Strategic decisions in turbulent times: lessons from the energy industry

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Leading organizational change for innovation in turbulent times:

lessons learned from the energy industry

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Leading organizational change for innovation in turbulent times: lessons learned from the energy industry

Abstract:

Most of the firms currently in the S&P 500 will probably not be part of this list in 15 years from now. In times of great uncertainty managers are called to make the right choices in their innovation strategy to preserve their core business, but also to build a future for the company. But, how can managers guess the right innovation choices if they have no time or tools to assess the current challenges? In this light, we explore the transformation of the energy industry. There, in an extreme short period of time, traditional business models eroded leaving a multitude of established players out of their dominant position in the industry. Based on personal interviews, we analyze how two CEOs from RWE (Germany) and NRG (USA) led the transformation of their organizations’ innovation strategies. We get immersed in their decision-making process and depict it using the popular VUCA framework, to map how they cope with volatility, uncertainty, complexity, and ambiguity in their approaches. We propose a guide for executive managers to navigate through current organizational challenges, taking into account the multilayered interactions with stakeholders and the necessity to make innovation strategy a central element in the short and long-term response.

Keywords:

Innovation Management, Strategy, Turbulent environments, VUCA, Energy, Business Model Innovation, Organizational change
1. THE CONSEQUENCES OF UNEXPECTED DISRUPTIONS

Much has been written on how the introduction of digital technologies changes the way organizations innovate and increases the speed of change across almost all economic sectors (Nylén & Holmström, 2015). The exponential possibilities of digitalization and new technologies can also have a dark side for established players, as they open up options for new competitors (Porter & Heppelmann, 2015) and increase the turbulences in the business environment (El Sawy & Pavlou, 2008). The first wave of technological change affected industries with products that could be digitalized in the music and film industry and generated the emergence of software-based platforms (Evans, Hagiu, & Schmalensee, 2006). The current wave, however, has put in motion industries that were considered as mature, stable and safe from technological disruption for decades, e.g. automobile and energy industry (Brem & Viardot, 2017).

We take the extreme case of the energy industry, where the process of digitalization has collided with a socio-technical external shock (Geels & Kemp, 2007) to make better sense of what are the implications of this transformation. The energy industry faced a sequence of accelerating events: first, markets transitioned to digital platforms changing the trading and commercialization patterns of energy; second, the renewable energy technologies disrupted the processes of energy generation; finally, the distribution paradigm started being decentralized putting the grid under pressure to become smart and responsive. These changes have put the industry under shock, creating a situation where leadership and innovation strategy were had to deal with a new level of uncertainty and needed to be reconnected accordingly.

To illustrate the degree of change in the industry, we turn back to the year 2010. After the global financial crisis, energy demand started increasing again. “We all had expected to see a recovery in the wholesale prices for energy, but a year later this did not yet happen” remembers Arndt Neuhaus, CEO of RWE Germany at that moment. This situation collided with a personal investment he had
recently done; he had bought a roof solar panel for his home, and he quickly realized that it was not only a good personal investment, but that this could be a game changer for the industry. Very soon, energy executives felt that the change in the industry was going faster than the response capacity of the energy companies: “we have moved away from a traditional, centralized grid-based power system. It is still co-existing, but it is moving to a fast-emerging high growth distributed generation sector” recalls David Crane, CEO of NRG Energy Inc. at that time.

Against this background the puzzling question arise: how to stay ahead of the competition which aggressively was entering the market while keeping a profitable core business running? There had to be a new approach to innovation strategy; but how do you lead a transformative innovation strategy in such uncertain environment?

In the following sections, we answer this question by first introducing the different dimensions that define this new context for innovation leaders; second, getting insights on how two leaders in the energy industry, Arndt Neuhaus (RWE - Germany) and David Crane (NRG - USA), responded to these challenges in their organizations; finally, contextualizing the lessons from the energy industry cases so that we can propose recommendations for managers in other industries.

