coming to the fore: EVs that do not require liquid fuel.

For  $\beta$ -Automotive, its technologies and expertise have always focused on liquid fuels. Questions must be asked: Does the rise of EVs pose a threat to  $\beta$ -Automotive's future? What is the company doing to identify future technologies and continue to grow and remain a major player in the automotive industry over the next five to fifty years?

In the summer of 2017, Steve Nolan had just been appointed CEO of  $\beta$ -Automotive. Prior to becoming CEO, Nolan oversaw growth at  $\beta$ -Automotive, with revenues of almost \$700 million (approximately 26% of the company's worldwide sales). He was responsible for corporate business in five Asian countries (China, Japan, Thailand, India, and Korea) with just under 2,000 employees. In the face of major changes in the industry, Nolan was concerned that the company was not innovating enough to sustain its competitive edge. He also considered what changes were needed to be implemented to ensure long-term growth and viability.

These issues were not just on Nolan's mind, but also on the minds of many employees who were beginning to worry that their jobs might disappear due to the introduction of new technologies. The HR department at  $\beta$ -Automotive had already signaled

that attracting new talent was becoming more difficult because new engineering graduates chose to work in the high-tech industry rather than for a company related to fossil fuels.

The company had reached a crossroads and deciding which route to take would be Nolan's primary challenge, one that would set the tone for the coming years. He had to ensure that innovators within the company were supported with the right conditions and environment to encourage development of new ideas—ideas that would identify what technology to focus on, ideas that would become the basis for next-generation products in the automotive industry, perhaps even within other industries. Nolan was on a quest to create an organization culture that would promote innovation. How quickly  $\beta$ -Automotive launched to the next level would determine its success.

## **HOW INNOVATION IS PROMOTED**

$\beta$ -Automotive innovation strategy is illustrated in Figure 3-1. Its internal innovation systems is comprised of four R&D centers that explore technological long-term trends, 20 development centers, 3,500 engineers, and 3,700 patents portfolio. The company invests 6% of its revenue on R&D. Its external innovation system is comprised of alliances with three universities (MIT in the US, DTU in Denmark, Technion in Israel), close relationships with industry experts, and technical startups.

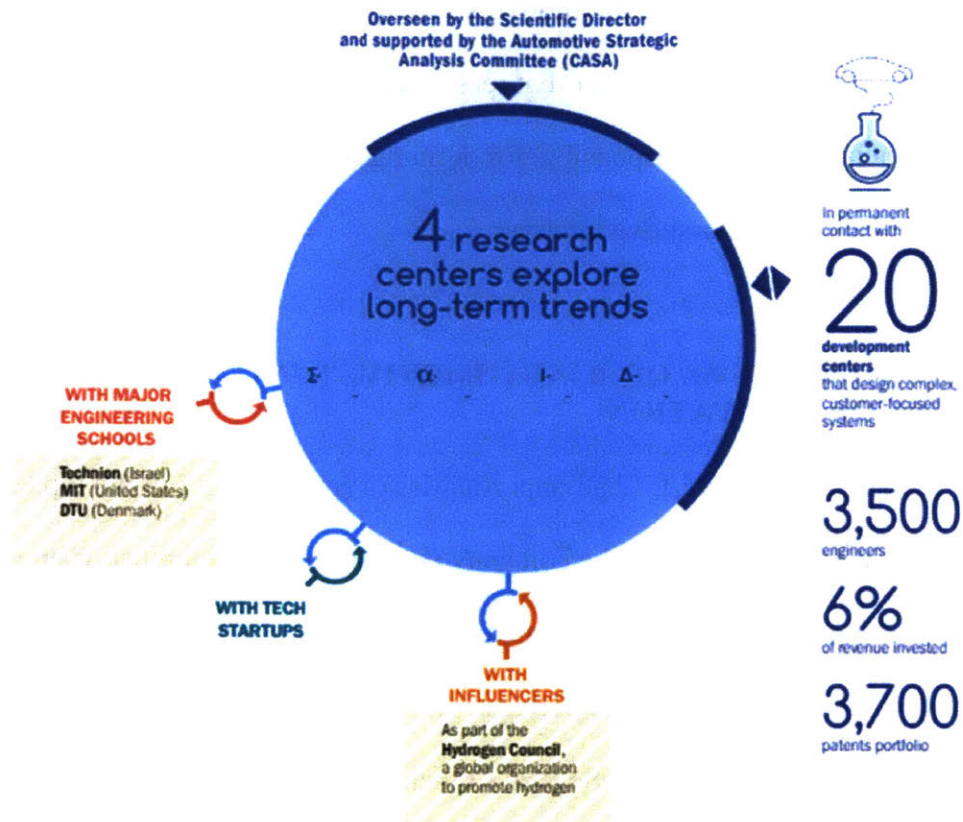


Fig. 3-1. Innovation strategy

Source: Adapted by thesis author from original

With its university alliances, the company strives to maintain continuous communication with top researchers.  $\beta$ -Automotive innovators and top management are kept apprised of the newest industry trends. In addition to collaboration with the three universities,  $\beta$ -Automotive maintains a strong focus on open innovation, looking outside the company to find ways to stay ahead of the ever-evolving technology.  $\beta$ -Automotive has acquired one start-up in Israel, part of a venture capital fund that focuses on mobility and energies of the future. This is an attempt to identify what might be the next technology wave that could impact its automotive business.

