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INNOVATION IMPLEMENTATION: THE ROLE OF TECHNOLOGY DIFFUSION AGENCIES

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Abstract

A great deal of 'innovation failure' can be attributed to ineffective implementation, rather than failure of the innovation itself. External agencies such as technology diffusion agencies (TDAs) have been created to assist organisations to implement innovation successfully, but there has been little empirical research investigating their roles. This paper presents a longitudinal case study of failed innovation implementation, and highlights in particular the role that technology diffusion agencies can play to prevent such failure in future cases. Results indicate the importance of changes in organisational factors such as training, climate, and management support during the implementation process in predicting outcomes, and imply a role for TDAs in assisting with both technical and non-technical aspects of innovation implementation.

Keywords: innovation implementation; technology diffusion agencies.

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Innovation implementation: The role of technology diffusion agencies

In an increasingly global business environment, it is becoming apparent that innovation is not only pivotal for an organisation to achieve a competitive advantage, but that it is also critical for survival in many industries (Klein, Conn, & Sorra, 2001). Greater recognition of its potential value has sparked organisations to adopt a variety of innovations such as Total Quality Management, Business Process Reengineering, and as discussed in this case, Lean Manufacturing. Often, however, the potential benefits are not realised, with reported failure rates of between 40 and 70 percent for new technology change projects (Burnes, 2003). However, much of this can be attributed to implementation failure, rather than failure of the innovation itself (Klein et al., 2001; Klein & Knight, 2005). In order to overcome this issue, external agencies such as technology diffusion agencies (TDAs) are being created to help companies implement innovation. However, there is limited research on the roles these agencies play and the services they can provide.

The aim of this study is to explore how innovation implementation can fail, and in particular, ways in which TDAs can help to minimise such failures. This research takes a dynamic perspective, examining how organisational factors change over time to influence the success or failure of innovation implementation, rather than simply considering the state of the company at one point in the process. This case study will thus contribute to a greater understanding of the integrative and combinative effects of these factors throughout the implementation process.

In examining this case, we will use Klein, Conn and Sorra's (2001) theory of innovation implementation, which identifies four key factors affecting implementation effectiveness. As shown in Figure 1, the model proposes direct and indirect relationships between management support for innovation, availability of financial resources, implementation climate (i.e. shared employee perceptions of the importance of innovation implementation), and implementation policies and practices (e.g. training and benchmarking) as drivers of implementation effectiveness. This model will be applied to the current case in order to investigate these relationships, and to determine how TDAs can affect these factors to reduce the likelihood of innovation implementation failure.

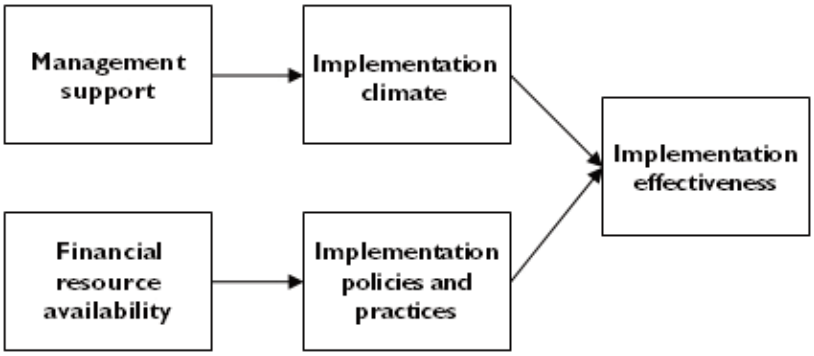

Figure 1.0. Model of Innovation Implementation. Klein, Conn & Sorra, 2001.

Technology diffusion agencies are "public or private sector entit[ies] through which an innovation is distributed or made available to the population at large" (Brown, 1981, p. 50). TDA actions may include building technical knowledge, providing financial subsidies, education services, absorbing risks, providing training, and setting standards or regulations for innovation use (Brown, 1981).