2. INNOVATION STRATEGY IN TURBULENT TIMES

2.1. The challenge of making innovation decisions

If treated in isolation, and with the necessary awareness, most of the market or technological changes can be traced and identified ahead of time and with enough time to respond. Besides that, incremental innovation used to be sufficient to survive, especially in predictable markets in mature industries. But because of the unpredictable interactions between market and technology, we are seeing sequences of change that escape the traditional innovation management tools and models, leading to unpredictable changes that could not been foreseen. It is this combination and acceleration of changes that evidences that risk management models are unfit for multidimensional uncertainty. The
difference between managing risk and uncertainty (Knight, 1921) was evident in the recent global financial crisis when the different actors involved had to shift from predictable risk to uncertainty models in order to deal with an unknown situation, this is also true for the traditionally stable industries. In this context, managerial decisions do not only have an impact on the company, but also on the regulators and the infrastructure. The problem is, how do organizations adopt innovations to respond to external changes with the intention to sustain or improve their competitive advantage and performance (Damanpour, Walker, & Avellaneda, 2009), be it using technological innovations introduced in the products, services or processes of the organization (Damanpour et al., 2009), or new practices in the management of the organization (Mol & Birkinshaw, 2009). In all cases, it is common that the source of ideas and skills to implement the innovations comes from outside the organization (Mol & Birkinshaw, 2009). Thus, we would expect established organizations to rely on their capability to identify, absorb and integrate external sources of innovation to consolidate and improve their competitive position (Brem & Voigt, 2009). However, this might not be enough in turbulent and complex times (Boulton, Allen, & Bowman, 2015). In turbulent environments organizations do not only struggle to foresee the technological or market changes, but also to absorb and integrate this change at the same pace that the external context is changing. As a result, despite identifying or owning unique knowledge on new disruptive technologies, we have repeatedly seen large and dominant organizations such as Kodak, Nokia or Research in Motion, fall victim to their inability to break away from a chain of transformative events in their industry (Lucas & Goh, 2009). This is also the reason why we introduce the broader perspective of the VUCA framework for our research setup.

2.2. What is VUCA and how it can help to understand change

Executives need to identify and implement innovation strategies that sustain the competitiveness of their organizations without losing the necessary focus for their core business – assuming it still exists while keeping different stakeholders satisfied. Therefore, having a framework how to implement a
strategy can be crucial for success. Strategic decision-making under uncertainty has been a topic of high interest to both academic researchers and practitioners, the difficulties to identify what lays ahead in the future requires to introduce combinations of strategic postures (Courtney, Kirkland, & Viguerie, 1997). The different possible strategic positions in relation to an unclear future mean that we can use a portfolio of actions. For instance, in some cases it might make sense that we take a leadership role and aim to reshape our industry, while in other cases we might instead prepare to be flexible and agile to respond to unexpected changes, or we could just wait and see, buffering resources and avoiding premature commitments (Courtney et al., 1997).

As we aim to transpose decision-making under uncertainty, we observe the diversity of situations where innovation is in play in an organization. Having a sound innovation strategy at the organization level is different from managing a portfolio of products and planning the new product launches. It is about making decisions with high impact on the general future of the organization, i.e. How to transform the business model of the organization? Whether to spin-off a business unit or not? Whether to acquire that new venture with a promising technology? Whether to partner with existing start-up companies? Or whether to avoid trying to manage innovation at all and delivering dividends to the shareholders instead? Each of these decisions requires a different approach and specific understanding on the available options, the future consequences of the actions, but also the interests of the stakeholders. The rising awareness that we have substantial limitations when we try to model reality using traditional management frameworks, has made the VUCA framework (Bennett & Lemoine, 2014a) particularly relevant. VUCA stands for volatility, uncertainty, complexity, and ambiguity; the acronym was popularized by politics and military sciences to describe situations where each action involves assessing multiple options with unpredictable consequences, in a context with limited and changing information (Mack & Khare, 2016). Each of the VUCA dimensions aims to capture a distinctive element that impacts on the decision-making context in turbulent environments.
We use the VUCA framework description by Bennett and Lemoine (2014a), see figure 1, to get an overview on each of the dimensions:

- **Volatility**: we observe more frequent shifts and unstable value of prices that fluctuate sharply. Managers perceive the changes to be unexpected and of unknown duration, but they can understand them and get information about them, and their evolution. Example: natural gas prices that increased volatility and deviation from historical trends have translated into less stable stock prices for energy companies and unexpected pressure from stockholders.

- **Uncertainty**: it becomes more difficult to predict the future; the models that were useful in the past show limited reliability nowadays. Innovation executives find that it is increasingly challenging to clearly assess a situation and predict when and how events will unfold. Example: disasters like the Fukushima accident in Japan created a situation where future regulation changes regarding nuclear energy went from predictable to being unknown.