Another key part of  $\beta$ -Automotive's strategy is to bring management closer to the influencers and opinion leaders. For that reason, the company became part of the European Nitrogen Council, which is responsible for defining future trends using nitrogen as an energy source for the automotive industry.

## **MANAGEMENT VIEWS OF $\beta$ -AUTOMOTIVE'S INTERNAL CULTURE OF INNOVATION**

As noted in Chapter 1, I had opportunities to speak with 17 of the top leaders of  $\beta$ -Automotive about innovation at the company (see Appendix B for a list of interviewees).. We talked about current innovation strategies and current challenges facing the company. Our conversations focused on their views of what the company is doing today to create a culture that promotes innovation. Several of them provided ideas for what they believe the company should do to strengthen the culture of innovation. In the following pages I summarize nine of the 17 interviews. These nine are representative of the views of all that were interviewed and serve to identify the main elements of the company's culture of innovation.

### **The CEO**

The first person I talked to was the CEO, Steven Nolan. Nolan started the conversation by explaining that there have been many technological developments in the last decade within the automotive industry, especially with the growth of electrical car technology. This technology presents a threat to the current use of regular liquid fuel as a source of energy for automobiles. Nolan said nobody really knows what will happen in the future. Should  $\beta$ -Automotive keep focusing on improving current technologies that utilize

liquid fuel? Should the company focus on markets beyond the automotive world? What about innovations like car sharing and ride sharing? These questions are constantly on his mind.

Nolan mentioned that the new R& D Center will be extremely important for identifying future technologies. Unlike other R&D centers, the new one should promote a culture of innovation focused on two elements: being open-minded and demonstrating corporate agility. He explained that  $\beta$ -Automotive has become a large company and may now run the risk of being less agile. I asked him for his thoughts on how to make the new R&D center more agile, especially since more than 100 engineers will be hired to work at the new R&D site. He answered:

We need to celebrate innovation. When we celebrate innovation, it becomes a virtuous cycle. It is my plan for the top leaders of the organization to spend more time at this R&D center. It is my plan for employees to present to our management team their ideas and innovation. This is a way to celebrate innovation. We have to provide the right tools to the people working on innovation, we have to provide a collaborative environment that promotes communication among them. We have to provide the environment where employees have the right to fail.

With new engineers being hired, Nolan explained the challenge of hiring the right talent. Since the automotive industry is growing, more companies will try to hire the same talent, and that could lead to a talent war.

Nolan believes many people within  $\beta$ -Automotive still work in silos. He said there is a communication gap between people who are in R&D and those involved in manufacturing. He saw a huge benefit to be gained from collaboration between these two teams.

## **Human Resources**

In another interview, I talked to Samuel White, Vice President of Human Resources. I asked him about the current culture of innovation and how he sees it evolving in the future. He said there are two conditions that are necessary in an organization that promotes innovation:

The first condition is that the organization has to be aware that it has to innovate.  $\beta$ -Automotive has been successful in the past, but this does not mean we will be successful in the future. Success can make people lose their appetite; they might not be hungry for innovation since we are doing well. Innovation is not for play, it is the critical condition to survive. The second thing is that people have to have the right to make mistakes.

He said  $\beta$ -Automotive is not well known, because it is a B2B enterprise. Most people know the major car manufacturers like Tesla, Ford, and Mercedes Benz, but few people know of  $\beta$ -Automotive—a tier-one supplier who manufactures many of the components found in vehicles. He is working with his team to find new ways to attract new talent.

When I asked White about how to manage young engineers, he responded that the company needed to train managers. He said that the people managing innovation at the R&D centers are mainly engineers who have grown with the company. It is generally thought that a good engineer does not always make a good manager. His point was that one of his team priorities is to develop the communication skills of his current managers and provide timely and relevant feedback to the engineers, specifically on innovation. He believes that by providing training and feedback, this will support a stronger culture of innovation at the new R&D center.

Then I talked with Madelene Palmer,  $\beta$ -Automotive Human Resources Manager for the new R&D center. This is what she said about  $\beta$ -Automotive's culture of innovation:



One of the main challenges from the Human Resources point of view, when talking about our culture of innovation, is motivation schemes for our engineers. Our innovators do not have regular professional development as generally happens in operation facilities. You start as a process engineer, you then can move to department manager, then you could become a program manager or a quality engineer. There are several paths for development. In our R&D Center, it is quite different. We have to find a way to keep motivating them in their area of expertise. We have a program called Master Expert, to which experienced engineers can apply. If selected, they become Master Experts and receive special recognition. We should create ways to give our Master Experts and regular engineers more visibility within the organization. I know that giving them more visibility is a good way to keep them motivated.

After talking about the challenges of motivating engineers, Palmer told me her belief that a manager's role is extremely important for promoting collaboration within the R&D center. She explained that most of the researchers like individual work because they are engineers and scientists. It was the manager's responsibility to transform the organization from one based on individual work to one based on teamwork and collaboration.

When asked about the challenges of doubling the number of staff at the new R&D center within a year, she said:

It is already difficult to hire engineers and scientists. The economy is growing, and there is a lack of people with the right skills. The best way to bring in top talent is by activating our individual networks and promoting our  $\beta$ -Automotive research identity. Hiring by word-of-mouth is way more effective than using headhunters or regular job advertisements.

She explained in greater detail her comment about  $\beta$ -Automotive's research identity.