Through actions such as these, TDAs have a unique opportunity to enhance the process of innovation implementation in organisations. They are likely to have their greatest impact through an organisation's implementation policies and practices. Indeed, enlisting external assistance can be seen as a proactive implementation practice in its own right. Working with many clients, TDAs gain experience in implementation across different technologies, organisations, and industries. This experience provides insights and process skills that are unattainable for many organisations. Furthermore, as independent, external agents, TDAs have the opportunity to provide a fresh perspective on organisational attitudes, culture, systems, and processes. The purpose of this case study is to explore the ways in which these external agencies, specifically TDAs, can assist organisations throughout innovation implementation.

Research Methodology and Setting

A longitudinal, qualitative methodology was employed to gain an in-depth analysis of the complexities of the organisation and the implementation process. Much investigation into the merits of qualitative research supports its ability to capture the

real-life context within which events take place and to depict the essence of events as they unfold (Yin, 2003).

Company background

This study was undertaken within a manufacturing firm referred to as 'WaterCo', a pseudonym to protect the confidentiality of the organisation. WaterCo is a large international organisation which designs, develops and manufactures a range of water mixing products. The company has been operating for over 50 years and employs more than 200 staff across three plants in South-East Queensland, Australia. The present research took place at the main plant, which manufactures over 20,000 products.

WaterCo has enjoyed a history of market monopoly and uninterrupted growth with virtually no competition. However, recent years have seen increased competition, particularly from lower cost, international sources. These rival companies began undercutting prices, leading to a sharp decline in WaterCo's market share and profitability. The company eventually turned to innovation in order to compete.

Due to the company's relative inexperience in conducting change programs, they enlisted the assistance of a partially government-funded technology diffusion agency. The TDA, known as 'TecHelp' for the purpose of this paper, has had a long-standing relationship with the company and operates as a not-for-profit organisation providing assistance in research, education, and implementation of innovative practices and technologies within the manufacturing industry.

Methodology

Three visits were made to WaterCo between April and August 2006. The timing of these visits enabled a greater understanding of the adoption decision and developments in the innovation implementation stages as and when they happened. Twelve semi-structured interviews were conducted on site with seven different employees. Four of these individuals were interviewed on multiple occasions, allowing examination of the changes in perceptions of the process over time. Purposeful sampling was utilised to select participants who were involved in the innovation decision or implementation, within the recommendations and restrictions imposed by the company liaison. Interviewees were drawn from all levels of the company, including senior management, engineering, and the manufacturing floor. All interview data were coded using NVivo 7.0.

Research interviews were structured around four broad issues. First, staff and organisational demographics were recorded, along with general information about issues such as the organisation's strategy, resources, and risk-taking orientation. Second, interviewees were asked about characteristics of the specific innovation they were implementing, including the source of the idea and the role of external agencies in the innovation process. In the third section, we discussed the reasons for adoption, allocated resources, anticipated benefits, and potential or encountered problems with the innovation itself. Respondents were also asked how they would measure the impact of the innovation in terms of performance indicators. Finally, respondents were asked about the implementation process, including anticipated hurdles and employee attitudes and reactions to change.

In order to supplement information from WaterCo, an additional interview was conducted with a representative of TecHelp who had been involved with the organisation for some years. This provided information indicating the degree to which the company had utilised TecHelp's services, as well as an external perspective on the effectiveness of the innovation implementation process at WaterCo.

Results & Discussion

Innovation Overview – "*If we're not moving forward we're not going to survive.*"

A brief longitudinal examination of the timeline of events at WaterCo highlights a decrease in key factors over time, and the subsequent gradual failure of the innovation. The change began in January 2005 when WaterCo's plant moved to a new, larger location. There was a consensus that the state of the company was grave, and all interviewees within the organisation agreed that some major change was crucial for the continued survival of the company. At the time, the Plant Manager reviewed their impetus for innovation:

> *I suppose my view is it's essential… without something, call it Lean Manufacturing, call it what you want, we're not going to capitalise on the opportunities we've spent years working on.*

While this statement clearly acknowledged the importance of innovation for survival it seems that there was little consideration of whether Lean Manufacturing itself was the appropriate solution. As we will show, this seemingly arbitrary decision-making occurred throughout the implementation, with many aspects of the change driven by the innovation itself rather than the management team.

Through their established relationship with TecHelp, WaterCo became involved in a 'High Performance Workplace' (HPWP) consortium, which led the management team, in mid-2005, to consider Lean Manufacturing as a possible solution to their company crisis. Lean Manufacturing is a method of streamlining

manufacturing operations based on the premise of eliminating all activities in the production process that do not add value for the customer (Liker & Morgan, 2006).

It was not until January 2006 that the decision to employ Lean was confirmed and implementation began. With the support of TecHelp, WaterCo supervisors and managers undertook a full-day Lean Manufacturing training session in March 2006. This was followed in April with a similar full-day simulation training game for some factory staff. At this time the first interviews were conducted for the purposes of this study, with staff reporting optimistic attitudes towards the initial stages of the implementation. Shortly after, in May, best practice measures for performance were introduced to the factory floor. On the second site visit, in June 2006, there were many more visible changes to the factory floor, with workspaces substantially altered and performance charts on display. At this stage staff were still enthusiastic, though they noted that some ongoing issues had not been resolved. In August 2006 the final visit to WaterCo took place, and significant changes in employee attitudes were evident, as pre-existing problems had surfaced which hindered the success of the changes. Interviewees indicated that the implementation had essentially stalled by this point.

We now examine the ways in which the four predictors in Klein et al.'s (2001) model affected the implementation of Lean Manufacturing in WaterCo, and identify the role of TDAs in that process. Importantly, we follow the organisation through the implementation process to understand how changes in these factors affected the success of the innovation implementation. We found that although the TDA was able to assist WaterCo to develop some implementation policies and procedures, this expertise was utilised only to a limited extent, and only during the early stage of the implementation. Furthermore, their help in this regard was diminished due to WaterCo's low investment of financial resources, weak implementation climate and poor managerial support, particularly as these factors declined over time.

Implementation Policies and Practices – "*They never took it up…*"

Klein et al. (2001) identified that a suite of high-quality policies and practices such as training and rewards for employees was important in successful innovation implementation. Although WaterCo initially provided basic training and undertook some changes with assistance from the TDA, over time these gradually diminished and eventually stopped. We will now detail the way in which WaterCo dealt with implementation policies and practices, in particular the planning of changes, the assistance provided to employees, training, and provision of benchmarks.

The primary change made by WaterCo was a shift to a new location and an attempt to apply a new structure that would maximise product flow. Despite these good intentions, WaterCo failed to take advantage of the resources and expertise available to them to ensure that the new premises were optimally utilised. The TecHelp representative reflected on the event:

> *One of the tools we suggested to them two years ago was… if they are going to relocate, ensure they lay out the operations to really optimise that product flow. There are tools that we have here we use to achieve it. They never took it up.*

This lack of planning had serious consequences, and little more than a year after moving into the new plant, the company was forced to redesign the factory operations. Sixteen months after the move a professional staff member reflected on the situation:

> *We got a big problem where we can design products but we can't get them made in the factory because of the way the factory works. So we've had to redo the way … we interface with the factory to allow products to flow through more effectively...*

Once the decision to implement a Lean system had been confirmed, WaterCo engaged both TecHelp and an independent consulting firm to assist with facilitation of the change. Seeking assistance was a significant and positive first step, which taken alone seems to indicate strong commitment to the change. Ultimately, however, this commitment was short-lived. For instance, a major step in WaterCo's Lean implementation was to undertake, with the assistance of the TDA, a program designed to streamline floor layout and maintaining better housekeeping systems. However, the assistance was not accepted by WaterCo until late in the implementation process. Furthermore, a factory worker commented:

> *A lot of it we knew but we had no choice. I mean we could work much faster, much more efficiently but we had no choice. We didn't have the [equipment], you know, so that was just how we worked…*

From this statement it can be inferred that the organisation had not provided sufficient resources for employees to work efficiently in the past, and that this change was critical to improve productivity within the company. Again, although TecHelp offered planning tools prior to the location change, these were not taken up until significantly later, and the change was subsequently less successful.

TecHelp was also engaged to provide basic training in Lean Manufacturing during March 2006. This consisted of a full-day 'Lean Simulation' exercise, and was initially targeted at the management team. Following this session, the program was extended

to interested shop floor employees directly involved in the Lean Manufacturing change (initially only one manufacturing line). The training was extremely well received by staff, particularly given that such initiatives had been lacking in the organisation. One managerial staff member reflected:

> *[WaterCo] has been traditionally quite ordinary at training people. In fact, they've virtually done none. So this is like a distinct initiative… everybody knows that something's got to happen.*

While this was clearly beneficial, a representative of the TDA noted that a single day of training would probably not suffice to instil a comprehensive understanding of Lean Manufacturing principles and change entrenched attitudes. Klein et al. (2001) recognise the importance of training, as it ensures that employees become comfortable and skilled in innovation use, and thus directly improves the likelihood of successful implementation; our research supports this finding, however, we further believe from WaterCo's experience that such training needs to be extensive and considered over time.

Following training, WaterCo acted to provide ready assistance from engineers to floor staff, to ensure that technical problems could be easily resolved. One floor worker recalled:

> *Before, you would call an engineer –they have no time … now we have an engineer who is in charge of assembly and we go with our problems to him, and … he does something pretty well straight away...*

Although this step shows an awareness of the need for integration across departments, it seems that this occurred only at the lower levels of the organisation. One R&D employee noted that, "R&D has been kept almost totally out of the Lean Manufacturing efforts." Liker and Morgan (2006) argue that in order for Lean to be truly effective, the principles must be adopted across all levels of the organisation, from the shop floor to the executives. In stark contrast, the mindset demonstrated by this employee represents the isolated use of a simple 'Lean tool', an approach that is unlikely to generate the sustainable changes in culture needed by WaterCo (Liker & Morgan, 2006).

The second 'Lean change' that was implemented early in the process was the introduction of measures and benchmarks for production teams. Benchmarks are an important implementation practice, as they provide feedback to the organisation on the innovation's effectiveness. WaterCo initially showed good implementation practices concerning these benchmarks: after the second site visit, there was a noticeable difference to the workspace, with charts tracking production and faults displayed around the factory floor. However, WaterCo failed to perform a benchmarking exercise prior to creating these measures, despite TecHelp previously recommending a best practice professional industry benchmarking tool:

> *The intent is that you run it annually to identify where you are today, go through some training in terms of best practice or new technology, after 12 months re-run that evaluation or benchmark to determine what the improvement has been. They haven't even run the first one yet.*

Thus, although targets were set, many respondents echoed the notion that these were not accurate or based on any past or external sources. One professional staff member noted: "Any target we set at the moment I would suggest it would be fairly arbitrary." A factory employee also stated that their line had achieved 110 percent of their goal, stating: "We might have set our target a bit low, and then we can increase that." This statement again suggests that changes were being made based on arbitrary standards or the demands of the innovation itself, without a firm understanding of the desired outcomes for the organisation.

Finally, employees also noted a lack of incentives for ongoing use of the new systems. While interviewees suggested that incentives would be appreciated, this was generally not perceived to be a strength of the organisation. A managerial level employee who had been working for WaterCo for 28 years remarked on incentives, "Typically as an organisation it's something we're very poor at." Rewards for innovation-related behaviour send a clear message about organisational values and priorities (Klein et al., 2001) and as such form an important implementation practice that was not used at WaterCo.

Overall, these findings paint a picture of an organisation seeking to implement major change in an unsystematic and fragmented manner. Although some positive policies and practices were evident, it seems that these were not comprehensively utilised. Rather, the majority of the change effort took place at a relatively superficial level, while in reality a major cultural overhaul was needed. Furthermore, while initiatives such as basic training were put in place, these were not supported by more extensive, higher-level programs.

Financial Resources – "*You've got to spend money to make money, haven't you?*"

As indicated by Klein et al.'s (2001) model, the deficiencies identified in implementation policies and practices may have been due to a lack of financial resources. Furthermore, WaterCo's ability to inject funding into their Lean implementation may have been hindered by the organisation's reactive orientation to the environment. Several respondents indicated that international competitors had led the company into a pricing war

which was eroding profits until there was no choice but to innovate to survive. The Plant Manager reflected at the beginning of the innovation implementation:

> *The prices of our competitors are coming down quite significantly and we really have to keep up so that is why we are doing it.*

This suggests that financial slack within the organisation would be limited as they struggle to compete with lower-cost international suppliers. Furthermore, one senior manager indicated that although the organisation was *willing* to spend money on the implementation, they didn't anticipate that it would be *necessary* to do so:

> *When it gets into serious spending and dollars, well I don't actually foresee we're going to need to, but you know if we do, there's a demonstrable benefit then, yes, it will be…*

This is a relatively simplistic view of a complex transformation. The physical redevelopments, massive cultural change and ongoing improvements associated with Lean Manufacturing would inevitably have involved significant investments of both effort and funds. The most positive attitude to financing innovation came from a line supervisor, who recognised the need for financial investment:

> *Well, yeah, you've got to spend money to make money, haven't you? … I mean, that's the thing, if you can spend a reasonable amount of money to know that you're going to get a return out of it in the end well it's a good philosophy.*

WaterCo's initial upgrade of workspaces was supported financially, with the firm investing in basic training and new work benches in order to facilitate manufacturing flow. However, the organisation showed reluctance to invest in further training during the early stages of implementation, and when offered a far more comprehensive training program, did not take up the opportunity. The TecHelp representative remarked:

> *They have taken up some of it but we would have liked to have seen them do more of it. With some companies [this program] is a five day workshop, so it is quite intensive in all of the Lean Manufacturing best practice… It's a big investment but it also has significant payoff.*

Overall, these findings suggest that the company was willing to spend money on initial 'concrete' changes, but less willing to invest in the more intangible staff development which would help to transform the organisation's culture. WaterCo's management team seem to have been relying on the Lean implementation to drive cultural change through the organisation, when in reality changing a stagnant organisational culture may be a difficult and highly resources-intensive process.

Kilmann and Covin (1989) argue that the willingness of management to provide resources for innovation can be seen as an indicator of commitment to the project. Thus, the provision of adequate resources does not only encourage innovation use and provide the means to overcome problems, it also ensures that the value of innovation within the organisation is clearly conveyed to employees, reinforcing the duality of implementation practices with implementation climate in enhancing the effectiveness of innovation implementation. In the case of WaterCo, however, a failure to maintain a reasonable level of investment in the innovation over time led to ineffectual implementation practices and resulted in gradual innovation failure.

Implementation Climate – *"I think they're interested in trying to change…"*

We now discuss the development (or rather, decline) of WaterCo's implementation climate. Initially, the novelty of the training and changes seemed to send a strong, positive message, creating a shared understanding about the importance of this innovation. However, over time, both the changes and support for the new systems diminished, leaving employees feeling that this was simply another short-term fad, rather than the intended organisational overhaul. Furthermore, those employees who were not initially included in the training had no further opportunity to become involved, and consequently pockets of change resistant employees emerged. This gradually eroded the efforts made by the change champions, and by the third site visit, the implementation climate within WaterCo appeared decidedly weak.

Preliminary interviews discussing the firm's general propensity toward change and innovation revealed that the majority of employees felt that it was not a risk-taking organisation, noting that change tended to occur very slowly, if at all. This assessment was echoed by a representative of TecHelp, who described the organisation as being highly resistant to change:

> *They have been a very conservative company over the years … it was almost, on a few jobs you had to belt them over the head with a stick to get them to try it. We fully subsidised some of the jobs for them too… 'here it is, go and try it'. Otherwise, why? Why not, what have you got to lose?*

Given its change-averse nature, the organisation had remained stable, and arguably stagnant, for an extended time period. As such, the initial training had a huge impact on employees and garnered much positive feedback. A professional employee reflected on the training and remarked that:

Everyone keeps telling us we're not competitive but nothing's happening, but at least now something's happening and we've given some amount of power back.

This statement underscored the value of training in both altering attitudes and sending a clear message about the value of the change project within this organisation. In this case, the unprecedented nature of the training made those employees who were involved feel that this was a transformation that management felt strongly about, helping to build a strong climate for implementation among this group. One staff member involved in the factory level implementation of the innovation said of the training:

It helped to spread that we are changing and in a good way… it is actually exciting and we're getting involved.

The TecHelp representative suggested that an important outcome of the training is establishing among employees that they each have a significant impact on their work and ultimately the organisation's performance:

A lot of the time [workers] don't really appreciate the impact they have… when you run the training … it becomes very obvious and they immediately recognise and reflect on this.

However, throughout the implementation phase, management failed to establish a climate that unified the organisation toward achieving integrated, enduring, and successful change. Creating a strong implementation climate can be challenging, particularly in organisations that are risk-averse and have a weak culture. One employee acknowledged, "You've got to change a culture that's been, I suppose, bad for a long time." This issue was exacerbated by strong divisions between management and staff. A factory worker observed:

The attitude down there is like 'we are just all cattle and we have no say and we're not anything to them' … It's like management has no respect for any of us, even though, we actually, at the end of the day … we are the company.

This poor climate is exemplified by the fact that many employees did not attend the training provided. Furthermore, the fact that this lack of employee cooperation was accepted by WaterCo makes clear the deficiency of management in signalling the importance of this innovation (that is, creating a strong implementation climate) across all areas of the organisation. A factory worker discussed the consequences of this:

…we've still got a lot of people that are set in their old ways and I think some people move forward but then a lot of [workers] don't want to interact and see that we're trying to change and … they've just never got past the negativity.

Given the clear positive response from those employees who attended the workshop, and the need to ensure employee participation to quash resistance, it is curious to wonder why further training with TecHelp was not conducted. While initial enthusiasm for training provided an optimistic start to the implementation, WaterCo, through their inaction, failed to capitalise on this momentum to drive through the change and ensure the success of the implementation process. The perceived lack of management commitment to innovation was thus directly opposed to the creation of a strong, positive implementation climate within WaterCo.

These findings suggest a clear link between the policies and practices adopted by WaterCo and their implementation climate. That is, during the early stages of implementation, training and the workshop redesign led to enthusiasm among employees, and a reported sense that this change would be somehow 'different'. However, as time wore on and the changes were not sustained, employees became cynical about the innovation and its benefits. Interestingly, this connection between policies and practices and implementation climate mirrors the theoretical model initially hypothesised by Klein and Sorra (1996); yet their study failed to support this relationship. One reason for this discrepancy could be the incidence of training within the companies: In WaterCo, the high level of novelty may have increased the salience of the implementation practices, while the organisation studied by Klein and Sorra may have had a more standard approach to training. It is, nevertheless, an interesting finding worthy of future research.

Management Support – "We don't really see management from above very much."

Klein et al. (2001) suggest that a weak implementation climate can be attributed to a lack of management support – we believe that this was the case at WaterCo. The support that was provided by WaterCo's management team was short-lived, and corresponding decreases in employees' perceptions of the importance and value of the change were apparent. Management support has thus been identified as a key factor limiting WaterCo's ability to effectively implement this innovation.

The management team provided early support to employees through training and engineering assistance. However, beyond this initial effort, there was minimal consideration of appropriate support systems, leaving the burden of change largely with employees. This is exemplified, in particular, by their failure to engage the employees in comprehensive training, undertake benchmarking in order to set appropriate targets for floor measures, and conduct appropriate planning to support supply chain systems.

The company's implementation climate was critically weakened due to major setbacks with inventory. Issues in both the internal and external supply chain significantly affected firm output, performance to plan, and delivery performance. Attitudes at WaterCo turned sour as the innovation failed to show any statistical improvement in the factory, or enrichment of the employees' work. One of the floor staff summarised the situation by saying: "We're getting nowhere… doing 99% but getting out only 50% because of the problems."

The effect of this lack of management support systems was serious. A clear erosion of positive attitudes was evident over time, with even the key innovation champion in the factory becoming gradually disillusioned with the process. This individual, a senior factory worker who was known for encouraging the implementation within their team, provided a prime example of the effects of a weak implementation climate and poor management support. In the first interview this individual was extremely positive about Lean Manufacturing and the potential impact it could have on WaterCo, citing Toyota as the benchmark: "If Toyota can do a car in seven days why can't it do it in four? … I've got to sort of say [to staff] how far can you go?" In direct contrast by the third interview, almost six months later, he raised the example as being irrelevant and disparate from WaterCo. Most potent was his statement summarising the company's degree of implementation: "The way of working is the same; it's just the benches that are different."

This was the first time in three interviews that this individual had broached organisational failures such as a deficiency of managerial expertise in members of top management, the futility of measures and lack of incentives, lack of management involvement in the innovation process, low levels of utilisation of the TDA, and the generally apathetic views of many employees on the factory floor. The fact that this leading advocate for change experienced a complete turnaround in their perspective over a period of six months firmly indicates that management was not fully supporting the ongoing implementation efforts.

Overall, these findings suggest that while the management team at WaterCo seemed initially optimistic and committed to this change, their enthusiasm waned over time, and consequently so did their support for the program. A more recent paper by Klein and Knight (2005) notes that managerial patience and a long-term learning orientation are critical to effective innovation implementation, and in particular to developing a strong implementation climate. However, WaterCo seems to have been looking for a quick fix, with the innovation driving the changes rather than the management team. As hurdles arose during implementation, due in part to poor planning, commitment to the changes slowly dissipated.

TDA Assistance – "*They can't tell us how to do our job.*"

It is clear that despite the best intentions, the implementation of Lean Manufacturing at WaterCo was fraught with difficulty. Although the program began positively, the changes that took place were largely superficial, with deeper-level support and comprehensive changes lacking. Furthermore, it seems that even in those areas where the company did seek out external support, they accepted the assistance offered only to a very limited degree. Naturally, external agencies cannot force innovating organisations to utilise their services, despite potential benefits and attractive pricing.

The role of the technology diffusion agency in this case was limited to technical assistance and provision of training and information services. By encouraging positive implementation policies and practices, TecHelp was able to assist in launching the change effort and educating employees about the program. While this technical expertise is invaluable, it is arguably not these 'concrete' issues that led to the ultimate failure of innovation implementation at WaterCo.

Although the company's policies and practices were haphazardly implemented, there was nonetheless a genuine effort made, and employees were initially positive and enthusiastic about the potential of the new system. Ongoing support for the transformation was minimal, however, and this ultimately led to a loss of momentum and the decay of the initial positive climate for change. Furthermore, there seemed to be a sentiment among employees that WaterCo's management did not exercise the managerial skills for planning and strategy that were needed to institute lasting change, with one factory worker noting that the plant was "run by engineers", rather than managers.

Clearly, organisations undergoing major change not only require assistance with the technical side of innovation, but also with the 'softer' aspects, such as developing a learning orientation, driving culture change, and maintaining a long-term focus. Burnes (2003) notes that in organisational change, failure is often attributable to deficiencies in the ability of the firm's management to implement change successfully, even when advice and assistance is available. This suggestion is further supported by theorists who note that major organisational change can expose areas of managerial weakness, and, if management does not meet expectations of staff, create a culture of employee resistance (Hoag, Ritschard, & Cooper, 2002; Longenecker & Fink, 2001). If TDAs can expand their role to incorporate the less structured aspects of innovation implementation (for example by helping organisations to develop and maintain a learning orientation) in conjunction with the technical aspects of change, they may provide an even more valuable service and ultimately

improve outcomes for organisations even further.

A further major limitation on the effectiveness of TDA assistance in this case stems from the perception espoused by several interviewees that agencies such as TecHelp are of limited relevance due to their lack of specialised industry knowledge. For example, one professional employee criticised: "How can they have a greater role without being in the business we're in? They can't offer an innovation to a product…" This not only illustrates an extremely limited concept of innovation, but also fails to acknowledge the importance of process in any innovation implementation. While each situation is clearly different, there are many consistent aspects of the implementation process which, having gained experience assisting many different clients, TDAs are perfectly positioned to guide organisations through.

Conclusion

This research aimed to explore how innovation implementation can fail and the potential roles of technology diffusion agencies in preventing this occurring. This was achieved through a case study of the implementation of Lean Manufacturing in a medium size Australian manufacturing organisation. Using Klein et al.'s (2001) model, we observed the integrative and combinative effects of organisational factors over time, providing a dynamic perspective on the implementation process within WaterCo.

The findings from this research support the importance of implementation policies and practices (and the corresponding financial resources) in ensuring effective implementation. However, in this case, those positive practices that were implemented early in the process were not comprehensive, and external assistance was not utilised effectively. While the company's initial steps to implement the innovation (e.g. initiating training, upgrading workspaces, and setting production targets) were positive, it is clear that they failed to sufficiently plan for the change and engage external agencies to provide additional expertise.

The present research also confirms the importance of management support and implementation climate throughout the innovation implementation process. While management commitment seemed strong early in implementation, this was not sustained. The decline in implementation practices within WaterCo also had a considerable impact on the firm's implementation climate, and the radical change in employee attitudes over the course of the study showed that initial enthusiasm for innovation turned to apathy or frustration.

A key theoretical implication from this research was the strong relationship that emerged between implementation policies and practices and implementation climate. This finding reflects Klein et al.'s (2001) original model, though their final model failed to provide quantitative support for this relationship. However, that research examined only one type of innovation in an American sample, while in different contexts, this relationship may be more salient. The results from this study also highlight the critical factor of time in examining an area such as innovation implementation. Organisations are not static and in order to gain an accurate view of implementation it is important to examine the role of organisational factors as the implementation process unfolds.

The practical implications of the study for innovating organisations are twofold. First, organisations seeking to implement innovation should be certain to examine the factors discussed by Klein et al. (2001) and consider their impact on innovation not only as individual factors but in combination. Second, it is essential that management ensures that an innovation will fit with the organisation, and plans strategically and into the long term for the potential impact of the innovation.

The role of technology diffusion agencies in innovation implementation is clearly limited to that level of assistance and advice that organisations will accept. However, innovation implementation is a complex process, and organisations may need assistance not only with the technical aspects of innovation implementation, but also with the more intangible aspects, such as creating a learning culture and maintaining a long-term orientation. TDAs are uniquely placed to provide this assistance, and expanding their services to include this aspect of innovation assistance may help them to become even more relevant to the organisations they seek to help.

The global business environment is now exceedingly competitive, with a high rate of innovation failure and the need to find ways to support organisations to successfully implement innovation is greater than ever. Technology diffusion agencies have emerged for this reason, and can be a powerful tool, however it is necessary to build a greater understanding of their possible roles and benefits for innovating organisations. This case study provides a preliminary examination of their potential for assisting organisations to make the most of their investment in innovation.

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