- **Complexity**: we operate in an interconnected and networked environment. Multiple options for each decision, and multiple possible outcomes for each action. Executives in innovation management can be overwhelmed by the number of influencing variables and the volume of information to be processed. Example: the transition from a centralized generation model to a distributed energy model did not only impact on the future asset investment decisions, it also made the management of the energy grid and coping with market demand changes more complex.

- **Ambiguity**: it captures the perception of complete lack of knowledge, in an unprecedented context where unknown unknowns are being faced. Innovation executives experience an absence of clear causal relationships and struggle to interpret clues and organize actions. However, there is still a pressure to take decisions and act. Example: responding to the
institutional pressures some nuclear and coal-based energy companies decided to enter the field of home solar systems, a high ambiguity move completely out of their competencies.

Nevertheless, these dimensions do also overlap: one dimension might also be a result or a precondition of the other one; i.e. it is not only complexity or uncertainty that defines a context, but a multilevel combination of all of them (Mack & Khare, 2016). Among the different dimensions there can be an accumulative effect: while complexity describes the extent to which elements are interconnected and the portfolio of choices seems close to endless, uncertainty adds the lack of connection and temporal visibility between causes and effects. Finally, volatility is an accelerator, which adds an additional layer to the complexity and uncertainty dimension. As these three elements spin, the perception of absolute ambiguity becomes invasive, but again, not making decisions at all is neither an option, thus, how do managers respond? We turn to the recent transformation of the energy industry to find answers to this question.

3. HOW DID THE ENERGY INDUSTRY BECOME A VUCA CONTEXT?

3.1. One industry, two perspectives: RWE & NRG

While the energy industry was continuously growing for almost a century, a combination of events triggered a new scenario: dramatic changes in energy-related technologies, the grid decentralization, renewable energies, deregulation of energy markets across the word, new CO₂ emission limitations, unpredictable events like the Fukushima accident, have changed the business environment in unpredictable and radical ways in a very short time. Facing these radical, industry-level transformations, the management of these companies saw a strong need for innovation while trying to protect their core business and avoiding any risk regarding new business opportunities. This obvious conflict of interests could be solved with different strategies with uncertain outcomes. We therefore talked to Arndt Neuhaus, the former CEO of RWE Germany and David Crane, the former
CEO of NRG; both “victims” of the fast-changing environment with widely differing interests within the different stakeholders. They described and reflected upon the decisions they have made for the last decade leading their organizations in different direction. David Crane still recalls that because of his approach to create a new vision for the future of NRG he “…got tagged with this label, at some point, that I was this visionary. I hated that label. Look, I said, I’m no visionary. If anything, I’m a historian.”

Arndt Neuhaus (RWE Germany) on the other side communicated the risk that a focus on innovation could mean, “leaving a large part of the organization behind because, of course, that is not their world: they were not hired for that, they were not educated for that, and for some (parts of the organization) the transition is quite difficult.” Both were very aware of the challenges ahead of them, but awareness is only the first step.

3.2. The turmoil in a stable and profitable industry

For many years, it was a highly-regulated sector, considered to be of strategic interest for the development of countries. This meant that the government had a strong direct presence, like in the case of RWE, where municipalities were one of the largest shareholders. But with or without government participation, the market dynamics favored the consolidation of large players, close to oligopolies, that would be managed like utilities. Predictable cash-flows favored large asset investments and long term strategic decisions. In the past, there had been some tensions when oil prices would peak, triggering temporal crisis; but these events never really threatened the industry’s strong business. In fact it was one of the “core skill of a good and large utility business, that it is able to cope with volatile wholesale prices for oil, for gas, for electricity” says Arndt Neuhaus. And similar to the banks before the financial crisis, large utilities weight in the current infrastructure might make them too big to fail, influencing how they approached decision-making and also how other
stakeholders made decisions on the industry. Even with the risk to oversimplify it is helpful to highlight the factors that triggered the transformation of the global energy industry in the last decades. First, the progressive implementation of measures for a low carbon economy, at a global and country level, that sets controls on the environmental and socially impacts the energy industry (Masini & Menichetti, 2012). Furthermore, it would impact on asset investment choices, even more after the Fukushima disaster. Second, the technological development of solar and wind energy quickly evolved from being an unclear promise to a reliable alternative. Subsidy programs around the world boosted their development, for instance in Germany, and affordable storage can make these solutions even totally independent from the current infrastructure in the future. Third, the recent disruption in the pricing structure of natural gas and oil as well as new alternative sources of energy such as fracking or new entrants in the oil market broke the price fixing mechanisms (Gond, Barin Cruz, Raufflet, & Charron, 2015). Finally, the digitalization of the demand-side of the energy consumption, including the introduction of smart grids, meters, batteries, peer-to-peer trading platforms, and more recently electric vehicles. On top of these different factors, we also have seen in the last decades how some of the governments that had positions in their national utility companies chose to divest, fostering intensified competition and internationalization (this was in particular a significant change in the European context).