The  $\beta$ -Automotive R&D center should be better known within the local innovation ecosystem. Top talent should hear from friends and people involved in innovation that  $\beta$ -Automotive R&D is a great place to work. We should better activate our networks so talented engineers and scientists will choose to work for us.

### Sales Leadership

I talked to next to Thomas Cheney, Vice-President of Sales, He said the company's current success is due to its culture of innovation. Cheney stated that he and his employees were proud of this culture. He drew a diagram representing his mental model of innovation (see Figure 3-2):

$$\text{INNOVATION} = \text{NEW IDEA} + \text{VALIDATION IN PERFORMANCE} + \text{VALIDATION IN MANUFACTURING} + \text{VALIDATION IN COST}$$

Fig. 3-2. Innovation, according to Thomas Cheney

He used the diagram to explain how a new idea for a product has to be validated by its performance. Once the new innovation is proven to solve a problem, then it has to be validated by manufacturing, i.e., is the part actually manufacturable? Once the first two steps are validated, the last step is to validate its cost and make sure it is a commercially viable product that customers are willing to buy.

When I asked him how he sees  $\beta$ -Automotive's culture of innovation, Cheney referred to the worldwide safety campaign launched by the company several years ago. The campaign was about reducing accidents everywhere in the company, from corporate offices to manufacturing, from the R&D labs to small-assembly operations that use Just in Time processes. The company deployed a massive campaign called "BE AWARE, BE ALIVE." The governing assumption was that all employees are responsible for their own safety. "If people are aware," he said, "then they should be safe."

Cheney went on to draw a parallel between the safety campaign and a much-needed innovation campaign. He suggested that in order to promote an internal culture that fosters

innovation, a new worldwide campaign should be launched within the firm and be named “BE AWARE, BE INNOVATIVE.” He felt that innovation was not only the job of the employees working at the R&D center; rather, innovation should come from all employees. He added that this campaign should come together with a worldwide intranet site dedicated to gathering innovative ideas from employees around the globe.

His last comments were related to company interactions with customers. He explained that employees working on product innovation are too removed from customers’ needs. He made a point that being close to customers is key to understanding their problems.

### **R&D and Strategic Leadership**

After talking with Cheney, I met with John Beaufort, Vice President of Industrial & Innovation. Beaufort’s first comments about the new R&D center also focused on the challenges of bringing new and younger talent to the company. He said that  $\beta$ -Automotive has to create the right environment at the new R&D center that will promote creativity among the new employees. He said the company has to understand several factors that affect this environment. He explained how the new R&D center layout and offices were designed much differently from what  $\beta$ -Automotive has done in the past. His team was working with a consultant to create office spaces that promote collaboration—long work tables for people to work as teams and open areas for people to communicate and share ideas. He believes that open spaces promote collaboration and collaboration promotes innovation.

Beaufort talked to other top leaders who were not involved in the internal innovation process, but instead with the external innovation arena. Since Beaufort is responsible for all innovation strategies, he wanted me to understand what was being done on open innovation and how this was part of  $\beta$ -Automotive’s innovation strategy.

The second person I talked to within the R&D department was Martin Ferris,  $\beta$ -Automotive Vice President of Strategy. An important part of Ferris' role is to work with the company's vice presidents to identify startups that would align with  $\beta$ -Automotive's future technologies. Ferris was leading the company efforts on the external ecosystem of the innovation strategy as explained at the beginning of this chapter (see Figure 3-1). His focus is primarily open innovation coupled with an extensive analyses of startups for potential purchase.

The company acquired two startups in the last several years, both with technologies that are quite different from those  $\beta$ -Automotive is currently working on. Ferris explained the reasoning for purchasing such start-ups:

Nobody really knows for sure what technologies will define the automotive market in 10, or 20 or 50 years. Today, there are so many things to choose from that our customers do not know what technology to focus on. By having  $\beta$ -Automotive engage in several technologies, we increase our chances of having the technical knowledge to create innovative options that customers might choose in the future. We are creating a portfolio of technologies in order to mitigate future risk.

I asked Ferris about  $\beta$ -Automotive's culture of innovation. He noted the company has improved but it still needs improvement. He went on to mention the voice of the customer. He believes the company is becoming better at dealing with how the customer's voice is heard. "We have had a challenge to determine at what stage in our R&D should we bring in our customer voice. How early in this process should we involve the customer?" He added:

Let me give you the following example: Many years ago, we were working with our largest customer, General Motors (GM), on a particular technology development. At that time, this technology was really revolutionary and not known to many in the industry. We were excited and started working with them. Over time, GM decided that this technology had no future and they cancelled all the research. We cancelled our research as well. We thought we

were very good at hearing and listening to our customer needs. Just recently, GM reopened this research and it looks that they might choose this technology over another. If we had continued our research, we would probably be in a much better position by now. My point is that we have learned that listening to the customer is important but it is more important for us to decide how early in our R&D process should we be listening to their voice.

Another point he made was about tolerating failure within the company. Ferris told me the following: “At  $\beta$ -Automotive, we are not very good with tolerating failure. The concept of failing is not well promoted or understood. I know that Francis Corbe,  $\beta$ -Automotive Director of Industrial, is trying to push this concept but it is very difficult.”

### **Open Innovation**

During my conversation with Ferris, he mentioned that I should talk to Philip Wells, Vice President of Open Innovation. Ferris worked closely with Wells on the latest startup purchases, and Ferris thought Wells might have some interesting things to say about  $\beta$ -Automotive’s culture of innovation. I contacted him via conference call.

