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Factors Influencing Technology Adoption in a Traditional Multinational Energy Company

Resolving tensions collaboratively, fostering open innovation, and standardizing knowledge makes technology adoption easier.

Alexander Schmidt, Tom J. M. Mom, and Henk W. Volberda

OVERVIEW: Environmental concerns like climate change are prompting traditional companies such as those in the energy industry to adopt new technologies. Rapid technology adoption is important, especially if companies want to be responsive and at the same time maintain their competitive and strategic advantage. This article explores technology adoption in a traditional multinational energy company. Using a single case study approach, we explore how adoption of technology takes place at manager and employee levels and the implications therein. We identify three important factors—constructive tensions, open innovation, and knowledge standardization—which positively influence the pace of technology adoption. We offer important implications for practitioners involved in technology adoption.

KEYWORDS: Technology adoption, Energy industry, Knowledge standardization, Organizational tensions, Open innovation

Greater efforts to combat global issues like climate change have put pressure on large traditional companies, like those in the energy industry, to adopt new technologies. At the same time, the market is shifting from conventional technologies to renewable ones (Gebauer, Worch and Truffer 2012; Adner and Snow 2009). One important area of research concerns how such companies can improve their innovation performance and their competitive advantage through faster technology adoption (Woiceshyn 2000). Companies often get classified as early adopters or late adopters according to the pace of their technology adoption.

To understand how companies can quicken the pace of technology adoption, it is helpful to understand the underlying managerial factors beyond R&D (typical R&D factors are R&D expenditures or number of patents). In large organizations, specific roles and activities of managers at different levels impact technology adoption. We aimed to identify those factors that affect technology adoption at the headquarter manager level, power station manager level, and power station employee level in a traditional multinational energy company.

A wide range of technology adoption models are already available (Ben-Zion, Pliskin, and Fink 2014; Damanpour and Schneider 2006; Rogers 1995), but they may be not well-suited to study technology adoption at different organizational levels. In this study, we aim to address a gap in the

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literature by highlighting specific factors that impact technology adoption in a traditional multinational energy company.

Literature Review

Researchers have developed various technology adoption models (Ben-Zion, Pliskin, and Fink 2014; Bunduchi and Smart 2010; Damanpour and Schneider 2006), but these models are not well-suited to studying technology adoption at different organizational levels. Current models focus on the effects of environmental and organizational factors as well as senior managers' innovative attitudes regarding technology adoption. Damanpour and Schneider (2006) apply a quantitative survey approach that does not elucidate how technology adoption occurs at different levels within an organization. Damanpour and Schneider's (2006) research is based on Rogers' (1995) technology diffusion model, which depicts the impact of various organizational factors on the adoption initiation phase, the adoption decision phase, and the adoption implementation phase. According to the authors, quantitative findings in such dynamic processes like technology adoption are not appropriate for identifying deep underlying managerial and organizational key technology adoption mechanisms; longitudinal case studies are necessary to explore these mechanisms over time. Bunduchi and Smart's (2010) process innovation cost technology adoption model is another widely used model. It consists of various stages such as innovation generation, innovation acceptance, and innovation implementation. Bunduchi and Smart's model is not suited to examine organizational, managerial, and individual level factors that affect technology adoption because it focuses solely on the process costs that influence the technology adoption phases in an inter-organizational research setting.

The literature also suggests that the fast strategic decision-making of senior managers enhances firm performance at the organizational level (Baum and Wally 2003) and that senior managers make decisions based on their experiences (Judge and Miller 1991). While Khanagha et al. (2013) showed that experimentation with important emerging technologies at different organizational levels improves technology adoption, it is still unclear what effect organizational factors may have. Adopters are often focused on fast knowledge acquisition as a crucial trigger for technology adoption while non-adopters concentrate more on performance improvements when trying to pursue technology adoptions (Reinhardt, Hietschold, and Gurtner 2017). Reinders, Frambach, and Schoormans (2010) found that rapid adoption of radical technologies was difficult for individuals since they lacked the knowledge for evaluating such new technologies. Morales-Raya and Bansal (2015) determined that if technologies are adopted too fast, the risk of organizational mishaps can increase.

Prior research on technology adoptions provides important considerations for our multi-level study, as technology adoptions will presumably be influenced by factors at the corporate level but also potentially at the business unit and individual level.

The Case Study

We chose the German energy industry as the setting for our case study on technology adoption because Germany introduced the "Energiewende," an energy-transition policy to transition to a low-carbon, nuclear-free economy. Germany aims to migrate from conventional energy sources such as coal power and nuclear power faster than all other European countries. We chose Germany for two significant reasons. First, because the country operates in an environment that is currently changing significantly, large traditional companies in the energy industry provide a useful setting in which to investigate technology adoption. Germany has pledged via the "Energiewende" to cease nuclear power production by 2023, end coal power production by 2038, and be producing carbon-free electricity by 2045. Since German energy companies have been going through significant organizational change over the last 10 years, we have chosen to look at technology adoption in this industry. Although the gas supply cuts from Russia to Europe due to the war in Ukraine will lead to higher conventional power sources through coal-fired power stations over the next few years, the plan to phase out coal by 2038 remains valid.

We selected ENERGYCOMP (anonymized name) for our study. ENERGYCOMP operates several conventional coal, gas, and nuclear power stations. Over the last 15 years, the German government has subsidized the development of renewable energy facilities, focusing particularly on wind and solar power. This has led to the emergence of several new competitors from the renewable energy sector—both larger companies and smaller disruptive ones—and has created a highly turbulent market environment for ENERGYCOMP. It is therefore an imperative for ENERGYCOMP to create competitive advantage by continuing to innovate within its existing power stations as well as create new business models for the future. One of the company's strategies is to operate its existing power stations for as long as possible. This is particularly important in times of crises involving the security of supply, which is a major focus of energy companies, at least in the short term.

We studied which of ENERGYCOMP's plants were first movers in technology adoption and which were followers. Although the company had previously undertaken improvement projects, in 2015 it initiated two major improvement projects in its coal and gas power stations. At the coal power stations the improvements entailed a redesign of the boiler to burn biomass to replace parts of coal combustion in order to reduce the company's carbon footprint. Improvements to the gas stations focused mainly on increasing the efficiency of significant parts of the stations through an optimized gas combustion in the gas turbines. The technology adoptions for coal and gas differ. We investigated three technology adoptions of the same biomass combustion redesign in three coal power stations and three technology adoptions of the same gas turbine efficiency improvement in three gas power stations.

We identified constructive tension, open innovation, and knowledge standardization as three important factors that impact technology adoption.

We selected three coal power stations of similar size (average size 600 MW), average headcount (50 employees), and similar age (40 years). The average size of gas power stations was approximately 600 MW, with 40 employees, and an average age of 30 years. The power stations are located in Germany, Hungary, the Netherlands, and the United Kingdom. Given that we had information from ENERGYCOMP about the technology adoption dates for the power stations, we were able to segment the power stations into first movers (two) and followers (four) within the two coal/gas technology adoption processes.

Method

Our single case study was strengthened by that fact that one author was working at ENERGYCOMP during the research. This enabled us to have easier access to data. In 2019 and 2020, we conducted interviews at ENERGYCOMP with production and maintenance managers. These two types of managers are relevant as they have the most technological and managerial knowledge about the technology adoption processes. They were key informants and enabled us to reduce the problem of informant bias. Of 21 possible interviewees, we conducted 17 interviews, 10 with production managers and 7 with maintenance managers. We conducted the interviews by phone, using MS Teams, or in person. Each interview lasted between 45 and 90 minutes (Table 1). We first prepared a detailed topic guide, which covered the basic areas for discussion about successful adoption of technology. We recorded 16 interviews. One manager declined recording, so we took detailed notes immediately following the interview that the interviewee subsequently reviewed. We transcribed all the recorded interviews into MS Word and analyzed them with ATLAS.ti. We also used secondary data sources such as internal project databases to obtain additional information to further substantiate our analysis of the interviews.

We used the common methods for grounded theory coding analysis (Strauss and Corbin 1998). First, we identified similar statements made by the managers of early adopters (first movers) and late adopters (followers) and grouped them into first-order codes (Table 2). We then followed Gioia, Corley, and Hamilton (2012) to create clusters of findings for the various phenomena we had observed from the first-order codes (Figure 1). After seven rounds of detailed discussions with practitioners at ENERGYCOMP, we ended up with three aggregate dimensions. We adapted the concept of absorptive capacity (Cohen and Levinthal 1990) for our dimensions to reflect the different technology adoption phases in our findings.

Results

We discovered that knowledge sensemaking, transformation, and exploitation are three separate phases of technology adoption at the coal-powered and gas-powered stations. We found that two of the six power plants we studied were early adopters (first movers) and four were late adopters (followers). We also identified three important factors that impact technology adoption: 1) “constructive tension,” which we

TABLE 1. List of interviewees

Interviewee	Role	Location	Interview Duration (min)
1	Production Manager	Germany	57
2	Production Manager	The Netherlands	68
3	Maintenance Manager	Germany	55
4	Production Manager	Germany	45
5	Production Manager	United Kingdom	45
6	Maintenance Manager	Germany	90
7	Production Manager	Germany	47
8	Production Manager	United Kingdom	50
9	Maintenance Manager	United Kingdom	48
10	Production Manager	United Kingdom	77
11	Maintenance Manager	United Kingdom	80
12	Production Manager	United Kingdom	85
13	Maintenance Manager	United Kingdom	60
14	Maintenance Manager	Germany	65
15	Maintenance Manager	Germany	55
16	Production Manager	Germany	48
17	Production Manager	Hungary	71

TABLE 2. First-mover and follower statements overview for main clusters of findings

	First Mover	Follower
Knowledge-Sensemaking Phase		
Constructive Tensions between Senior Management Teams and Power Station Teams on Industry Foresight	"We were pushed to push the boundaries of what the power station can do—whether we can save more money by improved operation or by consideration of increased operational risk. Instead, we implemented technologies that were more focused on the long-term value of the power station rather than on short-term operational improvements."	"In our headquarters team there are the people who should be looking forward. We haven't got that capacity."
Reducing Silo Thinking and Employee Motivation for Knowledge Search	"Together with our station employees, you have to try it out step by step, but that only makes sense if you make a calculation for yourself during this technology adoption process regarding whether it makes sense at all how many such products will be brought into the power plant in the future."	"Resources—you know the site engineers aren´t able to look back and evaluate, the engineers do not have time to think."
Transformation Phase		
Reducing Reliance on Externals	"If we are going to modify the plant to adopt new technology, we go for a modification process and that may then include verification by the OEM."	"Not including the technology development company was the weak spot of the acquired knowledge when we assimilated. What we did for the transformation is we had to adjust the technology. But we will see an improvement in the near future, for which we may have to invest in more technology know-how."
Exploitation Phase		
Knowledge Standardization	"As with most technology adoptions, it is often done for the executive people in headquarters, so also you have a lot of clever people in the power station, the new technology doesn´t make sense if there are no people using the technology. Regarding education, make people understand what the new technology is there for, why we are using the technology. Whenever we start something, we try to standardize how you use it."	"We have an internal engineering support organization within our company that we can use for standardizing our implemented technologies. Because there are certainly times where we generally reckon, we need some support in the standardization because we are not able to do this process."
Developing Organizational Support	"We coordinated with headquarters and other parts of the business, and also with our engineering office inside the company, to constantly check how realistic what we have planned here is. And headquarters basically supported us over the whole project lifecycle."	"I would say that as a company we are really bad at exploitation of technologies. When we exploit, we do a lot of installations, but we don't get the full potential out of them because the support has already dried up, the interest has dried up, and you're running to the next project. And because there is no back testing, we cannot verify if we achieved what we had promised at the beginning."

define as differing insights about the future direction of the power station between senior management teams and power station management teams that are resolved through debate and collaboration; 2) open innovation, whereby first-mover power stations collaborated with original equipment manufacturers (OEMs) and other external institutions and accelerated the technology transformation; and 3) knowledge standardization, which occurs through documenting an adopted technology in a handbook within the power station for the power station employees.

Knowledge-Sensemaking Phase

The starting point for the technology adoption processes was a change in the external environment because the energy industry was facing a transition from conventional electricity production to renewable electricity. The changes caused by the energy transition created a constructive tension between the senior management team at headquarters and the power station managers: they had different interpretations, respectively, of the direction that the industry is moving and what action(s) might therefore need to be or should be taken. We found that the plants that were early adopters tolerated this constructive tension between the company's strategic vision and the plant's own vision. By contrast, the plants that were slower to adopt the new technologies tried merely to implement the senior management team's vision. In terms of accelerating the process of technology adoption, it was during the knowledge-sensemaking phase that station managers in the first-mover power stations encouraged and motivated their employees to actively search for new knowledge both inside and outside the station and to come up with new ideas on how to improve the existing technology base. In the plants that we found were followers, managers sometimes failed to motivate or encourage their staff to take on additional work during their daily tasks.

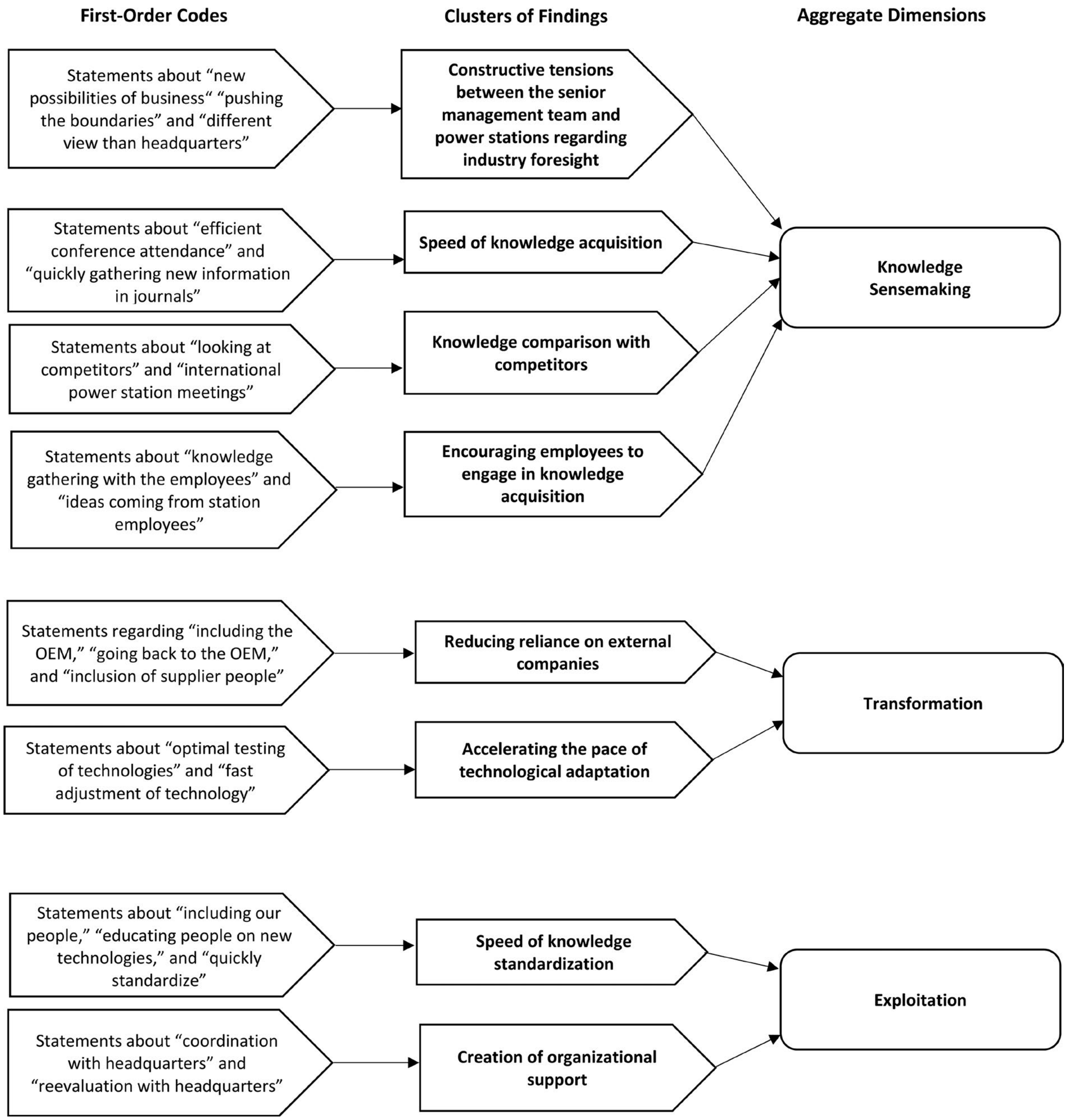

FIGURE 1. First-order codes, clusters of findings, and aggregate dimensions

Observation 1: Knowledge sensemaking is accelerated when knowledge exchange occurs between headquarters managers (the senior management team) and the station managers (the middle managers), and when the station managers subsequently encourage those at the individual level (station staff) to search for new knowledge proactively. Constructive tensions between corporate managers and middle managers about promising technologies during this phase seem to enhance technology adoption processes.

Transformation Phase

Upon identifying new technologies in the knowledge-sensemaking phase through constructive tensions, the new technology must be transformed or adapted to the current technology base in the power stations. During this phase of technology adoption, speed of adoption proved to be important for the first-mover power stations. They achieved a higher speed of technology adoption by drawing on the expertise and experience of an OEM during this phase. The station managers' decisions to combine the experience of their staff with that of the OEM led to faster adoption of the new technology as it reduced the possible technological risks quite early on. We found that when technologies are adopted without external companies, often a technological redesign is necessary or a transformation fails. Another advantage of bringing in expertise from an OEM is that the power station's staff can learn from that external knowledge and can apply it more quickly during the transformation phase of future technology adoptions. In subsequent transformations, the company can reduce its reliance on the OEM and other external companies. In the follower power stations, managers failed to establish a strong relationship with the OEM in this crucial phase, which can negatively impact current and future technology adoptions. We also discovered that some of the follower stations incurred additional costs stemming from repairing damages that results from internal efforts to transform or adapt existing technology.

Observation 2: In the transformation phase, middle managers (station managers) include external companies. The learning and experience acquired in this stage then reduces the company's reliance on external companies in subsequent technology adoptions. Less learning takes place when station managers and the OEM do not establish a good relationship, which in turn negatively impacts future technology adoptions.

Exploitation Phase

We found that knowledge exchange between the power stations and the OEM during the transformation phase was essential for technology adoption in the exploitation phase. Two main factors proved crucial for technology exploitation.

First, managers needed to quickly standardize the knowledge about the technology to be exploited. This standardization enabled station personnel to become familiar with using the new technology. They also understood how it should be used in critical operation modes when, for example, the power station is operating under maximum load. Management teams in the first-mover power stations standardized the knowledge of a technology by creating a technology handbook. The managers we interviewed emphasized how important it is to document knowledge and processes formally. They indicated that regardless of how skilled and knowledgeable employees are, if managers fail to make the new technology understandable to them, the employees will not use it. Only with employees' acceptance can the benefits of a new technology be exploited fully.

Second, business unit managers need to involve headquarters managers during this phase to improve technology exploitation. We found that successful technology adoption is not solely about exploiting the technology from a technological point of view. In addition, achieving a reduction in operational expenditure or an increase in revenue must be done in conjunction with headquarters, as a station is not capable of achieving these objectives on its own. The managers we interviewed expressed how important it was to work with headquarters staff during this phase, particularly in reevaluating the business case to see how close the exploitation was to the original business case. By contrast, it was evident from the follower plants how failure to include headquarters significantly slowed down technology exploitation. Managers mentioned how organizational support had dried up and headquarters did not undertake any back testing or reevaluation, which made it difficult to see the real benefits of the adopted technology.

The managers we interviewed emphasized how important it is to document knowledge and processes formally.

Observation 3: The middle managers (station managers) quickly standardized the exploited technology knowledge for those at the individual level (station staff), which speeds up the exploitation phase but also reacquaints headquarters managers with the importance of reevaluating the business case for commercialization. Waiting until the exploitation phase before involving corporate managers through sharing and standardizing knowledge about the technology results in faster technology adoption. Knowledge standardization typically starts at the beginning of technology adoption processes, but we observed it at the end of the technology adoption process. In our observations, it led to such faster technology adoption in the first-mover power stations.

Discussion

We provide an analysis of our key findings related to constructive tensions, open innovation, and knowledge standardization.

Constructive Tensions in the Knowledge-Sensemaking Phase

What was apparent during this phase was that the power stations that were early adopters tolerated constructive tensions between the strategic vision at headquarters regarding the new technologies and the station's own vision. The senior management team focused on short-term benefits, while the power station focused on long-term projects and future benefits. One would expect headquarters and the power stations to have the same vision, or that the power stations would not have the freedom to develop their own long-term focused vision. One would also expect that this difference in vision would impede rather than expedite technology adoption. Although the company and each power station's strategic vision should correspond, the first-mover power stations often focused on long-term strategic development of the station. Constructive tensions arose between the senior management team and the first-mover plant managers because they were able to have productive debate about the short-term/long-term goals of the power stations in various communication channels (performance meetings, business optimizations workshops, and power station leadership meetings) and ultimately resolve different perspectives on technologies. Such willingness to debate in different settings led to faster technology adoption. Once technologies are identified for adoption, managers of first-mover stations motivate their station staff to leave their knowledge comfort zone and begin to acquire knowledge rapidly about the new technologies.

Slow adopters (followers) mostly just followed the senior management team's vision for the new technology. These stations were not able to reduce tensions with corporate managers regarding industry foresight: these power stations were not able to push the boundaries of their technology base and failed to identify new business opportunities. In such cases, the power station managers did not challenge any aspect of the senior management team's vision, even if they had separate ideas. As shown through our study, these factors resulted in slower adoption of technology. In organizational structures where the strategic vision comes from headquarters, employees may resist new technologies because the mutual understanding and agreement about the industry foresight is lacking.

Open Innovation Approaches in the Transformation Phase

We observed that during the transformation phase the first-mover power plants involved different external parties. OEMs were heavily involved during this phase and were clearly following an open innovation approach, resulting in faster technology adoption. The open innovation approach was evident by the power stations incorporating OEMs, research institutions, or universities whose additional expertise improved the transformation of the technology. For example, the transformation and adaptation of the gas turbine combustion technology in the gas power stations was done in cooperation with the OEM and a university. Open innovation occurred when the power station combined industry knowledge with research knowledge to accelerate the technology adoption process. In ENERGYCOMP's slow-adopting plants, the focus was more on the appropriateness of the technology for the plants themselves, and these plants did not include external firms in the technology transformation. These plants followed a traditional closed innovation approach, as used in many traditional organizations, which resulted in slower adoption.

Knowledge Standardization and Organizational Support in the Exploitation Phase

In the early-adopter power stations, the senior management team was not involved until the exploitation phase when technology knowledge was standardized and codified. These power stations standardized knowledge of the adopted technology in order to motivate station staff to use it. When the senior management team collaborated with individual power stations, they codified knowledge in various databases that enabled further rollouts of the technology to other power stations. We observed that the slow-adopter power stations often told the senior management team that the technology knowledge could not be standardized because it was unique to the plant. In communicating such views, they lost the senior management team's support, which resulted in no further rollouts of the technology to other power stations because the knowledge was not standardized or codified.

Slow-adopter power stations often told the senior management team that the technology knowledge could not be standardized because it was unique to the plant.

Managerial Implications

Our study findings have important implications for managers in traditional multinational energy companies that pursue technology adoption:

1. Where necessary, those who are managing business units in traditional multinational energy companies should be prepared to challenge the senior management team's strategic view of technological innovations. They should engage in debate and collaborate (resolve constructive tensions) to speed up technology adoption. Local power station managers may have novel and better ideas about which technologies to adopt—and in some cases, these technologies might be ones the senior management team advises against.
2. To increase the pace of technology adoption, power station managers in the energy industry should consider including external parties (such as OEMs and universities) in the knowledge transformation process.
3. In the final phase (exploitation) of technology adoption, codifying knowledge for the senior management team is beneficial for future rollout to other units and for new technologies. Standardizing and codifying knowledge is more effective when done in the later stage of technology adoption rather than right at the beginning, as often suggested in the literature.

These implications relate to companies adopting new technologies in the energy industry. Our findings might be applicable to other industries with traditional companies, but further research is needed.

Future Research

Our study helps to advance work already started by other researchers (Chiaroni, Chiesa, and Frattini 2010) looking at how business units are moving away from closed innovation. While we have shown how important the shift from closed to open innovation is for business units in a traditional multinational energy company, we need a clearer picture of exactly how such shifts take place. Further case studies in large traditional organizations, such as that conducted by Chiaroni, Chiesa, and Frattini (2010), would provide a clearer understanding of these shifts and the implications for companies. It would be interesting to explore whether our findings are also applicable to small and medium-sized companies (SMEs) that may have only a few units. Future studies should also investigate why knowledge standardization and codification take place at later stages of technology adoption in large traditional organizations.

Limitations

The single case study approach has limitations. The results from our in-depth case study are valid for a traditional multinational energy company. We would encourage similar studies of technology adoption to be undertaken in other industries. Such studies could examine different organizational assets, such as car engine production units in automotive companies or the production assets of chemical companies. Although in our study the first movers adopted the technologies faster, it could also be that, in other research settings, the followers reach exploitation more quickly, as they learn from the first movers and are able to overtake them.

Conclusion

External factors may prompt or force companies to adopt new technologies to keep pace and maintain an advantage. Technology adoption can prove challenging, especially for traditional multinational companies. Our study of a traditional multinational energy company showed that there can be a disconnect between the headquarters' strategic vision and the vision at the local level, but when collaboration ensues to resolve constructive tensions, the pace of technology adoption is faster. Fostering open innovation and standardizing knowledge also aids technology adoption. Practitioners can use the managerial implications presented to facilitate technology adoption.

References

Adner, R., and Snow, D. 2009. Old technology responses to new technology threats: Demand heterogeneity and technology retreats. *Industrial and Corporate Change* 19(5): 1655–1675. doi: 10.1093/icc/dtq046

Baum, R. J., and Wally, S. 2003. Strategic decision speed and firm performance. *Strategic Management Journal* 24(11): 1107–1129. doi: 10.1002/smj.343

Ben-Zion, R., Pliskin, N., and Fink, L. 2014. Critical success factors for adoption of electronic health record systems: Literature review and prescriptive analysis. *Information Systems Management* 31(4): 296–312. doi: 10.1080/10580530.2014.958024

Bunduchi, R., and Smart, A. U. 2010. Process innovation costs in supply networks: A synthesis. *International Journal of Management Reviews* 12(4): 365–383. doi: 10.1111/j.1468-2370.2009.00269.x

Chiaroni, D., Chiesa, V., and Frattini, F. 2010. Unravelling the process from closed to open innovation: Evidence from mature, asset-intensive industries. *R&D Management* 40(3): 222–245. doi: 10.1111/j.1467-9310.2010.00589.x

Cohen, W. M., and Levinthal, D. A. 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly* 35:128–152. doi: 10.2307/2393553

Damanpour, F., and Schneider, M. 2006. Phases of the adoption of innovation in organizations: Effects of environment, organization and top managers. *British Journal of Management* 17(3): 215–236. doi: 10.1111/j.1467-8551.2006.00498.x

Gebauer, H., Worch, H., and Truffer, B. 2012. Absorptive capacity, learning processes and combinative capabilities as determinants of strategic innovation. *European Management Journal* 30(1): 57–73. doi: 10.1016/j.emj.2011.10.004

Gioia, D. A., Corley, K. G., and Hamilton, A. L. 2012. Seeking qualitative rigor in inductive Research: Notes on the Gioia methodology. *Organizational Research Methods* 16(1): 15–31. doi: 10.1177/1094428112452151

Judge, W. Q. and Miller, A. 1991. Antecedents and outcomes of decision speed in different environmental outcomes. *Academy of Management Journal* 34(2): 449–463. doi: 10.2307/256451

Khanagha, S., Volberda, H., Sidhu, J., and Oshri, I. 2013. Management innovation and adoption of emerging technologies: The case of cloud computing. *European Management Journal* 10(1): 51–67. doi: 10.1111/emre.12004

Morales-Raya, M., and Bansal, P. 2015. Racing to the bottom: The negative consequences of organizational speed. *Organizational Dynamics* 44(3): 226–235. doi: 10.1016/j.orgdyn.2015.05.010

Reinders, M. J., Frambach, R. T., and Schoormans, J. P. L. 2010. Using Product Bundling to Facilitate the Adoption Process of Radical Innovations. *Journal of Product Innovation Management* 27(7): 1127–1140. doi: 10.1111/j.1540-5885.2010.00775.x.

Reinhardt, R., Hietschold, N., and Gurtner, S. 2017. Overcoming consumer resistance to innovations – an analysis of adoption triggers. *R&D Management* 49(2): 139–154. doi: 10.1111/radm.12259

Rogers, E. M. 1995. *Diffusion of Innovations*. 4th ed. New York: Free Press.

Strauss, A., and Corbin, J. 1998. *Basics of Qualitative Research Techniques and Procedures for Developing Grounded Theory*. 2nd ed. London: Sage.

Woiceshyn, J. 2000. Technology adoption: Organizational learning in oil organizations. *Organization Studies* 21(6): 1095–1118. doi: 10.1177/0170840600216004