3.3. Finding competitive responses in an industry under transformation

There are two key periods of time in the last decades. First, we can describe a pre-global financial crisis context (2000-2008) where energy utilities were under pressure to gain size and efficiency facing some competition, and where their key strategic decisions were mostly related to generation asset investments (power plants) without a visible disruptive risk. Then, the post-financial crisis scenario (2010-2017), it has been one of accelerated transformation, where utility companies have been racing to react to the technology and market changes. The two CEOs of RWE Germany and
NRG followed different innovation strategies as they had to start responding to a VUCA context and helped us to understand their reasoning behind the decisions that where being made. While NRG’s CEO David Crane chose to shape the future aggressively, investing in what were considered as risky green energy projects, RWE’s CEO in Germany, Arndt Neuhaus, opted for a different strategic posture that would leave options open, aiming for a careful transition to a higher mix of energy sources and new grid distribution models focusing on their core business. Interestingly, both had lost their positions in early 2016, after more than a decade leading their organizations in the unexpected transformation of the energy industry. Both companies were hitting new lows in their stock market when they changed their CEOs (see figure 2).

[Insert Figure 2 about here]

NRG Energy ex-CEO, David Crane, joined the company when it was coming out of bankruptcy in 2003. The company’s core business was at that time the generation of electricity using coal, gas or oil. But only a few years later (2009) they acquired Reliant Energy (retail electricity), and from that point onwards David Crane led the transformation of the company to become a green energy player (Pyper, 2016). The company has over 12,350 millions in revenues and 8,700 employees worldwide (NRG, 2016).

RWE AG has been a large player in Europe since it started in the early 1900. While at some points it diversified its business into water utilities in the UK and USA, most of its business is related to the power plants it managed. The “Energiewende” in Germany (legislative plan to move the country to a low carbon economy and shutdown nuclear plants) meant that its national CEO, Arndt Neuhaus, had to find an alternative to the power plants (mostly nuclear energy) that had defined the core of RWE’s generation and retail business. Since 2010 the company has been in a process of accelerated change, where each region in Germany has had a different mix of energy sources and different approaches to
the transition towards a distributed generation model. The company still has over 50,969 billions in revenues and over 59,000 employees worldwide (RWE, 2016).

3.4. Leading in times of VUCA challenges – responses from NRG and RWE

The conversation with the former CEOs of the energy companies brought illustrative examples on the responses of their organizations when different aspects of VUCA became prominent in their industry (see Table 1). In some cases, the responses of the CEOs were similar, for example, volatility was not perceived as a new challenge for innovation management, although it was a source of additional pressure and scrutiny on their decisions and actions. Uncertainty, complexity and ambiguity where much more challenging, and they took different shapes and forms depending on the transformation stage of the industry. While there had been uncertainty on the evolution of renewable energies in 2010, a few years later the main uncertain area was the speed to which consumers would adopt home solutions to gain control over their energy consumption. Similar changes occurred with the ambiguity generated when the nuclear shutdown was announced, or still now when the variety of technology alternatives in wind or solar energy make investment decisions very complex.

But while looking at these VUCA problems both CEOs were sensitive on the challenges they faced concerning their stakeholders. While Arndt Neuhaus was concerned about the people within the company and pointed out the risk of losing most of the employees who were not hired for this new and innovative world, David Crane mentioned the remaining stakeholders, especially the shareholders and the board conflicting interest with a new, more innovative and aggressive strategy. Both were concerned about the challenges in this regard, David Crane even mentioned how “aspects very different from the business considerations, such as boards being afraid of active investors, could lead to a CEO being fired to avoid these active investors”. They both also were very aware about the fact that you will make decisions that in retro-perspective will seem wrong, because you didn’t have
the right or complete information, or you simply underestimated trends. Arndt Neuhaus believed that “it is more important, especially in the area of innovation and transformation that people believe in your decision and do it”. So, acceptance can be just as important as the strategy itself, which is why David Crane “was always conscious that you pretty much have to say the same thing to your employees as you say to your investors.” So, while the challenges in a VUCA environment can be very industry specific, the challenges regarding the stakeholders to handle these VUCA problems can be the same in every industry.