Wells has been at  $\beta$ -Automotive for many years. He worked in R&D for more than a decade, acquiring considerable experience as the company learned how to manage innovation. Recently, he was assigned a new role in the area of open innovation. His job is to explore interesting ventures outside the company and identify startups that are working on emerging technologies. The technologies of interest, however, must have the potential to be adopted by  $\beta$ -Automotive customers.

He then talked in more detail about the internal culture of innovation at  $\beta$ -Automotive. He believes the company does not have a good method for evaluating its projects at the R&D centers. He said there is a disconnect between risk and expectations

from top management. Top management is focused on results. Failure is not well received. Top management should spend more time at the R&D centers. By doing this, they would better understand the risk level of every new project, which would allow researchers to connect better with management.

Wells also talked about the need among researchers to read technology signals that exist out in the world. Such signals are difficult to read but extremely important for researchers to identify. They define the next technological development in  $\beta$ -Automotive products. In order to read the technology signals, researchers have to collect large amounts of information regarding technology and product innovations. This information can be collected via the technical literature and by participating in technology conferences and workshops. Researchers need to make this information available to the rest of the internal team through brainstorming sessions that encourage everyone to come up with creative ways to get information out and help the team draw conclusions. He referred to the process called “tech watch.” He said: “We researchers working on innovation at  $\beta$ -Automotive have to be in a constant “tech watch” so we are able to read technology signals.”

### **R&D Center**

On January 25, 2018, I met with George Zola,  $\beta$ -Automotive Control Systems Director at the R&D Center, to discuss his views on the company culture of innovation. Zola told me that the number of electronics technologies used in  $\beta$ -Automotive products in 2004 had increased twenty-fold by 2018, and this increase has added value to the company’s products. It also forced his team to think about products not just as single pieces that are part of the assembly of an automobile, but rather as part of several systems that support major functions. The use of electronics has enabled products to communicate with the main

automotive computer to provide valuable data as the engine runs. These capabilities have added increased value to customers. These developments in electronics have forced Zola to bring new talent to  $\beta$ -Automotive, people with skills and knowledge that were not required a decade ago.

He has also seen challenges on the customer side as they have improved their technical skills in order to develop new products using the communication technology in the automobiles. Zola explained how the company separates product development from product research. Product development is about developing products for customers that makes use of current proven technology. This product development is aligned with the new automobiles that launch every three to four years. There are specific milestones and due dates.

Product research however focuses on new technologies that need to be proven first. Innovation happens mainly during the product research stage. This is the specific focus of the new R&D center—to focus on future technologies that will define products in 10, 20 or 30 years. He stated emphatically: “Product development is about today. Product research is about tomorrow.” He went on to say that the timing and deliverables are completely different when comparing product development and product research.

On January 24, 2018, I met with Walter Sinclair, Vice President of Research, to discuss his views. Sinclair’s team is in charge of the construction of the new R&D Center. He told me that today there are 15 nationalities represented on his R&D team and he expects this number to grow as they hire more engineers and scientists for the new center.

He also expressed concern about bringing in new talent. Sinclair told me that one of  $\beta$ -Automotive’s strengths is top leadership’s willingness to work with startups in new technologies. He said that his team cannot develop everything internally. They have to be

able to work with external partners. Sinclair said it is important for his employees to have technical knowledge so they can understand those technologies being explored externally. His point was that all the required technical knowledge might not be available internally. When asked about the internal culture of innovation, Sinclair added: “Our top management is not very involved with the innovation process. Managing innovation is about creativity, research and science. Sometimes innovation is seen as project management with tight timing and specific milestones. We need the freedom to innovate. With freedom to innovate we need fast assessment of ideas.” He then gave the following example:

We were working on a particular idea that could turn into a promising product. A team of engineers and scientist was formed. The team was very motivated. During several months we continued to work on this idea but we were not receiving a clear direction from people close to the customer on the assessment of this idea. After one year of many hours spent on this particular idea, we were told to kill the project. My frustration is that it took too long to make a decision.

Sinclair detailed some of the ideas they were trying to implement in the new R&D center which, according to him, would improve innovation. He noted that they will try to manage projects in a visual and collaborative way, using tools such as digital boards that can be accessed remotely. He finished by explaining that in order to promote innovation they have to find ways to be more creative and agile.

### **Summary of Interviews**

In Chapter One I presented five questions that I would ask during interviews at  $\beta$ -Automotive. The following section is a compilation of the set of responses to each question:



*What are the main attitudes, values, goals, and practices that are encouraged in order to promote innovation?*

Most of the people interviewed agreed that the company's success is due to its successful technical innovations in the past. They explained that project management practices are what enabled such innovations. They thought the company's commitment to innovation was apparent in recent acquisitions of high-tech startups. These purchases came up in almost every conversation. Half the people mentioned that investment in the new R&D Center showed the company was continuing to invest in innovation.

*Is the CEO directly involved in the innovation process?*

The vast majority answered that the CEO was involved in the acquisition of the startups. They also mentioned that he was not involved in their day-to-day activities at the R&D Center—but most also agreed that there was no need for him to be involved.

*How would you describe company culture regarding tolerance for failure?*

There was almost unanimity on the answer to this question. They expressed their view that failure is not well regarded by the company. They expressed discontent that research is measured as a regular project with specific deliverables. Some of the interviewees brought up the company's low tolerance for failure even before I asked the question.

*Does the company have an innovation contest? If yes,*

All 19 interviews confirmed that there is no innovation contest at the company

*What are the categories?*

Refer to above question response.

After these interviews, I compared the information gathered to the best practices identified in my research. In the following and final chapter, I provide summary of my research and some general recommendations for companies (including  $\beta$ -Automotive) that are seeking to strengthen their innovative processes.

## CHAPTER 4

### SUMMARY AND RECOMMENDATIONS

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I began this thesis by elaborating the intertwined relationship between leadership and culture. I explained how culture within organizations is comprised of a set of shared attitudes, values, goals, and practices, and I posed the question: how can top leaders influence that culture? Then I explored relevant frameworks in innovation management and leadership.

I acquired insight by interviewing professionals involved in the process of innovation in different industries and individuals of a specific company,  $\beta$ -Automotive. The objective of the literature research and my interviews was to identify key practices that top leaders should embrace in order to create a culture that promotes innovation.

I presented two frameworks of innovation management: one by Eric Von Hippel, e and the other by James Utterback. I believe both authors contribute considerably to an overall understanding of where and when innovation happens and the need for top leaders to be aware of these two frameworks when trying to shape an organization culture that promotes innovation. Both frameworks offer a guide to leaders on the specifics of innovation based on the dimensions of time and sources. However, they do not answer the question of how to create a culture that promotes innovation.

To answer this question, I explored the innovation literature and interviewed leaders involved in the innovation process. Through this exploration, I conclude that there are three main elements that leaders should consider when attempting to create a culture that will

support the innovation process. The three elements are: the role of top leadership, tolerance for failure, and creativity.

**First Element: What is the role of leadership in creating an innovative culture?**

Creating a culture that promotes innovation is about the CEO adopting a set of innovative values and behaviors that are important for the whole company. The CEO becomes the Innovation Architect and it is his responsibility to infuse this set of values and behaviors throughout the company. The CEO's role as a leader is the first step needed to create the company's culture as one that promotes innovation. The primary job of the leader is to build and sustain a work environment that helps people engage in key innovation behaviors as part of their daily work (Miller & Wedell, 2013).

**Second Element: How do you create a tolerance for failure in an organization?**

Companies that do not have a tolerance for failure find that innovation may stall. Successful leaders of innovative companies remember that creating a culture that embraces a tolerance for failure recognizes and rewards employees who dare to try but do not always succeed. Innovation architects promote a tolerance for failure that helps create a culture of innovation. In general, what Dyer, et al. (2014) call "discovery-driven people" will take smart risks because they understand failure can increase learning and they understand the benefits of failing fast. Most important, they feel safe because the companies they work for have a culture where failing is seen as a natural part of the innovation process.

**Third Element: Is creativity important to innovation?**

Hill, et al. (2014) have a solid model based on years of research into how creativity is critical to innovation. They argue that creativity is not a “solo” process performed by the top leader; it is a collaborative effort, and it is the top leader’s primary responsibility to create a culture that fosters collaboration among all employees so they can build innovative products and services by adding everyone’s “slice of genius” (Hill et al, 2014).

The Venn diagram in Figure 4-1 represents the three elements that leaders need to create a culture that promotes innovation.

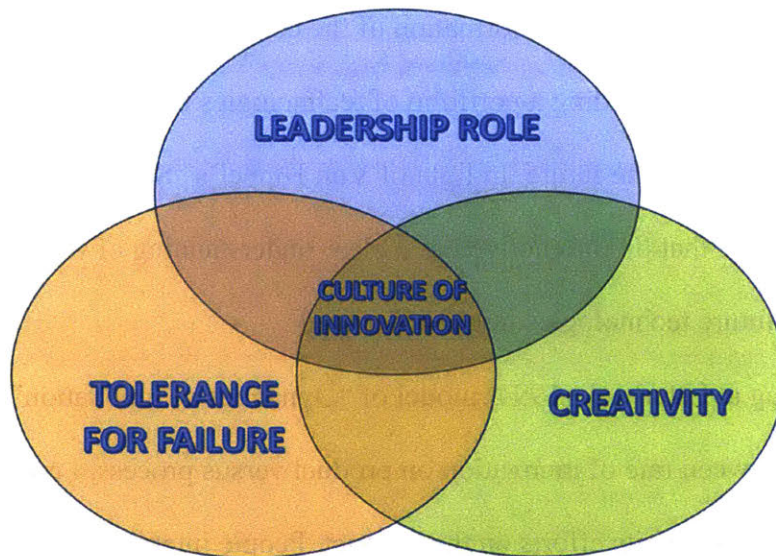


Fig. 4-1 Three Elements that Create a Culture of Innovation

Source: thesis author

A culture that promotes innovation does not happen on its own in organizations. It is the responsibility of top leaders to create an environment in which they serve as role models

for the innovation process, promote a tolerance for failure so employees experiment and “dare to try,” and implement processes foster for creativity.

## **RECOMMENDATIONS FOR B-AUTOMOTIVE**

In this section I provide general recommendations to  $\beta$ -Automotive based on the insights gained during this study.

### **Sources and Dynamics of Innovation**

The information I gathered during the interviews, particularly the conversation with the Vice President of Open Innovation, helped me understand what the company is doing in terms of open innovation. This information of the company’s innovation strategy shows a strong commitment to building a portfolio of technologies that might be required by the automotive industry of the future. In light of Von Hippel’s “Sources of Innovation” model (1998), I conclude that  $\beta$ -Automotive has a clear understanding of where the sources of innovation in future technologies might be located.

Looking at Utterback (1994) model of “Dynamics of Innovation” and the interrelation between rate of innovation on product versus process, I conclude that  $\beta$ -Automotive is focusing its efforts on the product. People interviewed at the R&D center focus mainly on product innovation. All discussions about innovation were related to products, not processes. It is my recommendation that  $\beta$ -Automotive give the same importance to process innovation as it has given to product innovation. Both are interlinked and rate of innovation should be followed along the lines of Utterback’s model.

Based on the three elements that create a culture of innovation, I present the following recommendations. They follow my general recommendations given above.

### **First Element: Leadership Role**

Nolan, as CEO of  $\beta$ -Automotive, wants to create a culture that promotes innovation. His engagement with me in this thesis research is proof of his interest. During my conversation with Nolan, he indicated that he and his leadership team do not spend enough time at their new R&D Center. He said he intended to hold several global leadership meetings at the center in support of his engagement.

As described in this thesis, it is one of the CEO's primary objective to be involved and active in the innovation process. This does not mean that Nolan has to spend one or two days a week at the R&D center. However, it is important for Nolan and his direct reports to engage more in the innovation process in order to establish communication with the scientists and engineers working there.

One of the main concerns expressed by those scientist and engineers was that top leadership does not fully understand the risk and timing involved in the innovation process. Their concern was that they are not given enough freedom when innovation is managed like a regular project with set milestones and deliverables. It is my recommendation that Nolan engage himself and his leadership team in the innovation process so the gap between expectations and actual results in innovation are smaller than today.

### **Second Element: Tolerance for failure**

One common comment heard throughout my interviews was that failure is not well received at  $\beta$ -Automotive. Top leaders, as well as managers working at the R&D Center, shared their views on this topic. They all know that failure is a natural process of innovation. Unfortunately, people working on innovation are not expected to fail. If the culture does not allow people to try, innovation is constrained. People must have the right to make mistakes.

It is my recommendation that Nolan give particular weight to the second element when improving  $\beta$ -Automotive culture of innovation. Creating a celebration for ending a failed project or celebrating a poor project's rejection by the team is one way he could begin to change the perceptions about failure. In terms of the three elements, this is the most critical.

### **Third Element: Creativity**

Creativity is a collective process. During the interviews and discussions at  $\beta$ -Automotive, I noticed great excitement about the new office environment that will be created at the R&D Center, especially the open office concept that promotes collaboration and interaction. This conscious effort by leadership represents their efforts to promote creativity. However, creativity and collaboration are more than just an open-space concept. I found the model developed by Hill, Brandeau, Truelove, and Lineback (2014) powerful and useful. It is my recommendation that Nolan use this model, "The Willingness and Ability to Do the Hard Work of Innovation" as a guide when creating the culture at the new R&D Center. This will allow Nolan to create a sense of community for employees and give them with the abilities needed to use their "collective genius" in the innovation process.



### **An $\beta$ -Automotive Workshop: Something to Do Immediately**

I recommend that Steve Nolan and  $\beta$ -Automotive organize a one-day workshop in the coming months with top leaders at their R&D center. The objective of a one-day workshop would be for Nolan and the top leadership of the company to reflect on the company's current culture and how they see the future. The purpose is identify the next technological wave and not miss it. This one-day workshop could present the findings of this thesis and trigger an exchange of questions and discussions. Such a workshop should be supported by an external consultant with expertise in organizational culture. Literature and examples explored in this thesis could be used during the workshop.