4. MANAGING INNOVATION IN A VUCA CONTEXT

Leading an organization as the industry transitions from being a stable business environment to a turbulent and difficult to control playing field becomes a personal quest. Thus, the CEOs’ insights go beyond managing innovation projects and suggesting that innovation strategy in a VUCA context becomes multi-stakeholder effort, where it is not only about what decisions you make but also about how these are accepted and implemented by your organization and the overall industry.

4.1. Making decisions in a VUCA context requires a shared understanding in the top management

The assessment of how the different VUCA components impact on the innovation strategy must be a shared exercise. As David Crane recalls “[I never ever had any doubt as to which direction the industry was taking, it was all questions as to how to get there from our unlikely starting point of being big coal-fired generators”]. Thus, the perception of uncertainty or ambiguity can be rather subjective, even in a decision-making setting where information is available, sometimes we are framed by a different interpretation of the reality. “Even the management at the top did not believe that [impact of renewable energies], and all the people supporting them were creating data, in fact, against that” as Arndt mentions. Therefore, dealing with VUCA while aligning the stakeholders is not only a task in
the hands of the CEO making decision, and being exposed to the outcome of those decisions, but needs to be integrated as a corporate level responsibility and supported by a shared sensibility on the internal and external factors driving it.

4.2. Balancing the different pressures in a VUCA context requires dedication and discipline

While innovation strategy could be an annual exercise in stable business contexts, in VUCA contexts it becomes a discipline. Not only because it involves dedicate practice, but also because embracing a portfolio of initiatives, even if they are not “big bets”, requires for new mechanisms in the organization: “you need a very rigorous process to cancel developments in product (projects)” suggests Arndt Neuhaus. Otherwise the risk is to generate a situation where the CEO perception is “I definitely got NRG involved in too many things” and “I just didn’t have enough time to immerse myself in all these areas. I should have been much more rigorous about it” as David Crane reflected.

Thus, it was not enough to introduce scouting tools, technology portfolios, and corporate entrepreneurship initiatives to identify promising technologies; it was also about having the capacity to manage these initiatives and keep them aligned with the key drivers of the business while assuring that the shareholders do not only understand the challenges, but also support the strategy that is being implemented. It is not enough to keep informed the rest of the company on what you do and plan. Unless the external stakeholders, especially the shareholders and the board are in line with the long-term strategy, you risk losing your position without having enough time to show the outcomes of your decisions.
4.3. VUCA is not a temporal situation, it is the new normal and requires a broader mindset

The transformation of the operating conditions in an industry is not absent of tensions and conflicts, what might be an opportunity for new entrants is a problem for established organizations. The first reaction to a sudden change is to slow it down to a tolerable pace: “companies were lobbying the local politicians against regulation favoring the renewable energy” remembers Arndt Neuhaus. But as the different components of VUCA are activated, the turbulent context becomes the new normal, and this means that additional options should be brought on the table. It is not only about activating governance forms to manage innovation projects, but also on more radical decisions as David Crane suggests “I should have taken it private (the company) because I think you have more ability to make radical change as a private company” or implement change. In this realm he regrets not having divested from the coal plants faster when they still had market value, even if they were the core business back then. This aspect refers again to the importance of managing shareholders’ expectations.

5. A GUIDE TO LEAD CHANGE IN RESPONSE TO THE VUCA CHALLENGES

What we have seen in energy industry can give us guidelines into what managers need to consider when leading organizational change in times of high uncertainty. This includes not only internal organizational aspects, but also aspects like engaging and aligning with the company’s stakeholders. They can have a very different point of view and therefore maybe sometimes even conflicting interests that need to be identified, understood and managed.