## Appendix A

### 2017 - Top 100 Most Innovative Companies

Rank	Company	Country	12-Month Sales	Innovation Premium*	Rank	Company	Country	12-Month Sales	Innovation Premium*
#1	<a href="#">Salesforce.com</a>	United States	25.87%	82.46%	#51	<a href="#">CR Bard</a>	United States	8.72%	47.30%
#2	<a href="#">Tesla</a>	United States	73.01%	78.43%	#52	<a href="#">Mastercard</a>	United States	11.47%	46.99%
#3	<a href="#">Amazon.com</a>	United States	27.08%	72.78%	#53	<a href="#">Magnit</a>	Russia	12.37%	46.81%
#4	<a href="#">Shanghai RAAS Blood Products</a>	China	15.27%	71.72%	#54	<a href="#">Anheuser-Busch InBev</a>	Belgium	4.64%	46.58%
#5	<a href="#">Netflix</a>	United States	30.26%	71.54%	#55	<a href="#">Ctrip.com International</a>	China	66.67%	46.51%
#6	<a href="#">Incyte</a>	United States	46.70%	70.91%	#56	<a href="#">Oriental Land</a>	Japan	2.66%	46.42%
#7	<a href="#">Hindustan Unilever</a>	India	3.03%	68.59%	#57	<a href="#">TransDigm Group</a>	United States	17.15%	45.98%
#8	<a href="#">Asian Paints</a>	India	7.19%	68.28%	#58	<a href="#">Booking Holdings</a>	United States	16.47%	45.87%
#9	<a href="#">Naver</a>	South Korea	23.62%	65.85%	#59	<a href="#">Lindt &amp; Sprungli</a>	Switzerland	6.78%	45.85%
#10	<a href="#">Regeneron Pharmaceuticals</a>	United States	18.44%	64.40%	#60	<a href="#">Baidu</a>	China	0.39%	45.85%
#11	<a href="#">Unilever Indonesia</a>	Indonesia	9.78%	63.65%	#61	<a href="#">Intuitive Surgical</a>	United States	13.73%	45.78%
#12	<a href="#">BioMarin Pharmaceutical</a>	United States	27.18%	63.57%	#62	<a href="#">Chipotle Mexican Grill</a>	United States	-13.26%	45.74%
#13	<a href="#">Monster Beverage</a>	United States	13.45%	63.16%	#63	<a href="#">Norilsk Nickel</a>	Russia	5.67%	45.52%
#14	<a href="#">Adobe Systems</a>	United States	23.14%	62.75%	#64	<a href="#">Dassault Systemes</a>	France	7.61%	44.11%
#15	<a href="#">Autodesk</a>	United States	-17.96%	62.39%	#65	<a href="#">Roper Technologies</a>	United States	5.79%	43.76%
#16	<a href="#">Amorepacific</a>	South Korea	18.44%	61.53%	#66	<a href="#">Intuit</a>	United States	-	43.72%
#17	<a href="#">Vertex Pharmaceuticals</a>	United States	64.89%	61.41%	#67	<a href="#">Brown-Forman</a>	United States	-2.51%	43.64%
#18	<a href="#">Illumina</a>	United States	8.05%	58.97%	#68	<a href="#">Essilor International</a>	France	5.94%	43.42%
#19	<a href="#">Marriott International</a>	United States	17.93%	58.46%	#69	<a href="#">Iliad</a>	France	6.97%	43.05%
#20	<a href="#">Alexion Pharmaceuticals</a>	United States	21.12%	58.46%	#70	<a href="#">Inditex</a>	Spain	11.53%	42.86%
#21	<a href="#">CP AI</a>	Thailand	10.95%	57.82%	#71	<a href="#">Equifax</a>	United States	18.07%	42.72%
#22	<a href="#">Constellation Software</a>	Canada	19.72%	57.62%	#72	<a href="#">Edwards Lifesciences</a>	United States	18.85%	42.72%
#23	<a href="#">Red Hat</a>	United States	17.52%	57.38%	#73	<a href="#">Reckitt Benckiser Group</a>	United Kingdom	11.46%	42.42%
#24	<a href="#">Tencent Holdings</a>	China	39.92%	57.29%	#74	<a href="#">Constellation Brands</a>	United States	11.98%	42.23%
#25	<a href="#">FleetCor Technologies</a>	United States	7.56%	56.85%	#75	<a href="#">Pandora</a>	Denmark	21.17%	41.91%
#26	<a href="#">Rakuten</a>	Japan	9.58%	56.83%	#76	<a href="#">Luxottica Group</a>	Italy	2.82%	41.87%
#27	<a href="#">Sysmex</a>	Japan	-1.08%	56.24%	#77	<a href="#">Mead Johnson Nutrition</a>	United States	-8.07%	41.50%
#28	<a href="#">LG Household &amp; Health Care</a>	South Korea	14.37%	56.08%	#78	<a href="#">Bharti Airtel</a>	India	-1.10%	41.40%
#29	<a href="#">Coloplast</a>	Denmark	5.55%	55.52%	#79	<a href="#">Coca-Cola</a>	United States	-5.31%	41.32%
#30	<a href="#">Nielsen</a>	United States	2.22%	54.50%	#80	<a href="#">Geberit</a>	Switzerland	8.30%	41.30%
#31	<a href="#">IDEXX Laboratories</a>	United States	10.83%	53.25%	#81	<a href="#">Cerner</a>	United States	8.39%	41.23%
#32	<a href="#">Fast Retailing</a>	Japan	6.23%	53.13%	#82	<a href="#">Jiangsu Hengrui Medicine</a>	China	18.89%	41.15%
#33	<a href="#">Almarai</a>	Saudi Arabia	6.55%	53.07%	#83	<a href="#">SGS</a>	Switzerland	4.78%	41.03%
#34	<a href="#">Ulta Salon Cosmetics &amp; Fragrance</a>	United States	23.72%	52.46%	#84	<a href="#">Yahoo Japan</a>	Japan	30.87%	40.99%
#35	<a href="#">Hermès International</a>	France	7.46%	52.34%	#85	<a href="#">Molson Coors Brewing</a>	United States	36.93%	40.98%
#36	<a href="#">Ihs Markit</a>	United Kingdom	145.61%	50.81%	#86	<a href="#">General Mills</a>	United States	-5.70%	40.93%
#37	<a href="#">Unicharm</a>	Japan	-3.76%	50.66%	#87	<a href="#">Ramsay Health Care</a>	Australia	-	40.92%
#38	<a href="#">Verisk Analytics</a>	United States	13.32%	50.57%	#88	<a href="#">Boston Scientific</a>	United States	13.34%	40.73%
#39	<a href="#">Genmab</a>	Denmark	60.29%	50.44%	#89	<a href="#">Procter &amp; Gamble</a>	United States	-0.37%	40.72%
#40	<a href="#">AmerisourceBergen</a>	United States	8.01%	50.27%	#90	<a href="#">Falabella</a>	Chile	2.47%	40.61%
#41	<a href="#">Expedia</a>	United States	31.49%	50.25%	#91	<a href="#">Mondelēz International</a>	United States	-12.53%	40.60%
#42	<a href="#">Starbucks</a>	United States	11.29%	49.89%	#92	<a href="#">Compass Group</a>	United Kingdom	11.46%	40.42%
#43	<a href="#">Shimano</a>	Japan	-14.70%	49.82%	#93	<a href="#">Cielo</a>	Brazil	10.60%	40.40%
#44	<a href="#">Sirius XM Radio</a>	United States	9.78%	49.36%	#94	<a href="#">Experian</a>	Ireland	18.29%	40.39%
#45	<a href="#">Visa</a>	United States	8.66%	48.77%	#95	<a href="#">PepsiCo</a>	United States	-0.40%	40.34%
#46	<a href="#">Perrigo</a>	Ireland	-49.89%	48.74%	#96	<a href="#">Fanuc</a>	Japan	-13.87%	40.25%
#47	<a href="#">Kangde Xin Composite Material Group</a>	China	23.28%	48.50%	#97	<a href="#">Colgate-Palmolive</a>	United States	-5.23%	40.19%
#48	<a href="#">Smith &amp; Nephew</a>	United Kingdom	-	48.12%	#98	<a href="#">McCormick</a>	United States	0.0268	39.73%
#49	<a href="#">Keyence</a>	Japan	8.81%	47.69%	#99	<a href="#">LabCorp</a>	United States	11.08%	39.65%
#50	<a href="#">Global Payments</a>	United States	-	47.59%	#100	<a href="#">ASML Holding</a>	Netherlands	0.0807	38.94%

## **Appendix B**

### **Interviews & Interactions**

Andjuar, Mauricio. Digital Transformation & Innovation Leader. Partner & Founder at LIQUID. Meeting on January 30<sup>th</sup>, 2018.

Corrochano, Alessandra. Head of Innovation lab “laBentana” at Interbank. Meeting on January 30<sup>th</sup>, 2018.

Echecopar, Milagros. Head of SHIFT Peru. Meeting on January 30<sup>th</sup>, 2018.

Ferrari, Gianfranco. CEO Banco de Credito del Peru. Personal meeting at BCP General Head Quarters in La Molina, Lima, Peru. February 1st, 2018

Filomeno, Maria. Vice President of Innovation and Strategy – Apoyo Comunicacion. Meeting on January 30<sup>th</sup>, 2018.

Juarez, Guillermo. Head of Innovation COSAPI. Meeting on February 1st, 2018

Murray, Fiona. Associate Dean for Innovation & Co-Director MIT Innovation Initiative. Faculty Director, Legatum Center. Meeting on December 12<sup>th</sup> 2017.

Ostraat, Michele. Head of R&D. ARAMCO Boston. Individual questions during Sloan Fellows group visit on April 13<sup>th</sup>, 2018.

Raffo, Francesca. Head of Innovation, Banco de Credito del Peru. Meeting on February 1<sup>st</sup>, 2018.

Salicetti, Humberto . Head of PWC Peru. Meeting on January 30<sup>th</sup>, 2018.

Spear, Steven. MIT Sloan Senior lecturer, Systems Dynamics. Conference call on February 15<sup>th</sup>, 2018.

Thompson, John. MIT I-lead series. Individual questions after I-lead series panel. March 7, 2018.

Washington, Ken. Vice-President, Research and Advanced Engineering and Chief Technology Officer, Ford Motor Company. Individual questions after Ford Autonomous Vehicle Lecture on Ford day at MIT. September 12<sup>th</sup>, 2017.

Zilberman, Jack. Business Faculty Managing Director at Universidad Peruana de Ciencias Aplicadas. Meeting on January 30<sup>th</sup>, 2018.

## **β-Automotive**

Beaufort, John, Vice President of Industrial & Innovation. Meeting on January 23<sup>rd</sup> 2018.

Camden, Brian. Prototype Manager. Meeting on January 25<sup>th</sup>, 2018.

Cheney, Thomas, Vice President of Sales. Meeting on January 23<sup>rd</sup> 2018.

Corben, Francis. Director of Industrial. Conference call on March 2<sup>nd</sup>, 2018.

Ferris, Martin. Vice President of Strategy. Conference call on January 30<sup>th</sup>, 2018.

Haynes, Douglas. Research Program Manager. Meeting on January 25<sup>th</sup>, 2018.

Lori, Vanessa. Director of Human Resources. Conference call on March 5<sup>th</sup>, 2018.

Mackenzie, Henry. Model and Simulator Manager. Meeting on January 25<sup>th</sup>, 2018.

Nolan, Steven. CEO. Meeting on January 24<sup>th</sup> 2018.

Palmer, Madelene. Human Resources Manager. Meeting on January 25<sup>th</sup>, 2018.

Seymour, James. Advance Materials Director. Meeting on January 25<sup>th</sup>, 2018.

Sinclair, Walter. Vice President of Research. Meeting on January 24<sup>th</sup> 2018.

Stanford, Ryan. Chief Technology Officer. Conference call on March 9<sup>th</sup>, 2018.

Stern, David. Vice President of Purchasing. Conference call on February 27<sup>th</sup> 2018.

Wells, Philip. Vice President Open Innovation. Conference call on March 15<sup>th</sup>, 2018.

White, Samuel. Vice President of Human Resources. Conference call on February 6<sup>th</sup>, 2018.

Zola, George. Control Systems Director. Meeting on January 25<sup>th</sup>, 2018.

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