In an ambitious attempt to summarize the experience of decades of being at the forefront of an organization in only a few actionable insights, we have combined the VUCA framework from Bennett and Lemoine (2014b) and the responses of the energy companies’ executives in a revised matrix (see
figure 2). The intention is to offer support to managers that are in the position to make strategic choices on how to use innovation to respond to the VUCA challenges. Thus, for each VUCA dimension we propose a limited set of priorities that should be the focus of the innovation action, for each of them there are different possible governance forms.

[Insert Figure 2 about here]

5.1. Involving the top management team and the board with the VUCA Framework

There is, nevertheless, an important caveat. When assessing a specific situation, it is less and less likely to be able to attribute a single factor to the challenging situation. Instead we are more and more subject to the presence of a combination of factors. Thus, the response will still require for a subjective evaluation of alternatives and greatly benefit from a shared understanding across the top management on what are the underlying factors that make it a turbulent situation. In case where there is only one leading person in a company – feasible in a family-owned business – this is doable. When it comes to top management teams with different educational and cultural backgrounds, this task can be very challenging. This revised framework aims to at least providing clues on how a guide to innovation in VUCA can help to reduce the often-overwhelming task of executives’ decision-making.

The rapid pace of change and the disruption of industries forces boards and management teams to work on strategies that will be sufficient in the long term. This can be a challenge and different elements should be an inevitable part of any strategic implementation in a VUCA environment. Because while being convinced that a strategy will lead the company into the future, we have seen that stakeholder management is just as important, if not even more important. David Crane and Arndt Neuhaus both were “victims” of stakeholders that had a different view, different knowledge or different aspects motivating their decisions. Therefore, our framework needs to be implemented with the stakeholders of the company.
5.2. Leading innovation strategy with the right choices and the right timing

First, understanding the different stakeholders is crucial. Managers need to know what boards, shareholders and employees (have to) know about the radical changes that companies are facing today. Second, managers have a responsibility to ensure that the necessary stakeholders are educated in these regards so that they can understand the challenges and help ensuring that any strategic decision is supported. Finally, managers need to ensure that the communication between the different parties involved is functioning and that they act fast enough to survive these changes. David Crane for example recalls that “I think that the biggest mistake I made was not trying to go from brown to green, but not going from brown to green hard enough, and fast enough. I should have sold out the company’s coal-fired power plants when they still had value, rather than waiting.” So, timing can be crucial and support, even if generated, can fade. So, trusting in a solution is the first step, acting on it on the right of time, is just as important.

In times of exponential digital growth, new technologies, radical innovation, and industrial transformation, we often overlook the possibility of not-innovating. While looking at NRG and RWE we cannot avoid raising the question of what would have happened if they had instead chosen to do not engage in a process of change, instead trying to slow down the disruption in their industry and in their own organizations. The non-innovation response is contingent on the capacity to control the introduction of new technologies and the industry regulatory context (Mone, McKinley, & Barker, 1998), a power that was slipping away from the hands of both companies. But, even without this power, an overlooked option is to accept to de-growth, divesting when possible, and returning to the shareholders as much value as possible as the company unwinds.

6. A RESEARCH AGENDA FOR INNOVATION LEADERS IN VUCA CONTEXTS

Management research on the effects of VUCA in organizations is still an underdeveloped area, especially regarding stakeholder management. We need more research to provide further insights to
practicing managers. This research aims to provide a first-step for further work in this area, for instance to study the decision-making process in this context from two angles: the individual (CEOs or managers) and the stakeholders.

From the individual’s perspective, making decisions in VUCA environments exposes individuals to aspects such as goal conflict or tensions (Segerstrom & Solberg Nes, 2006), putting in action novel psychological research concepts such as self-discrepancy or self-concordance in the management context (Kelly, Mansell, & Wood, 2015). Such concepts could help to understand how the CEOs in our cases managed to cope with the multiple challenges they faced. Moreover, future research should also consider the different roles in top management teams (Carpenter, Geletkanycz, & Sanders, 2004); there are not only decision-making process challenges in organizational teams, but also potential effects related to differences in age, personal, professional, and cultural backgrounds.

On the other end, the perception and participation of stakeholders in the decision and its implementation suggests that CEOs are not acting as isolated agents. Instead, the assessment of their decisions is not only based on the results, but also on their relative performance to other organizations in their industry. As a result, understanding the stakeholders linkages as well as the multi-level governance mechanisms (Jordana, Levi-Faur, & Fernández i Marín, 2011), could bring additional insights to understand why our CEOs lost their jobs despite having been successful in transforming their companies during more than a decade. The role of shareholders should be in the focus: they put pressure on the company management to deliver short-term results, but they also expect from the management team to pursue long-term goals positioning the company in a future-oriented context. This creates tensions, which become even more complex in a principal-agent-dilemma context (Holmstrom & Milgrom, 1991).

Finally, further research on corporate governance and ethical issues is proposed. So far, there is not much research on how to address the introduced VUCA challenges with a mind-set of sustainability
and ethical responsibility. The current discourse on Responsible Research and Innovation (RRI) might be inspiring to deal with this important aspect (Sarkar, 2016; Stahl et al., 2017). Besides that, the current corporate governance both in Europe and the USA might not be prepared to face the challenges of VUCA and therefore more research should be done in this regard. Maybe we will soon be surprised by the introduction of artificial intelligence to support the autonomous management of a company in a VUCA contexts without the traditional CEOs and boards.

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Table 1. VUCA concepts and illustrative examples the study cases

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<tr>
<th>VUCA dimension</th>
<th>Challenges</th>
<th>Responses</th>
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<tbody>
<tr>
<td>Volatility</td>
<td>• Lower natural gas price impacts negatively on the share price of the company, higher prices impact on production costs.</td>
<td>• NRG &amp; RWE: Risk management and hedging strategies as a core competency for their organizations, in addition, when possible, transfer volatility to customers.</td>
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<td></td>
<td>• Volatility increases the overall risk of the industry, it becomes less predictable.</td>
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<tr>
<td>Uncertainty</td>
<td>• The centralized model of producing and delivering energy becomes challenging.</td>
<td>• NRG: Shape market, move ahead of the change, strong investments in green energy projects.</td>
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<td></td>
<td>• The impact of new technologies from other fields/industries.</td>
<td>• RWE: build a portfolio of alternative options, hire skills even if not needed in the short term, avoid big bets.</td>
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<td></td>
<td>• The energy policy changes become more difficult to control (in the European context).</td>
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<tr>
<td>Complexity</td>
<td>• Digitalization threatens to make classic distribution grid obsolete. Multiple options come into play in the future model.</td>
<td>• NRG: invest in companies in complementary business areas in the industry, let them run independently and explore options.</td>
</tr>
<tr>
<td></td>
<td>• Different technological options are available for each of the new renewable energies, multiple variables should be taken into consideration.</td>
<td>• RWE: invest in alternative technologies and activate new instruments that help you to collect more and better data. Use your internal resources to test different options in a controlled environment.</td>
</tr>
<tr>
<td>Ambiguity</td>
<td>• Change in energy consumption trend after the financial crisis transforms economic model, nobody had a scenario with lower energy demand in their plans.</td>
<td>• NRG: Portfolio of investments in different businesses, even if this challenges the cultural identity of the firm.</td>
</tr>
<tr>
<td></td>
<td>• Home batteries change the grid model, a completely unknown situation.</td>
<td>• RWE: run real parallel projects, even if they have competing business models, be ready for a diversity of possible outcomes, do not try to predict but act.</td>
</tr>
</tbody>
</table>
Figure 1. The VUCA framework developed by Bennett & Lemoine (2014a)
Figure 2. Stock price evolution for NRG and RWE in the stock market

Source: TradingView graph for RWE and NRG.
**Figure 1. Revised VUCA framework with insights from the innovation strategy in the energy sector**

**Innovation Strategy decisions in VUCA contexts**

- **Complexity**
  - Isolate “noise” factors in your business models to identify the winning options.
  - Create test beds in your own organization.
  - Start a corporate venturing program to invest in emerging technologies.
  - Use evidence, fight against biases in decision-making.
  - Run experiments to generate unique-data for your decisions.
  - Run competing business models in your organization, prepare for internal conflicts.

- **Volatility**
  - Identify the elements subject to sudden changes, assume that hedging is a mandatory competency and cost for the organization.
  - Restructure your business, vertical integration, upstream or downstream.
  - Create buffer of technologies and skills in your organization for unexpected changes.
  - Shape the direction of the market by stepping in the upcoming trends, invest in the future.

- **Ambiguity**

- **Uncertainty**

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*How can you predict the results of your actions?*

**How much do you know about the situation?**

- Short term action
- Long term action

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This is a pre-print, final paper after review process available at: