LEADERSHIP CRITIQUE & SUPPORTING PORTFOLIO

A critique to meet the requirements of the Doctor of Business Leadership at Torrens University Australia:

Leadership for the Future in the Mining Sector

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Submission: October 1st, 2018
Subject: DBL710

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I Dale Blyth hereby declare, that this critique is my own work and to the best of my knowledge it contains no materials previously published or written by another person, and no materials which have been accepted for the award of any other degree or diploma at Torrens University Australia or any other institution, except where due acknowledgement is made in the thesis. I acknowledge that copyright of published work contained within this critique resides with the copyright holder(s) of those works. Any contribution made to the research by others is explicitly acknowledged in the thesis.

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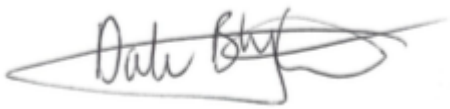
Signed: 

Student number: 00155840T

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This work would not have been possible without the understanding and patience of my family. Nobody has been more important to me through this journey than my family; I wish to thank my loving and supportive wife, Kim, and our sons, Madsen and Damon, who provided unending motivation (literarily).

I would also like to thank the coffee; lots and lots of coffee!

Ethics Statement and Contributor Approvals

The research associated with this critique was conducted in accordance with the National Statement on Ethical Conduct in Human Research (2007).

Each individual respondent completed the Research Respondent Consent Form to participate in this research and can be supplied upon request. The majority of respondents consented to providing information for the research with the caveat that no personal identifying information is published. This confidential information will only be supplied to the appointed examiners upon request from the database which aligns to the consent provided.

The following Ethics Statement reflects that each survey respondent was:

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Referencing Style

American Psychological Association (APA) 6th edition referencing has been used in this Critique and supporting portfolio for alignment to business practice within Caterpillar Inc.

Glossary of Related Terms

Adaptive Leadership- The practice of mobilising people to tackle tough or adaptive challenges and thrive while doing so (Heifetz, Grashow, & Linsky, The Practice of Adaptive Leadership, 2009, p. 14).

Autonomous Machinery- Large mobile mining machinery that has traditionally been operated by personnel onboard the machine.

Autonomous Haulage System- A fleet of six to 100 Autonomous Machines operating in one eco-system to haul material on a mine site.

Dealerships- The Caterpillar Inc. business model: to sell all products, parts and services through independently-owned, geographically-separated dealerships acting as licensed distributors around the world.

Desired Outcome- The contractually committed or strategic imperative that is sought from a course of actions and planned for.

Leadership- The activity of an individual using their skills to engage others towards achieving a common purpose (O'Malley & Cebula, 2015, p. 6). Leadership is not a position.

Management- A complementary system of action to Leadership (Kotter, What Leaders Really Do, 2001, p. 85), that entails the administration of processes and controls to support personnel within a business.

Mining Technology- Technology being applied in the mining environment on mobile machinery, fixed infrastructure and across a mine site to create data.

Personal Contingent Leadership Paradigm (PCLP)- Is a justified set of theoretical propositions and personal values that logically underpin a set of practice guidelines to guide how a leader perceives and responds to leadership challenges (Australian Graduate School of Leadership, 2016, p. 39).

Abstract

The adoption of technology over the last decade in the mining sector has reached a point of critical mass that has been propagated by the implementation of autonomous mining machinery. This change has conflicted traditional norms, accepted processes, social elements and behaviours as the application of autonomy, as a control system, reduces variability and process deviation within the mine. This change has created ongoing adaptive challenges that have seen technical resolutions applied to resolve the challenges and have been largely unsuccessful. The traditional top down management approach within mining has struggled in cases to deliver the desired outcomes of the technology introduction.

This situation has developed a need to understand the requirements of leadership with disruptive technologies in the mining sector and the impacts of autonomous machinery in a highly variable environment. This Critique investigated this disruption through longitudinal case research over four sequential case studies involving the adoption of technologies in the mining sector and a subsequent survey of present practitioners in the field. It was established that the implementation of autonomous machinery on a mine site creates an overarching complex adaptive system that is continually evolving in a manner that is not entirely predictable, thus does not necessarily yield the desired outcomes. There is a correlation within this system to adaptive challenges frequently arising, that create disequilibrium and induce complexity on those faced with the challenges that are not technically-based.

Adaptive leadership within this system becomes a necessity to work through multi-dimensional issues across multiple parties involved, creating a climate where experimenting and failure is acceptable. The adaptability of organisations and people are put to the test as there are no ‘quick fixes’ and exigent behaviours are required from leaders to moderate the disequilibrium within a limit of tolerance. To accommodate these leadership demands, a Personal Contingent Leadership Paradigm has been created with a holistic view of leadership requirements in this climate and into the future. These are supported by a set of self-adapting leadership practice guidelines that allow my leadership capabilities to continually grow and evolve.

Chapter 1: Overview of the Research Context

This chapter provides an overview and context of the Researcher's (hence forward referred to in the first person) experience in roles of authority that has evolved from being a practitioner in the field and forms the basis for this Critique, as outlined in the following summary.

My career to date is based in the mining industry starting as an individual contributor within working teams. Twelve years ago, I commenced my first role of with accountabilities and scope of authority, typically referred to as 'leadership roles'. My roles have grown in responsibility and accountability as I moved between different positions and continents. The timing of these moves, employer and team size have been summarised in Appendix A Leadership History as tangible measure of the changes over time.

An overview of my experience in these roles is abridged in chronological order, as follows:

- **Frontline Supervisor**, 2006 – 2010: Supervised hourly wages workforce in the tactical achievement of tasks ranging from daily to three-month horizon with a high degree of technical competence. This was truly leading by example on a technical level as I utilised my mechanical and hydraulic systems expertise to engage the workforce and actively solve problems encountered.
- **Leader of Frontline Supervisors**, 2011 – 2013: This grouping of roles had three to seven direct reports that in turn supervised the frontline workforce, which allowed me to become less tactical and focus on more strategic work to support and establish the business requirements to be successful. This work had a three-month to one-year horizon for planning and delivery of desired results to the business.
- **Senior Leader**, 2014 – Present: This grouping of roles has transitioned me to be a leader of leaders with Profit & Loss (P&L) responsibility for the business unit, and direct accountability for achieving our one to five-year business plans. I have transitioned away from requiring a high degree of technical

understanding and capability to leadership roles, and less of an administrator of processes, as outlined in the prior two groupings.

Commencing my career in a 'hands on' role also started the development of my technical competence where, over the first four years, I established my technical troubleshooting capability with machinery on which I was working. This was a very reactive environment as I worked to resolve unexpected issues that arose with over 40% of the work conducted being unplanned and classified as breakdown maintenance. As I transitioned into roles that provided me with Frontline Supervisory experience, these unexpected issues increased and the resolution of them in the shortest possible time was viewed as the vital key performance indicator. Reflecting on this experience now with my understanding of leadership, has shown it provided me with unique skills and the ability to adapt quickly to evolving situations; although not all of these skills are positive due to their reactive nature.

Over the last five years I have had a Senior Leader role introducing new technologies and services into the mining industry working for Caterpillar Inc. as the developer of these products. While in this role, I have started to deploy autonomous machinery at our customers' sites, developing supporting services and have been on the 'bleeding edge' of this disruption in the mining industry. In many cases, I was working through challenges with my team that the industry had never previously encountered. As I have continued to research leadership material, it has become apparent to me that over the last two years while undertaking the first four modules of the DBL, the majority of organisational issues I have faced as a leader were multi-dimensional. However, applying technical resolutions delivered inconsistent results (of which I have multiple examples). These situations have necessitated the reduction in tactical approaches for introducing technology to this industry and requires the critical analysis of the factors that are creating this environment and its resulting dynamics.

I had a desire to employ leadership well before I was given roles of authority in my working career that were exhibited in my actions and behaviours dating back to when I was in high school, taking on challenging issues with little or no authority. This initial

yearning was nurtured through playing team sports where we were regularly faced with common issues that we had to work through to win the game. Thinking through the next series of actions, communicating ideas and inspiring others on the team to act spurred a deep-seated craving to continue on my leadership journey. Although I sought roles of authority such as the School Treasurer and Swimming Club Captain to fulfil this need, I came to realise these delivered hierarchy and did not foster my actual desire to be a leader by inspiring others to act on challenges with which we were faced. I will further expand on the definitions and relationship of leadership and authority in Chapter 2 (Leadership Theory Review).

Throughout my career, I have filled this need by changing roles regularly to take on more progressive and challenging situations in my career and personal life that have allowed my capabilities to grow through practical experience. The thirst to do what others cannot do (or that is too hard, or will take too long, as examples), has resulted in a duty to help others succeed personally, while gaining my personal fulfilment from seeing others grow through these experiences, and positively contributing to the community. Establishing a family has also challenged my capabilities; I regularly contemplate the legacy that I leave as a result of my actions and behaviours and is subsequently embedded in this body of work.

Fulfilment from the work I undertake does not only come from the content or achievement of milestones, it also comes from the opportunity these tasks provide to develop and aid others in growing as part of their journey in life. A conclusion that Clayton Christensen (2010) drew from his work embodies my values and has stuck with me over the last few years. In his concise summary, he states,

> "*Management is the most noble of professions if it's practised well. No other occupation offers as many ways to help others learn and grow, take responsibility and be recognized for achievement, and contribute to the success of a team*".

The term 'management' is aligned to the roles represented in the workplace, although I see this as where leadership comes into 'practising well in the profession' and the foundation to leaving a positive legacy through experiential learning with others.

Chapter 2: Leadership Theory Review

This chapter provides an historical overview of leadership theory derived from literature, which is then distilled into the justification for the proposed adaptive leadership theory that underpins the Personal Contingent Leadership Paradigm in the next chapter. The relevance of adaptive leadership is tested within the researcher's environment with the adoption of automation technologies within the mining industry.

Historical Overview of Leadership Theory

Before moving into specific research on today's, or future challenges within the context of leadership, it is necessary to establish an understanding and appreciation for the evolution of theory over time, as no one theory in isolation provides an adequate perspective of leadership. Leadership is one of the most complex and multifaceted phenomena to which organisational and psychological research has been applied to better understand and define (Van Seters & Field, 1990, p. 29). Due to this complexity there is an aura around the leaders themselves which is best summarised by Gronn (2002, p. 423-424), "leadership study, indeed society in general is infatuated with leaders – people who occupy some superior status or position and to whom we often ascribe some form of greatness". What further compounds these theories are the various 'autobiographies' by those who have attained greatness in the field, sharing their view of their experiences as descriptive or normative commentary, rather than fact supported by theory.

Reducing this to what is known, the work of Bolden, Gosling, Marturano, and Dennison (2003) viewed the evolution of leadership theory over a seventy-year period which has been adapted into Table 1: Evolution of Leadership, showing the common theory name and a brief description. To aid with the transition between the theories, a column was added to Table 1 for grouping which brings to light the similarities in theories and also shows the progression through the descriptions. For this overview, the expansion on the groupings is a practical method to portray the basic history that follows:

Trait-Based Theories: Focused on dissecting the 'great man' as a visible leader who had natural capabilities and was born to lead; as such their individual traits were sought as the reasoning for their capabilities. It was (and remains) a challenge to make trait-based theories tangible, as there was a large breadth of terms associated with the positive and deltas of the traits a leader exhibited.

*Behaviour-Based Theorie*s: Progressed from focusing on the traits a leader possesses to their behaviours that were demonstrated to understand how they interacted with their subordinates or followers. These behaviours were then categorised further into styles of leadership, so leaders could be grouped to understand their strengths and weaknesses.

Situational-Based Theories: This evolution of theories transitioned away from being myopically-focused on the leader, pursuing an understanding of the variables at play and that a leader may use different styles of leadership to suit the situation or their level within an organisation; finally reaching a point where the situation at hand was understood and contingency measures were applied to approach situations with the optimal leadership style.

Relational-Based Theories: Delved further into the variables 'at play' within a leader's environment seeking to understand the relationship between the leaders and subordinates or followers with the leverage a leader had (e.g. remuneration); eventually maturing to the leader portraying a vision that was sought and transforming the organisation to achieve the vision.

System-Based Theories: Were encompassed in the coexistence of sciences and the application of systems theory to leadership to provide a consistent methodology across the sciences that enabled the multiple sciences to be comprehended in one situation. This also saw complexity theory applied to leadership to fathom the variables that a leader can be faced within a situation.

Table 1: Evolution of Leadership

Grouping	Theory	Description
Trait-based theories	Great Man	Based on the belief that leaders are exceptional people, born with innate qualities, destined to lead. The use of the term 'man' was intentional since until the latter part of the 20th century leadership was thought of as a concept which is primarily male, militarian and of Western origin. This led to the next school of Trait Theories.
	Trait	The lists of traits or qualities associated with leadership exist in abundance and continue to be produced. They draw on virtually all the adjectives in the dictionary which describe some positive or virtuous human attribute, from ambition to zest for life.
Behaviour-based theory	Behaviourist	These concentrate on what leaders actually do, rather than on their qualities. Different patterns of behaviour are observed and categorised as 'styles of leadership'. This area has probably attracted most attention from practising managers.
Situational-based theories	Situational Leadership	This approach sees leadership as specific to the situation in which it is being exercised. For example, whilst some situations may require an autocratic style, others may need a more participative approach. It also proposes that there may be differences in required leadership styles at different levels in the same organisation.
	Contingency	This is a refinement of the situational viewpoint and focuses on identifying the situational variables which best predict the most appropriate or effective leadership style to fit the particular circumstances.
Relational-based theories	Transactional	This approach emphasises the importance of the relationship between leader and followers, focusing on the mutual benefits derived from a form of 'contract' through which the leader delivers such things as rewards or recognition in return for the commitment or loyalty of the followers.
	Servant	Centres on the leader taking an approach of ‘leading from behind’ putting the followers first and supporting or enabling them as their highest priority.

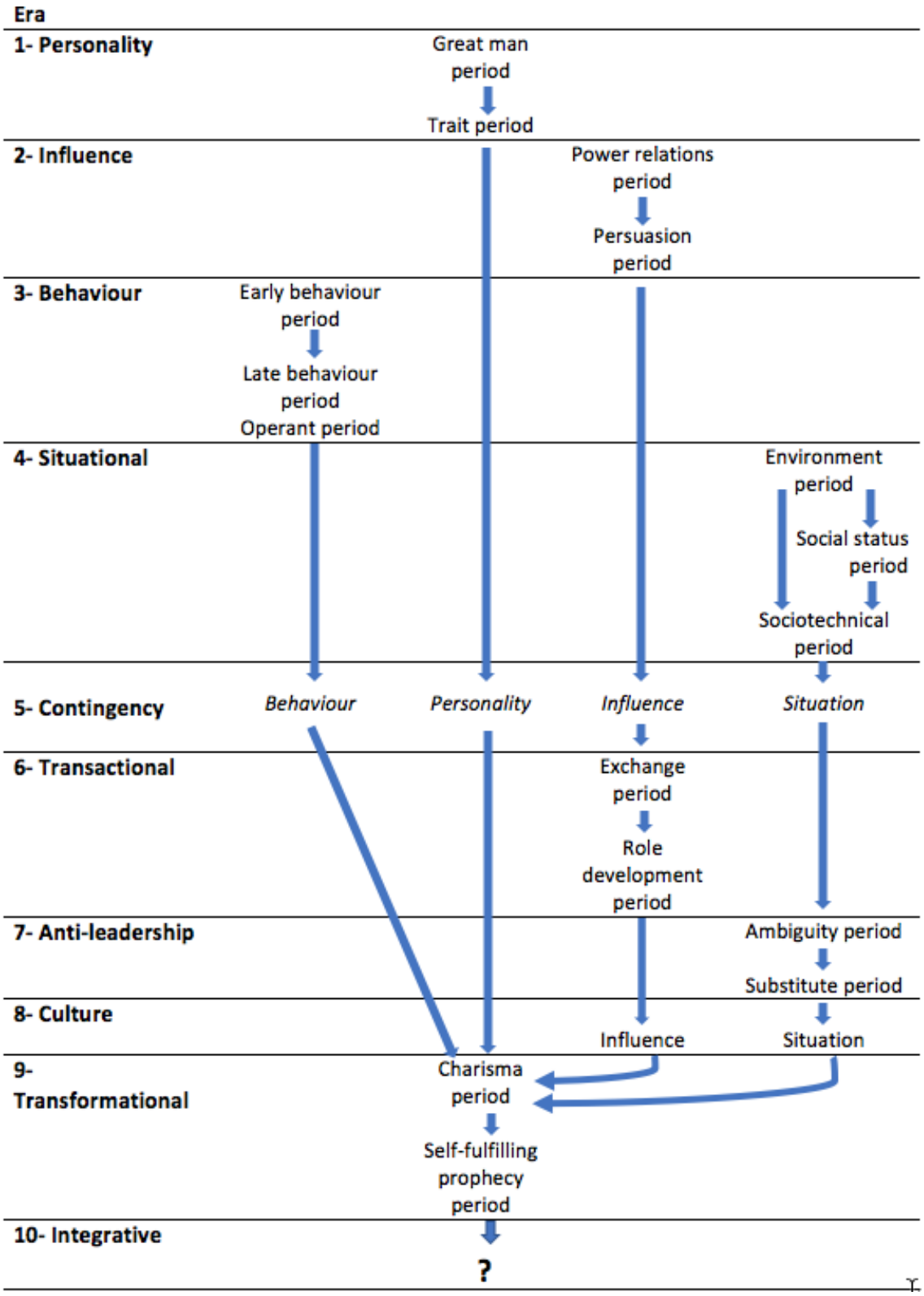
Relational-based theories; *Continued*	Transformational	The central concept here is change and the role of leadership in envisioning and implementing the transformation of personnel and organisational performance.
Systems-based theories	Systems	This approach saw the application of systems thinking and system theory to leadership, to provide a consistent approach to the study of nature, society and science.
	Complexity	The adaption of complexity theory to leadership created a means to view the modern organisation and variables at play through a Complex Adaptive Systems framework.

Adapted from (Bolden, Gosling, Marturano, & Dennison, 2003, p. 6)

The progression of the leadership theories, over time, is not a sequential process that has clear timelines, nor is it simply the improvement of the previous theory solely which portrays the variables at play in understanding the evolution of leadership theory. During these stages, it is also evident that there was a strong correlation from the trait theories with leadership and authority which is evident thereafter in each grouping.

Van Seters & Field (1990) aggregated the leadership theories to a detailed level asserting that there were ten eras over time in which periods existed where several theories were at play, and as the understanding for the existing era became inadequate it transitioned to the next. This work is represented in Table 2: Evolutionary Tree of Leadership Theory where the progression through the eras become apparent when applied to the framework of Behaviour, Personality, Influence and Situation with the evolutionary development approach.

Table 2: Evolutionary Tree of Leadership Theory



Adapted from (Van Seters & Field, 1990, p. 33)

Van Seters & Field (1990) hypothesised at the time that the tenth era would be Integrative; with the addition of the further variables of complex technologies, fast-paced change, multiple decision arenas, widely-dispersed players, multicultural context and extensive political activities. There are several differing views on the leadership theory at play currently and whether these are truly a theory or taxonomy of a trend that has emerged. What seems to be the common thread though is that; traditional, hierarchical views of leadership are less and less useful, given the complexities of the modern technology enabled world (Lichtenstien, et al., 2006, p. 2).

The synopsis of Van Seters & Field work was that for leadership theory to continue to evolve and provide practical applications for managers, researchers must recognise that leadership:

1. Is a complex, interactive process with behavioural, relational, and situation elements.
2. Is found not solely in the leaders but occurs at the individual level, dyadic, group and organisational levels.
3. Is promoted upwards from the lower organisation levels as much as it is promoted downwards from the higher levels.
4. Occurs internally, within the leader-subordinate interactions, as well as externally, in the situational environment.
5. Motivates people intrinsically by improving expectations, not just extrinsically by improving rewards systems.

Complexity leadership theory follows these five points and saw the coupling of complexity theory and leadership theory as researchers sought to understand how leadership was being impacted by technology. Succinctly stated, this was a shift where organisations transitioned from optimising human capital of individuals, to understanding and strategically planning the social capital through the connectivity of individuals and ideas (Arena & Uhl-Bien, 2016, pp. 22-23). With the addition of a complex adaptive systems perspective, a new logic to leadership theory and research by understanding leadership in terms of an emergent event rather than a person, was established (Lichtenstien, et al., 2006, pp. 3-4).

With the uptake of connected technologies and continued consolidation in the business sector since the turn of the century, resulting in the emergence of Distributed Leadership theory. This transition in a large, wide-spread organisation with the need for de-centralisation of decision-making, psychical locations and the growing size of organisations, necessitated a need to reduce hierarchical layers. The contribution from distributed leadership is not in offering a replacement for other theories, but in enabling the recognition of a variety of forms of leadership in a more integrated and systemic manner across an organisation (Bolden R. , 2011, p. 253). Leadership is exhibited across the organisation, but not solely by those in management or senior roles top down and is displayed at all levels through leadership practice, depending on the organisation's maturity.

Since the turn of the century, leadership has reached an inflection point becoming focused on aligning efforts rather than managing personnel. The growing interdependence of organisations has removed the autonomy of individuals, wherein a matrix organisation of their work, interaction and deliverables are tied to many others within the organisation via technology (Kotter J. P., What Leaders Really Do, 1990, p. 105). In these times of rapid change and environmental complexity that has been created, leadership has taken on a greater importance than ever before (Van Seters & Field, 1990, p. 29).

Leadership and Authority

With this understanding of leadership theory, it is constructive to expand on the relationship between leadership and authority as they are commonly misrepresented or confused with each other. The definition of the two terms (Macquarie University, 2001, pp. 65, 643) will form the initiation of this expansion:

Authority: The right to determine, adjudicate or otherwise settle issues or disputes; the right to control, command or determine.

Leadership: The action of guiding or directing a group, as of any army, movement, etc.

The basis for society to operate is authority forming the framework that supports our behaviours and interactions as people. Authority formed with the evolution of mankind has been viewed as possibly originating as dominance in primate society, in small groups, using their psychical attributes and within mental capabilities (Heifetz R. A., 1994, pp. 50-54). The explanation above illustrates that authority is a right to control, command or determine that can be given or taken away. Organisations and society create structured layers of authority to forming a hierarchy that has growing responsibility and accountability as it progresses towards the pinnacle of a single individual or small group that is central to the organisation.

The departure emerges with the definition of leadership being an action of guiding and directing; whereas authority is a set of accountabilities and responsibilities that can be given or taken away. The ability to be a leader cannot be granted in such a manner as authority and must be developed over time organically or through education with the individual required to have a desire to exert leadership. In this view, leadership is then the activity of an individual using their skills to engage others towards achieving a common purpose (O'Malley & Cebula, 2015, p. 6).

It is possible for an individual to have a position of authority and not exert leadership in this position, and purely administer the responsibilities and accountabilities of the role not engaging their subordinates. Conversely, it is also possible for an individual to have no authority yet apply leadership in a situation through their behaviours to motivate others to help or assist towards a set of actions. Taking this notion, a step further, Heifetz (Debate: Leadership and Authority, 2011) stated very succinctly: “Leadership requires a capacity to honour history but also to challenge the current way of doing this, and to generate a culture of experimentation where conflict is seen as an engine to creativity – where people operate at the frontier of their current competence and are not ashamed to admit they have failed again”.

Expanding on my personal aspirations of leadership and inspiring others to act in my application of Heifetz’s vision, it is a prerequisite to investigate adaptive leadership

theory that will form the foundation on this research and Personal Contingent Leadership Paradigm.

Adaptive Leadership

Developing from system-based theories is adaptive leadership, “the practice of mobilizing people to tackle tough challenges and thrive” (Heifetz, Grashow, & Linsky, The Practice of Adaptive Leadership, 2009, p. 14). Although adaptive leadership emerged from more than one theory, it has been identified that situational and transformational leadership theories with complexity theory have also contributed directly to evolving this theory (Nastanski, 2002, pp. 55-57). Adaptive leadership is based on defining the situation at hand, whether it is technical with a known solution or adaptive with an unknown solution that requires experimentation to resolve. The adaptive context consists of a gap between aspirations and operational capacity that cannot be closed by the expertise, along with procedures currently in place (Heifetz R. A., Creelman Research. Ron Heifetz: Adaptive Leadership. 2.5, 2009, p. 1). This results in challenges that are multidimensional with a need for adaptive change that is confronting, and causes disequilibrium as values, beliefs and knowledge are contested in the pursuit of a desired outcome with no fixed instructions to achieve it.

Leadership becomes particularly relevant when we go beyond predominantly technical problems that can be managed, to adaptive challenges where the courage to lead is required (Heifetz R. A., Debate: Leadership and Authority, 2011, p. 307). The differentiation between technical problems and adaptive challenges is transparent with a more comprehensive description to consider these two elements. O’Malley and Cebula (2015, p.18) gave the following thoughts on the differentiation:

- *Technical Problems- Can be solved by experts or authorities. Few people may be required. Someone, somewhere has solved the problem before and a roadmap for the next steps exists. Best of all, many technical problems are quickly and easily solved.*
- *Adaptive Challenges- Have a totally different feel. The conversation is circular. Movement on an issue is difficult to track. We need to learn exactly what the problem is and then how best to proceed. Stakeholders, not just authority figures, must work on adaptive challenges. With no clear roadmap, one must experiment to test possible ways of moving forward. Even the time table is elusive.*

Expanding on these descriptions, Figure 1 provides an outline of the basic characteristic differences that exist in both cases, the behaviours exhibited by the leader, team and finally the change impacts – exposing the origin of the complexity between the two. The fundamental difference rests in the change that is being taken on with an unknown problem statement and solution, although it affects elements that are held closely and are personal in nature. This can be a confronting process and in Figure 1 it qualifies this by showing that the problem (and the solution) may well be avoided by those who know the impacts they will face when they act to overcome the adaptive challenge. What further complicates the diagnosis is that there are cases where an 'issue' will have both technical problems and adaptive challenges needing to be identified and dealt with differently.

Figure 1: Characteristics of Technical Problems and Adaptive Challenges

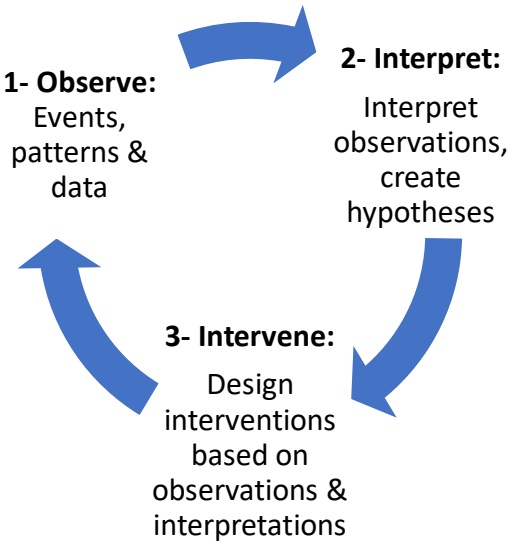
Technical	**Adaptive**
Known Problem	Unknown or Avoided
Known Solution	Unknown or Avoided
Leader exercises authority to attain a define goal.	Leader mobilises people to address the real problems.
Team focus on following, complying and implementing.	Team focuses on organisational learning and systemic change.
Change is not personal, besides expected reward or punishment.	Change involves personal loss such as values, identity and habits.

Adapted from (Haeusler, 2010, p. 14)

The ambiguity created when faced with adaptive challenges, with no known solutions and involving personal loss, requires a type of leadership that differs from managing technical problems. Heifetz, Grashow & Linsky (2009, p. 32) proposed an iterative, adaptive leadership process of observing, interpreting and intervening as displayed in Figure 2 recognising the complexities involved as a diagnosis tool. In comparison, for a technical problem where the *Plan, Do, Check, Act* (PDCA) process would be utilised (for

example, the differentiation is in the first two elements). *Plan* what you want to accomplish, define how, and do not proceed without a plan; and *Do* execute the plan (Pietrzak & Paliszkiewicz, 2015, p. 153). *Plan* and *Do* methodically approach the issue at hand with the methodology that there are many 'knowns' and for the elements where there is not, they will be accommodated in the *Check* stage. The Adaptive Leadership Process first begins with observation without bias, then progresses to interpretation of the facts at hand before taking any action with intervention. While both are virtuous processes, the difference is in seeking to understand the adaptive challenge versus dealing with a technical issue that has a defined problem statement.

Figure 2: The Adaptive Leadership Process



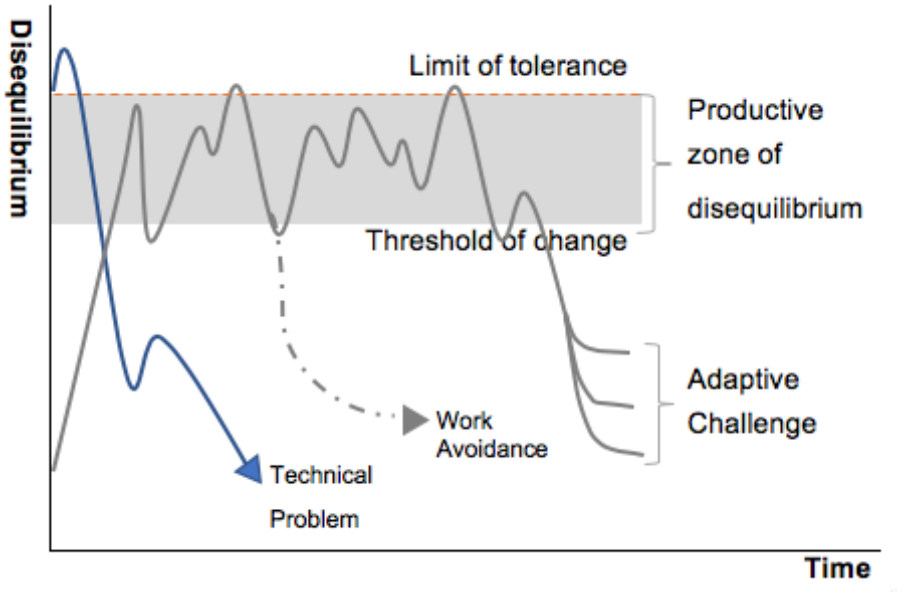
Adapted from (Heifetz, Grashow, & Linsky, 2009, p. 32)

Organisations have become accustomed to dealing with technical issues over time, as they are tangible, can be planned for and the expertise to overcome the issue is available internally or externally. Thus, people feel pressure to solve problems quickly, move to action, deliver progress and as a result minimise time in the Observe and Interpret stages of the process diagnosing the issue (Heifetz, Grashow, & Linsky, The Practice of Adaptive Leadership, 2009, p. 7). Given the 'unknowns' and variables at play with adaptive challenges, this seems counter intuitive, although the organisational culture supports this approach. The delta of this behaviour is when the institutional

equilibrium is disturbed, people push back; and people resist this type of change in all kinds of creative ways (Heifetz & Linsky, 2017, p. 2).

Expanding on the notion of equilibrium, we must review the environment that disequilibrium creates within an organisation as an adaptive challenge is being experienced. To visualise this effect, Figure 3 represents a comparison of a technical problem and adaptive challenge as they take hold, recognising that initially the disruption of a technical issue exceeds the limit of tolerance causing action; although, it is not sustained, as known solutions and expertise are applied. However, in the case of the adaptive challenge, it is slower to take hold and remains at a high level of disequilibrium for a sustained period as the unknowns are dealt with (or not). At this stage there is a point where a leader can regulate the challenge to a productive zone of disequilibrium (Heifetz, Grashow, & Linsky, 2009, p. 30). A side effect of this approach is that those who cannot sustain the pressure this change creates may move personnel towards work avoidance, or they move into other parts of the organisation or depart completely. The challenge does not self-regulate with leadership intervention.

Figure 3: The Productive Zone of Disequilibrium



Adapted from Heifetz, R. and Laurie, D. "Mobilizing Adaptive Work: Beyond Visionary leadership", in *The Leader's Change Handbook*, eds. Conger, J., Spreitzer, M. and Lawler III, E. (San Francisco, Jossey-Bass, 1989). Cited in (Heifetz, Grashow, & Linsky, The Practice of Adaptive Leadership, 2009, p. 30)

Being unaware of the level of disequilibrium that an adaptive challenge creates, it is necessary to focus on the mechanisms to deal with these challenges and regulate the disequilibrium to provide a tolerable level to those trying to evaluate and intervene with the challenge, from bottom up in the organisational structure. Heifetz and Linsky (2017) have evolved their process over decades and utilise a ballroom dancing analogy to give context to their work. From this, O'Malley and Cebula (2015) have distilled their own simplified version of the process. To provide an overview of these processes without immense detail, Figure 4 was created as a representation of the key steps in a comparison understanding of the process through the aforementioned Observe, Interpret and Intervene framework.

Figure 4: Process of Working with Adaptive Challenges

	Heifetz & Linsky	**O'Malley & Cebula**
Observe	Understand the Danger	Leadership Principles Diagnose Situation
Interpret	Get on the Balcony Think Politically	Diagnose Situation (cont.) Manage Self
Intervene	Orchestrate the Conflict Give the Work Back Hold Steady Manage Yourself	Energise Others Intervene Skilfully

The process of Heifetz & Linsky in Figure 4 in the first two stages of Observe and Interpret are diagnostic with the Intervene stage getting to the core of orchestrating the disequilibrium as the adaptive challenge evolves. To sustain the effort over time, it is crucial to confront the challenges at hand by orchestrating a conflict, then assigning the work back to the team involved, weather the storm by holding steady and manage your own emotions and behaviours. In essence this approach is seeking the application of Emotional Intelligence, which Oxford University Press (2018) define as "the capacity to be aware of, control, and express one's emotions, and to handle interpersonal relationships judiciously and empathetically". To deliver the changes required by dealing with an adaptive challenge, it is crucial not to let the disequilibrium exceed the limit of tolerance for a sustained period, as this will have adverse effects on the

personnel faced with the challenge. This is why the Observe, Interpret and Intervene steps are a virtuous loop, as formal and informal feedback loops guide the process and allow for adjustment for variables that emerge over time.

Limitations of Adaptive Leadership

There are limitations to Adaptive Leadership as with all leadership theories, and prior to progressing this Critique, there is a need to surface these and understand the boundaries they present to this body of work.

Tradition:

Adaptive leadership departs from traditional leadership theory in that it is not applicable in all situations being ideally suited to adaptive challenges; a leader may not be faced with these consistently at all times. While a leader may not be faced with adaptive challenges at all times, it is notable that leadership is still required in those cases. Expanding on this, Cojocar's (2008, p. 122) work sought to establish whether adaptive leadership was a theory of its own or theoretical derivative based on its emergence, finding that it is in use in the field as an acceptable approach, and considered by some as a developing theory. The counter argument to adaptive leadership being accepted as a leadership theory, is that it is a suite of tools and processes to be used as required to underpin another leadership theory which views the possibility that adaptive leadership is used in the minority of cases (McCrimmon, 2018). However, I would counter that all leadership theories are just that – tools, processes and frameworks that must be applied in practice with the ability of the individual to fashion them to their circumstances being the defining difference. These tools and processes also encompass the evolution of software packages that are becoming more prevalent in supporting leadership to make informed decisions.

The departure from traditional leadership theory comes with the evolution of what leadership is in the modern environment and the subsequent complexity that is created. This is highlighted by the variability of comparing leaders in the same position; as individuals, their positions, transitioning roles and as significant changes occur (Yukl, 2008). Making an adaptive challenge tangible from the onset is an arduous task in

itself; then endeavouring to establish the leadership theory that was applied to overcome the challenge can only be carried out in a retrospective manner after there are established case studies and practices to conclusively justify a theory.

Adaptive challenges are not amenable to top down solutions pushed through a hierarchy of an organisation to deliver an outcome. McCrimmon (2018) contests Heifetz's construct of adaptive leadership as being focused on one person in charge, limiting the ability of influence to be utilised given the complexity of adaptive challenges and that leadership can occur without a 'figure head' as teams work through the adaptive challenge. In this view, the leaders facilitate creative thinking and act as catalysts to work through challenges with teams. The construct of this contest by McCrimmon can be viewed as criticism for applying the processes of adaptive leadership theory in a hierarchical manner, when at a stage someone must identify they are faced with an adaptive issue. "The adaptive demands of our time require leaders who can take responsibility without waiting for revelation or request. One can lead with no more than a question in hand" (Heifetz & Laurie, The Work of Leadership, 2011, p. 78).

Technology:

It can be argued that there is a possibility to solve adaptive challenges with technology changes that reflect critical and adaptive thinking (Craig & Clark, 2010). However, what publicly exists today with technology is a technical based suite of systems and products that follow design protocols and hierarchy. The precursor with this statement is that artificial intelligence has been excluded as it is not available to, or in use for, the public. It may be possible to make technology changes to resolve an adaptive challenge, although there would still be an element of adaptive leadership to observe, interpret and intervene while embedding the changes required for the technology to be successful.

In understanding Craig and Clark's (2010) position, the counter argument is that the adaptive problem being faced could be misidentified; being both technical and adaptive could result in a challenge being faced with a much larger technical portion

than the adaptive. In this case, it may be possible for the challenge to be resolved with critical and adaptive thinking being implemented through the technology, although a risk would still remain that the adaptive portion is not dealt with adequately. If the situation was in reverse, and the elements were switched to the majority of the challenge being adaptive (instead of technical), the probability of overcoming the challenge would be greatly diminished without adaptive leadership being applied to the change.

Risk:

Across the adaptive leadership material reviewed, there is a convergence of thought from O'Malley and Cebulla (2015) and Heifetz and Linsky (2017) that in working on an adaptive challenge, the resulting change is risky to the individual. The common theme is that to apply this type of leadership that inherently has periods of sustained disequilibrium, limited tangible diagnostics for the problem and no prescriptive resolution at the onset, places immense pressure on those dealing with the challenge at hand. What further complicates this is that these challenges involve the beliefs, values and deeply held understanding of an organisation and individuals which results in dissent towards those seeking to overcome the challenge. Without support and understanding from others in the organisation, the good work on the adaptive challenge can be a threat to others, making an unsupported leader in this situation vulnerable to criticism and negative behaviours (Heifetz, Grashow & Linsky, 2009).

If the risk is high it enviably begs the question: *Why take this on?* To make progress and remain relevant in the emerging world there is a need to overcome adaptive challenges, whether it be in business or the not-for-profit sector. The willingness to take on the challenge can be varied from being a personal objective through to being one of those faced with the challenge and necessitating the need to overcome it. There is risk associated with doing so; even if successful with the adaptive challenge, there may be long-reaching effects to career and perception within the organisation (many of which are not initially understood at the onset of the task). This makes the communication to peers and superiors crucial while establishing an understanding of who the sponsors and advocates for the cause are to prevent being in a position of

'going it alone', which significantly increases the risk profile. The reasoning to take on the role of leadership is best stated by Heifetz and Linsky (2017, p. 3) that it is worth the risk, as the goals extend beyond material gain or personal development, by improving the lives of those around you by creating purpose.

Hero-worship:

To apply adaptive leadership in practice with the ballroom analogy that Heifetz and Linsky (2017) use in their examples, it can also be interpreted on the extremity that there is a need for the leader to be in two places at once – on the dance floor and the balcony overlooking the dance floor. While not psychically possible, the reference to being on the balcony is a psychological state of the practitioner as they are faced with an adaptive challenge and understanding the situation at hand on both levels. There is criticism that a leader in this position may use this to build a 'unique' capability or appearance of one, throwing back to the earlier stages of leadership in Trait Theories to evoke hero-worship as a result. Today's technologies could enable or prevent this from occurring, depending on the manner in which they are being used and how the timeliness of information is being used by individuals. I foresee this would create an ethical dilemma with the morals of individuals and values of an organisation being put in conflict, which would draw attention within an organisation. While the risk of this occurring cannot be discounted, I believe it would require the perverse behaviour of an individual to evoke these behaviours.

Relevance of Adaptive Leadership

With the growing momentum new technologies cause from their emergence and resulting disruption, the need to apply adaptive leadership is fundamental to overcoming the adaptive challenges that occur. As a new technology materialises, there are intended and unintended outcomes that result from its use and application, which lead the personnel faced with these challenges to overcome them, bottom up. While the vision of what Caterpillar is aspiring to achieve is top down within the business, the real adaptive change required to make the technology successful is bottom up, requiring new processes, business models, techniques, and approaches with people. The circumstances vary in each case, and as such the majority of

challenges have a mix of technical issues and adaptive challenges that must be diagnosed and understood before they can be handled.

Observing the rate of change technology has provided by reviewing Moore's (n.d., cited in Cusumano & Yoffie, 2016, p. 33) law from 1965, "predicted the number of transistors on an integrated circuit would double every eighteen to twenty-four months" as the groundwork to the velocity this change has introduced. While Moore's law is specific to hardware, it can be extrapolated to other technology elements, such as software, as the hardware is no longer the constraining factor within a system as it was in 1965. To apply Moore's law founded on a technical engineering understanding of hardware (Cusumano & Yoffie, 2016, p. 34) to software, we can accept from our personal experiences with mobile devices that the extension of Moore's law to software is applicable as a tangible guide for velocity. In today's world this velocity of change creates many of the adaptive challenges faced in business and also inhibits a 'business as usual' methodology.

In the mining technology business unit within Caterpillar, our challenge has been the junction of mining technology products moving from being operator assist functions (like cruise control in a personal vehicle) to control systems operating the personal vehicle. This has created many adaptive challenges in the field that arise from implementing a system for the first time in a live mining environment. The involvedness this change introduced (moving from an 'assist' to 'control' functionality) is exposed in Appendix B around the Desired Outcome with Autonomous Machinery Complexity Mapping showing the first order of variables. There are copious cross functional interdependencies that come from this mapping thereafter that are dependent on the variables at play in an unsystematic manner that produce the adaptive challenges, which can rarely be forecasted until encountered.

Coupling this with Moore's Law and multiple software releases per year, the constant change has created the need for adaptive leadership in the field. This has been a large departure for Caterpillar, a machinery manufacturer with 93 years of research, development, engineering and manufacturing legacy that has created a culture that

thrives on dealing with technical issues. The distribution of the machinery throughout the world is handled by 170 independently-owned dealerships which are geographically bound to specific territories. This provides an environment where Caterpillar can focus on the core business of designing, manufacturing and supporting its products with the local dealerships providing regional expertise, facilities, personnel and capability to support customers in the field. The dealerships provide spare parts and services (such as trade labour) to work on and maintain the machinery for customers, which has been the business model for the entire 93 years, enabling the company to expand rapidly outside of the United States where it was founded.

The introduction of autonomous mining machinery, such as large off-highway trucks, bulldozers and drills operating in a systems mindset, has started to strain the business model due to the multifaceted differences being introduced. The dealerships have traditionally viewed the machinery as individual units that are subservient to a loading tool which dictates productivity. As well as automation, there is now a systems view required, as technology combines and operates multiple individual units without having operators present onboard the machines. This has also centralised the potential failure points from multiple personnel dispersed across a mine site to several in a centralised control room which may be on the mine site or up to 1,600 kilometres away. The dealerships have limited ability to affect change in the software, and given the risk of shutting down the entire mine with a software issue, the customers are seeking direct support from the software creator, Caterpillar.

The change for all parties involved to implement and operate autonomous machinery on a mine site is significant and to establish the variables at play the Caterpillar mining technology team had created a framework to categorise the issues being face into People, Process and Technology over the last ten years with the ‘assist’ capabilities. This framework has supported the resolution of numerous issues over the last decade by clearly articulating where the issue is, and then ownership assigned appropriately to resolve the issue in a truly technical approach. In reviewing the top three challenges I have encountered in the last five years, I realise that these were adaptive challenges and persevering with these at the time by applying technical fixes unsuccessfully to try

to resolve the issue. It has also led me to evaluate the framework of People, Process and Technology, as this is a long-standing model within our business that is applicable when coupled with technologies that are operator assist capabilities. This is due to the assist capability enabling operations or optimising what a person is doing while using the technology, although their task is not dependent on this technology working, as with the cruise control example a car can be operated without the cruise control, although it can be argued there are more variables at play without the technology.

Having already established the supporting theory of exercising adaptive leadership for adaptive challenges, the relevance of the rate of change that I encounter in my present role, along with the introduction of autonomous mining machinery, requires adaptive leadership. The need for this leadership approach and development is a core that underpins my Personal Contingent Leadership Paradigm and will be expanded on further as the Critique progresses. I have ascertained from my peers in the mining sector, and within Caterpillar that there is general acceptance that a different style of leadership is required to yield the full benefits from the technology being introduced.

Maturity Model

The evolution towards adaptive leadership is not a binary point where the theory can be adopted immediately, as there is a progression of skills and decision-making that enable this type of change, over time. The work of Hogan (Hogan, 2008, pp. 58-60) built on existing adaptive leadership theory with a maturity model that was constructed from a decision-making perspective towards approaches and skills. Hogan first established that there was a sequential order of skills; as a leader becomes culturally competent in their environment or organisation, they then begin to manage knowledge, which enables a holistic vision, and finally an ability to reconcile challenges with creative Synergy. This is represented in Figure 5 showing the Skill Sets and Decision-Making stages building out competency with the decision-making approach across the top of the figure.

Figure 5: Skill Sets and Decision Making

	Cultural Trap	***Serendipity***	***Natural Selection***	***Compromised***	***Adaptive***
Cultural Competency	-	+	+	+	+
Managing Knowledge	-/+	-	+	+	+
Holistic Vision	-/+	-/+	-	+	+
Creating Synergy	-/+	-/+	-/+	-	+

Adapted from (Hogan, 2008, pp. 59-60)

Where Hogan's work deviates from being purely sequential in Figure 5 is with the decision-making steps of Compromised and Adaptive; he views a leader is constrained in their creating synergy skill if they can only view outcomes as win-lose (Hogan, 2008). This is a critical differentiation which I believe is particularly relevant working in an organisation such as Caterpillar with a strong technical capability embedded into the culture. A technical outcome, in my experience, is tangible and win-lose against a set of performance measures that are deemed acceptable. Whereas with an adaptive challenge, it is not that clear. To truly create synergy, the outcome of the decision (which could be in the unknowns between win-lose) may not be apparent for an extended period of time as equilibrium is restored. This is where an understanding of adaptive maturity with skills and decisions needs to be understood when working with those faced with an adaptive challenge.

Chapter 3: My Leadership Journey

This chapter expands on my personal leadership journey with the framework I have been applying to evaluate situations, and the formal feedback loops I have had since 2012 to form a foundation. This also provides historical context prior to progressing into research methodology and context that will form the subsequent chapters.

Framework

To date, I have been applying a framework of People, Process and Technology in my role while implementing and using transformational technologies beyond operator assist functionality to categorise and deal with challenges that arise. As I have expanded my understanding of systems theory and systems thinking, I reviewed my experiences to date in the DBL modules 703 and 704 with the three critical factors I have been using in this framework. My logic has evolved to shift focus going forward to People, Process and Self as the core factors; the technology (or product) in my mind becomes irrelevant as these will emerge over time. They can come from many places/competitors and are not a direct element I control; I only have internal influence on Caterpillar products. The elements of People, Process and Self adapt to the changes that emerge in the environment and this includes the technology, which I have focused on by default, given the enterprises historical legacy at Caterpillar, as a manufacturer. From my experience, I also see that removing Technology reduces the inherited risk to move to technical resolutions versus taking a system approach to evaluate the issue at hand, diagnose it and begin to appreciate the associated complexities.

What further accentuates this change is that the technology becoming a control mechanism can no longer be seen as optional to use. With autonomy as a control layer that machinery is operating within, it becomes an integral element within an operational ecosystem on a mine and requires significant change to implement successfully, given the change in criticality. Using the cruise control example, the only way to impact the speed is to set the limits and let the machine operate within these tolerances while driving within the mine. This can no longer be done by an operator on each machine or manually overridden. This point of differentiation alone, from an

assist function, shows the dependency that the whole mine now has on the technology and also that it is an embedded system to deliver production outcomes safely.
This change supports the change to my logic shifting to full control over the 'self' element, which then enables a linkage of behaviours and actions to my Personal Contingent Leadership Paradigm in this environment. As I have constructed my leadership portfolio, I then applied this framework against each portfolio entry and this now builds the foundational elements that will flow through to my practice guidelines creating an adaptive spiral for feedback. By including the self, it has also aligned to my persistence Personal Core Value in seeking to improve my leadership understanding and ability through continued learning.

In establishing the scope of the framework elements, I created the following descriptions to utilise in ripening this framework to suit my personal needs, and as the framework is applied, there is consistency:
People- Those involved or affected in the task, from team members to stakeholders. This becomes much boarder when considering some of the social issues involved with automation. (I have not yet fully defined the bounds of the social issues involved.)
Process- The processes used and developed to adopt mining technology systems into the mining industry.
Self- Relating directly to myself and my role as a leader in the mining industry with the adoption of disruptive technologies.
Technology- Hardware and software that creates a system for the mining industry (this category is no longer required as it was replaced by 'Self' above).

Historical Feedback

Having participated in continuous leadership development over the last decade, I have been able to gather significant insights on my behaviours as a manager and leader through several formal feedback loops. Compiling and reviewing the tangible materials on my leadership journey, facilitated my work towards my proposed Personal Contingent Leadership Paradigm and was constructed using two sources of information that provide consistent insights based on the percentage of positive

responses given to a series of questions. To expand on these two sources, the following time ranges and overview are provided as context to the background.

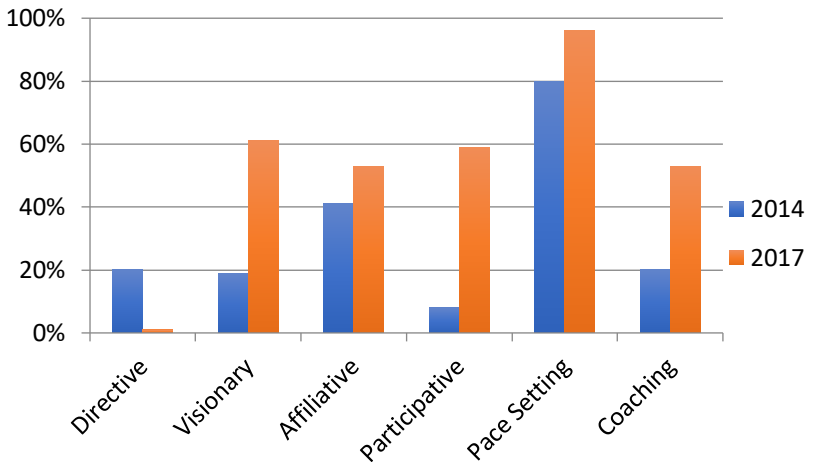
1. **Making Great Leaders**: completed in 2014 and 2017 using Hays profiling tool adapted to Caterpillar's developmental requirements. My Manager, Peers and Direct Reports were surveyed providing insights on my Leadership Style, the Climate I create and a Capability profile against Caterpillar's desired skill sets. An overview of this feedback is provided in Appendix C, Historical Making Great Leaders Capability Comparison, for reference.

   As sub-sets to Appendix C, a leader's capability in the Making Great Leaders tool first focuses on the behaviours exhibited by the leader and are classed as styles. The leadership styles, as represented in Figure 6, represent feedback from survey respondents as a result of behaviours. A dominant style is deemed greater than 65% and back-up styles are resulting from a score between 50-64%, which, in 2014, exposes that with a new team. I had one dominant behaviour with Pace Setting and no back-up behaviours, resulting from a technical centric approach whilst learning a new business with Mining Technology that I entered that same year.

   In comparison with the results of the 2017 survey, Pace Setting is still my dominant style and now Visionary, Affiliative, Participative and Coaching are back-up behaviours. As I have grown into this business unit, it became apparent that unlike the business unit I transitioned out of (that aligned to Caterpillar's history, top down strategy and standard processes), Mining Technology was in a formative state, building the strategy and processes, bottom up. This shifted my leadership behaviours significantly and also challenged me to pursue further education to understand this dynamic environment and shifted away from being technical centric, as I no longer had the technical expertise in this field. It is also key to note that as I did not have the technical expertise, my directive ability to tell the team 'how to do their tasks' decreased from 20% to

1%, as in many cases we were determining how to overcome many challenges for the first time.

Figure 6: Leadership Style

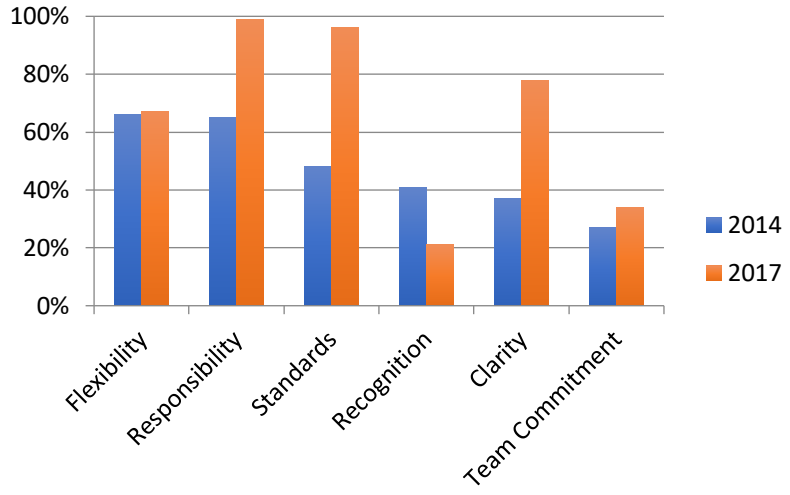


The next part of this feedback process was to measure the Climate I created for those working for me as represented in Figure 7, which is a subjective measure given the feedback sought. This represents that in 2014, we were a highly-reactive organisation and rapidly becoming more accountable and decisive with the vision we were seeking to deliver. The complexity of this environment compounded as other Caterpillar business units in mining continued to downsize, stretching our ability to recognise the Technology team's achievements. The Mining Technology business continued to grow counter-intuitively to the industry cycle and gave the team stability in their employment, which came to the detriment of the team's and personal recognition. Having two restructures from 2014 to 2017 saw the team commitment grow incrementally.

The Responsibility, Standards and Clarity all increased by more than 18%, which was built on having Participative, Coaching and Visionary leadership styles, which was supported by consistent behaviours with the team (when together and individually) aligning to the desired outcomes we were working towards. This was a critical point as I started to step away from 'doing the work' with the team to taking a less directive approach and removing items or challenges that

were inhibiting the team's performance, as opposed to being the technical subject matter expert.

Figure 7: Leadership Climate



This process culminated in the creation of Appendix C, Historical Making Great Leaders Capability Comparison measure of alignment to Caterpillar's Values Based Competencies that are associated with all leaders in the business. In 2014 my capabilities were in Vision and Execution, which left a gap in the legacy elements I created with my tactical approach, with short term objectives being below 3.5 that is deemed the measure of competence. While this improved in 2017 (through a combination of maturity in the role and creating a strategy to execute) it was detrimental to my Directive Leadership Style, which decreased. Informal feedback loops reveal this was largely due to my transactional leadership style on managing by exception; giving the team their goals and then leaving them to execute them and checking in with my team along the way.

2. **Employee Opinion Survey**: Completed by all team members who were in my reporting structure, from individual contributors to leaders with direct reports, in 2012 to 2017 (the 2016 survey was not conducted, due to restructuring). The survey changes year to year based on the previous year's feedback, enterprise objectives, focus areas and strategy. An overview of this feedback is provided in Appendix D, Historical Employee Opinion Survey Results Comparison.

To accumulate this feedback into a form that is practical for this Critique, I sorted the elements of the survey into the People, Process and Self framework aforementioned to give context. As this is bottom up feedback from those in my reporting structure and under my supervisors, it has helped guide my efforts, year over year, following each survey. From this, the table in Appendix E was compiled that applies the survey ratings into the framework (People, Process and Self). It also shows the evolution of the survey as questions were added, amended and removed, as it progressed over time. The Self element had 33% downward trending feedback from the first to last data point which were in the fields of managing change, holding personnel accountable for results and values. These were attributed to the restructuring and downsizing of my team, given the personnel reductions incurred, which I acted upon with a transactional behaviour. There was 66% positive feedback in Self under the same methodology which related to a close grouping correlated to the Making Great Leaders Results with team environment and behaviours exhibited.

The People element had 57% positive movement with Quality, Leadership, Business Knowledge and Inclusion within the team and the 43% delta was in Confidence in Officers, Social Responsibility and Customer Focus. This was directly bottom up feedback from my team that the cost reductions being driven top down by the Executives were hindering customer relationships and the verbatim comments reflected this heavily. The closing of facilities and large layoffs also impacted the team's view of the company's Social Responsibility, as the rapid growth in the years up to 2012 was down by over 30%, over time. The Process element saw compensation stay neutral, Production Systems improve (as we became a leaner business) and Growth and Development opportunities decreased significantly as the reductions in spending on training declined.

This view of the Employee Opinion Survey is stretched over time as it is not a holistic data set in the same fields for every year and does not account for the economic and industrial drivers which create some of the variables that impact

responses. Although acknowledging this weakness, it does provide a gestalt of my leadership when applied to the framework to assemble the groupings of responses connected. My tactical approach during this time (coupled with the surrounding mining industry downturn over five years) led to feedback that was biased at times towards being emotional-based around change because people were faced with having their privileges removed.

Both these formal feedback loops provide insights that are tangible, although with differing and evolving methodology it does provide a relevant basis to compare against the work being encountered (being Technical or Adaptive), as distinguished in Table 3. My consistent focus on Pace Setting in Making Great Leaders over both surveys aligns to that of technical work, and my 2014 survey results underpin this as an Expert in the field with Authority as a leadership style. This is supported by the Employee Opinion Surveys results from 2012 to 2014 with positive growth in Strategy and Execution, Quality, Business Knowledge and Accountability for Results, resulting from technical work.

Table 3: Distinguishing Technical and Adaptive Work

	Technical Work	***Adaptive Work***
The Solution	Is clear	Requires learning
The Problem	Is clear	Requires learning
Whose work is it?	Experts and authority	Stakeholders
Type of work	Efficient	Act experimentally
Time line	ASAP	Longer term
Expectations	Fix the problem!!	Make progress
Attitude	Confidence and skill	Curiosity

Adapted from (O'Malley & Cebula, 2015, p. 17)

This transformed after 2014 as I moved into an emerging field which was a departure from my technical expertise and 20 years of working experience. This is revealed in my Making Great Leaders 2017 survey results as my Participative, Coaching and Visionary

leadership styles all grew by over 20%. I could no longer depend on my technical expertise and ability to deliver on rapid time lines efficiently and resolve problems. The basis of my work had shifted from being predominantly technical to adaptive, and required me to learn, experiment and progress towards a Vision as the outcome. This is reinforced by the Employee Opinion Survey as my teams' Job Engagement and Inclusion in their work group grew by over 12% from 2014 to the highest level in my survey history.

This retrospective observation indicates that my leadership evolved organically to a point to handle the work that my team and I were being faced with at the time. To develop this deliberation further, it is practical to for me to evolve a research methodology and supporting questions to account for these learnings and then incorporate such learnings to the future of my leadership proactively. The overlapping of the Employee Opinion Survey with the People, Process and Self framework in Appendix E did not provide a sound correlation to the work being conducted, that was provided by O'Malley and Cebulla's (2015) distinguishing differences in Table 3. However, this delta was to be expected given that the People, Process and Self framework is functionally allocated to areas of accountability and the Distinguishing Technical and Adaptive Work is task-orientated into a process that encompasses the work's potential lifecycle. Adding a framework to the process lifecycle of the work provides another dimension to evaluate core elements of the work as they relate to leadership.

Chapter 4: Research Methodology and Research Questions

This chapter progresses on from my leadership journey with an outline of the research that needs to be conducted to develop my future Personal Contingent Leadership Paradigm and application to the research questions that will be addressed. This will provide purpose and theoretical underpinning of the case research to be conducted thereafter in this Critique, creating a new set of feedback loops as learning opportunities to be applied in my leadership practice guidelines.

The three research questions in their succinct form are the basis for this work:

1. How was leadership applied in disruptive situations with mining technology?
2. How do the variables of People and Process advance within the mining sector as technology evolves?
3. How do I lead in this progressing environment in a methodical and adaptive manner?

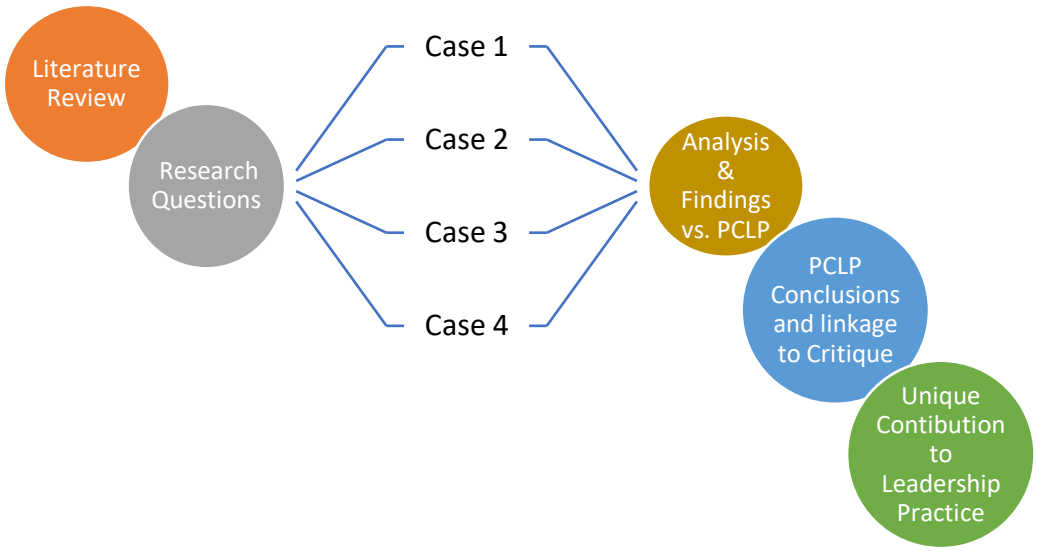
These questions will be analysed against a set of historical (in the last ten years) case studies formed from my personal leadership experiences to gather qualitative and quantitative data, as these events developed. The use of the three questions will maintain focus on the purpose of the research and will test the validity of adaptive leadership in my paradigm, resulting in findings being incorporated into the leadership practice guidelines.

Research Methodology

The research methodology utilised in this work is based upon: literature review, longitudinal case study, and survey with a progression of sequential stages in the process as graphically represented in Figure 8, that aligns to the structure of this Critique. The case study method has been intentionally chosen to cover contextual conditions that are pertinent to the study of my leadership experience as an empirical inquiry (Yin, 1994, p. 13). The case study research design incorporates a leadership theory literature review as an initiation point to the research and a prerequisite to providing a unique contribution to leadership practice, as desired outcomes of this

Critique. The work of Ridder (2017) shows a direct correlation with the use of theory in case study research that will critically enhance the rigour of the case study research and potential contributions to theory in the relevant field.

Figure 8: Research Blueprint



Yin (1994, p. 20) poses five elements of case research design that are especially important and provided the basis of the research in this critique:

1. A study's questions;
2. Its propositions, if any;
3. Its unit(s) of analysis;
4. The logic linking the data to the proposition; and
5. The criteria for interpreting the findings.

Applying these five elements to the research design provides a rigorous and structured approach to the case studies that is consistent over time as each case occurred at a different point in time and the variables at play in each is significantly different. Reviewing the past will not necessarily lead to a reflective review for the researcher, unless there are specific questions sought to draw it out and constant methodology applied. The selection of this approach enables the researcher to evaluate the assumptions and restrictions prior to the research beginning and considering the

impacts of these on the scope of work (Dresch, Lacerda, & Cauchick Miguel, 2015, p. 1120). By using critical reflection of the key themes and associations from the cases, it will provide another output from analysis of these historical events to compare the inputs for analysis.

Employing known theory and frameworks to the research of these personal experiences provides a systematic approach that is intended to remove any bias from the researcher (such as emotion, values, politics and pre-dispositions) that may reside. This method is known as interpretive approach – seeking to understand the facts through inductive theory-building and subjective information from surveys and experimentation to establish a holistic position. During development of the research design the need to have correspondence tests, and insight from triangulation of the findings was identified (Perry & Coote, 1994, pp. 3-4) and resulted in the use of four cases and three questions as an inherent mechanism to review and compare findings. Examining the work through this filter allows for a balanced approach to inductive reasoning and deductive logic being applied by the researcher that is known as grounded theory, resulting from data systemically obtained from social research (Glaser & Strauss, 1999, p. 2). The value of multiple case reviews was more practical based on these design requirements and a single case design was not warranted based on Yin's (1994, pp. 37-40) synopsis with three justifications warranted for a single case; critical, extreme or revelatory case material from which to generalise.

The case research method will expose primarily qualitative data and ensuing quantitative data will be collected resulting from these initial inquiries to provide a means to apply correspondence tests under the post positivism paradigm. Where gaps arose after the case review, these were assessed based on their individual merit and additional research via a survey which was conducted to reduce the delta in the research to as low as practicably possible through quantitative data collection and consensus testing. However, as Patton (1990, p. 185) elaborates "The validity, meaningfulness and insights generated from qualitative inquiry have more to do with the informational richness of the cases selected and the observational/analytical capabilities of the researcher than the sample size". With this observation being

acknowledged by the researcher, the next phase of the methodology process is the case selection.

Case selection was based on the type of research questions, based on how or why, and the context of control the researcher had over the behavioural events as evidenced in Yin's (1994, pp. 4-8) work and aligned to historical event research. Thereafter, a review of the case options was conducted across nine potential cases of their technical content, intended purpose, inquiry alignment, validity and informational richness that has been summarised into Appendix G, Case Study Selection Review.

With multiple cases being selected following a replication logic applied to the technical content to ensure the validity of material and not a sampling mindset (Yin, 1994, p. 45), it can be summarised as:

a) Complexity of the situation going beyond business processes that existed internally at that time.
b) The use or adoption of technology in the mining industry or suppliers to the industry.
c) The amount of information that could be compiled on the specific case.
d) Situations that are likely to occur again in the future.

This selection approach (while extremely time-consuming) proved instrumental in establishing the four chosen cases to be further documented for use in the ensuing research in Chapter 5 and in establishing a dependable data set, as a footing. Table 4 provides a summary of the process taken to evolve the research design that incorporates the aforementioned theories and methodologies applied. The following list represents the cases selected by their titles:

1. 2010-2013: Leading through an acquisition and divestitures
2. 2013-2015: Leading team through decline/restructure
3. 2014: Entering a new business; Mining Technology
4. 2016-2017: Duplicating desired outcomes with Continuous Improvement

Table 4: Research Design

Step	Inputs	Process	Outputs
1. PCPL review and research questions finalisation	- Leadership theory review - DBL701-704 - Leadership experience over last 10 years	- Literature review - Reflection on capabilities and outcomes from DBL701-704	Finalised Research questions: 1. How was leadership applied in disruptive situations with mining technology? 2. How do the variables of people and process advance within the mining sector as technology evolves? 3. How do I lead in this progressing environment in a methodical and adaptive manner?
2. Case selection and documentation	- Case selection - Data collection	- Using a selection matrix to identify historical events that are suitable for mini-cases. - Collate information for cases and supporting detail into a common database. - Document mini-cases for use of comparison with developed practice guidelines.	- Documented cases that provide the basis of analysis for the effects of technology in mining.
3. Case analysis	- Analytical tools/processes	- Critical reflection and thinking creating new insights through categorising data against theory. - Review of the analysis created, methods used and method to provide a succinct summation in this Critique. - Use of triangulation, external and Internal validity, coherence test	- Comparison of PCLP to analysis for incorporation into practice guidelines. - Application of Adaptive Leadership in the mining technology environment and its definition in this context. - Evolution of leadership practice guidelines into Vision, Influence, and Ethics. - A scholarly analysis of cases utilising the researcher's personal experience with technology in mining.
4. Survey	- Gaps identified from case analysis.	- Survey development to mitigate case analysis gaps without quantifiable data. - Selection of survey respondents to achieve this and provision of required confidentiality.	- Completion of analysis, and closure of gaps identified from cases. - Solidify the leadership practice guidelines. - Inputs to limitations of research that may result.

Framework Application to Research

The framework of People, Process and Self was introduced in Chapter 3 when exploring my leadership journey as a framework that I have grown through leadership practice in the field and will be utilised in the research with the following definitions:

People- Those involved or affected in the task – from team members to stakeholders. This becomes much broader when considering some of the social issues involved with automation. (I have not yet fully defined the bounds of the social issues involved.)
Process- The processes used and developed to adopt and adapt mining technology systems into the mining industry.
Self- Relating directly to myself and my role as a leader in the mining industry with the adoption of disruptive technologies.

While this framework is logically-based on my leadership journey, it is well within my comfort zone. However, it could potentially limit the findings of the research or directly imply an unconscious bias towards complacency. To prevent this from occurring (and not discarding the reliable framework of People, Process and Self), a second framework was conceived to use in parallel during the research providing another perspective for observation. The second framework of Vision, Influence and Ethics has the following definitions:

Vision- The strategic position beyond routine managerial tasks and administration, towards the future.
Influence- The ability to steer and direct efforts internally and externally to deliver the desired outcomes with resources outside of my direct span of control.
Ethics- The moral and values-based principles that guide my actions.

The use of two frameworks furthermore removes the inherent risk of the research accounting for traits that may be exhibited in the cases, and potentially leading towards the origins of leadership theory with the trait-based theories explored in Chapter 2. These frameworks (coupled with the aforementioned research methodology) will facilitate the research to behaviours which are tangible and

quantifiable from actions. As a basis of comparison between the two frameworks, Vision, Influence and Ethics were also applied to an employee opinion survey with Appendix H representing the distribution of factors for both frameworks. As with the work in Chapter 3, this new framework then also applied to the employee opinion survey results in Appendix F, with a differing distribution of results casting varying insights on the retrospective views already drawn. This work with the employee opinion survey will provide a correlation point for the findings of the research.

Chapter 5: Case Research, Analysis and Reflections

The following chapter will outline the four case studies sequentially through time that will form the basis of the empirical enquiry outlined in the preceding research. The research questions will follow the cases as they are each applied over the cases in the two frameworks and taking into consideration the employee opinion survey results introduced in Chapter 3. A synopsis of this historical research is then provided, before the current business unit is prefaced by a survey conducted on the variances exposed and research findings presented, as a finale to the research.

For context with the following cases, a basic overview of the matrix organisation structure of the entities involved is provided for consistency with an outline of the organisational structure in increasing hierarchical order, as follows:

Business Unit- A functional sub-set of a department that is structured around a set of accountabilities and resulting activities.
Department- A segment within a division that has profit and loss responsibility, grouping business units together by product family.
Division- A business division that is structured around an industry segment such as Surface Mining with multiple departments within servicing that industry.
Executive- Several divisions grouped under Vice Presidents and reporting to the Executive Officers of the company.

Case 1: 2010-2013 Leading Through an Acquisition and Divestitures.

I was the Western Branch Manager for Terex Mining running the business unit in Western Canada in British Columbia, Alberta and Saskatchewan provinces. I was accountable for all operations in these areas from selling machinery, parts and services to support of the product range.

In 2010, whilst working with Terex Mining, it was announced the company had been acquired by Bucyrus International and that the business would remain interdependent as an integration plan was developed. As the head of Terex Mining in Western Canada with a team of 45 personnel, I continued business with the only communication from the acquirer as public information for shareholders available and focused on pre-existing targets. Our business began to stall, with declining sales due to having overlapping agreements with customers between Terex and Bucyrus, and as a result this saw a 30% employee turnover in four months and resultant job uncertainty.

To stabilise the business, I established 'informal' meetings with the local Bucyrus executive leadership to start communications, integration planning, interactions between workforces and manage our customers' expectations. The complexity of the integration was largely centred on retaining people; as a small business in Western Canada, the business was dependent on relationships and 'tribal knowledge'. Meeting with the Bucyrus Executive Office and questioning the change management philosophy, was a low cost approach due to the acquisition price and the process was reactive as the top down view was that it was largely machine sales and support business being assimilated. The implementation of an enterprise resource planning system emerged as a sole priority for the business which became the change mechanism to merge the businesses together. This then displaced 36 disparate software systems managing the businesses and gave one 'source of the truth'. I communicated the gap I identified to the Executive with accountability for the project, explaining the gap I foresaw in having a technical integration, and not addressing the people element with the same level of rigour.

After one year in this transition state, it was announced that Caterpillar had purchased Bucyrus International and over the coming three years would divest the Bucyrus assets in all geographic locations that were supporting customers to the Caterpillar dealer in that region. There was a high degree of communication internally that I delivered to my teams, and strategic actions taken to retain key personnel and significant work with local dealerships to manage customer expectations. As the owner of the Service Operations business for Canada with 165 team members, I worked through a divestiture plan to transfer the business to the five Caterpillar dealerships in Canada. The first dealership taken over by the Bucyrus business was Western Canada (covering British Columbia and Alberta) with 300 employees being transferred.

To conduct this work, we created a business change management plan as a senior leadership team that comprised 14 work streams and over 1,200 actions items within the required work streams. I was the owner of three of the work streams in Operations, Workforce (Trades) and Component Management. Over the next 13 months, I worked through the change management process around these work streams, so we could get approval at the commercial gates to transfer the business to the appropriate dealership as divestitures. During this process, we stabilised the business from the initial acquisition and ERP Deployment by Bucyrus, sustained the core business and suffered less than 12% employee turnover during the year whilst we transferred the non-union workforce to becoming unionised.

I remained with the business for three months after the largest divestiture when the dealership took the business over as a seconded resource from Caterpillar, ensuring that the relationships were transferred and to coach the new executive leadership team. During this time, I focused my efforts on growing the dealership's understanding of this business and how it differed from their existing business to prevent a 'one size fits all' type assimilation. To do this, I leveraged my customer relationships to have working sessions on what customers saw as the strengths and weaknesses of our interactions over the prior two years, from a business perspective.

The mining industry had started to decline at this stage, so we revised the integration strategy to occur in a much shorter timeframe to reduce facility costs and maintain the established workforces in isolation of each other. We also sought to reduce the complexity created by multiple business systems in place to get to one source of truth for business performance. This was the second largest divestiture as part of the acquisition, and the comparison metrics between divestitures (on a purely commercial basis) was challenged as they occurred at different times and different geographic areas, and there are significant complexities in the measuring against the customer base.

Case 2: 2013-2015 Leading team through decline/restructure.

During this time, I held the role of Product Support Manager for Western Canada, then moved to Technology and Solutions Region Manager for Asia Pacific and was accountable for selling, implementing, operating and optimising Mining Technology in these regions.

In January 2014, Caterpillar had seen a reduction in capital expenditure in the mining industry of over 55% that resulted in less equipment and technology being purchased; thus, revenue had dropped in parallel to this trend over the following 12 months. As the business unit head, I planned to defer the initial 10% restructuring that was directed with my peers in the department for another four months and let attrition occur first. As we did not act in the same timing with other departments, it also pressured our 3% attrition to grow to 9%, which reduced the redundancies required to 4% of our workforce. The challenge I faced was to inherently keep the team motivated and perform during this cycle in a department that had never faced a reduction in personnel. At the same time, the enterprise also deployed a new Human Resource Management Tool (HRMT) to track employee performance, career path, capability and their development.

I conducted multiple communications, and compiled questions and answer sessions with the departments affected (although this did not offset the reduction in employee satisfaction and reduced performance of the team). This is referenced in the Employee

Opinion Surveys for 2013 and 2014 (ref numbers) in the Appendix B portfolio. This impacted the psychological contract between me and the team, which is evident tangible in the survey results, although more evidenced in the drop in the confidence in company officers by 16%. To gain the ability to peak shave our resource capabilities from this restructuring, I utilised contract workforce to replace attrition for this year and a half as the mining industry continued to contract. This was not a traditional strategy within Caterpillar and was challenged heavily by internal stakeholders not recognising the requirement for the flexibility. I continued with this strategy to rebuild confidence in my team that we had some insulation to further employee reductions from the core team.

In June 2015, we were faced with another corporate resizing and organisational reduction which was counter-intuitive as we had remained consistent with our revenue and cost structure in the department. As I worked through this reduction and reorganisation, I had exhausted the ability to leverage opportune restructuring such as retirements, contract staff or transfers to other business units. To achieve our objectives, I agreed with my peers that we would instead increase our revenue target to offset 40% of the reduction requirement and then held a workshop on the functional restructuring of the business. Along with my peers in the business units within Mining Technology, we reorganised the business into functional structures in each geographical region. This process allowed us to plan and iteratively change the business over a six-month period in a more proactive manner than the 2014 restructuring and allowed for succession plans to take effect with the most competent team members.

As the mining technology business grew following the 2015 restructuring, and the rest of the mining business declined, it created a disparity in the cultures of the team as those around my team had a much lower workload and ‘sense of urgency’. I continued to take on large, complex projects to achieve the desired business needs while keeping the organisation structure flat and increased workloads of the team. In this environment, we had a growing issue with recognition amongst the team and also their perception of the remuneration they received for the work they conducted. As a

result of this feedback, I launched a recognition system to give credit to the team for their efforts, ranging from dinners with small groups, to having their project profiled at All Employee Meetings and one-time cash bonuses outside the formal bonus structure. While these initiatives did not affect remuneration for the majority of the team, based on the Employee Opinion Surveys from 2015 to 2017 in the attached profile, there was a tangible improvement in employee recognition of 8%.

During these restructuring efforts, the entire mining industry was undertaking similar projects to reduce their costs base, capital and operational expenditure in a more presumptuous manner. Hence, we were not in a unique situation in the mining industry and it also aligned to the position of the global economy in a decreasing state. The introduction of a new HRMT took heavy criticism for the first two years, as it was associated with the reductions. I focused on the career planning aspects it provided to the team and utilised the technology to build their internal brand image within the business.

Case 3: 2014 Entering a new business; Mining Technology.

I transitioned into the role of Technology and Solutions Region Manager for Asia Pacific and was accountable for selling, implementing, operating and optimising Mining Technology in the Asia Pacific regions. This was a large departure from my experience and background with mining machinery and maintenance operations that I had built over 15 years.

This change in department brought a fresh set of challenges with the adoption of proven technologies, such as positioning systems into mining and their application with customers on sites across Australia and Asia. I gained an established team as we sought to grow the business with new customers and expanded the two Autonomous Haulage Systems (AHS) in operation which were both in the initial implementation stage of the projects with six trucks operating at each site in Western Australia. As I spent time with the team interacting with the dealership and customers, it became evident that the proven technologies, such as Fleet Management Systems, Condition Monitoring and Material Tracking, had a high degree of competence.

After spending time at the two AHS sites in Western Australia, it became apparent to me that we were struggling to expand the operations due to the complexity of the system in operation and the infancy of our experience in the field with many variable factors at play. I focused on expanding the teams on site by adding more personnel to provide more coverage, built our capabilities and grew our competence with our customers, as we hardened the technology to make it more practical in this environment. With the AHS system being a command and control system, there is no Artificial Intelligence (AI) and as we learnt through the first 15 months of operation, the machines functioned, as designed, 100% of the time. When incidents occurred we always found an element that related to people and process as the root cause. The maturity centric focus the customers had on the system shifted from being technology centric as it worked as designed, to the ability to affect change in a long-established workforce and the skill sets required. Both operations started to expand on this foundational experience with the system on their sites.

Expansion in segregated operations at the sites compounded the complexities of operation through duplication of work and the variables of running an AHS and traditional operation with personnel operating the trucks in parallel. However, this did not become evident until two months after the expansion, as we struggled with new technical issues and people-related challenges that emerged. The two sites applied different change management logic with Site X being very passive where my team and I played an influencing and supporting role with technical problems. Site Y had my team as active change members, and where I provided equal decision rights on the complex issues that arose with keeping the velocity on key decisions. I led the governance of this operation for the mining technology division with the customer and approached this with a focus on the vision, and not tactical day to day issue focus. We started to see a difference in the performance of the systems in this state with Site Y delivering a 12% difference in outcomes with the same machines, technology and mining methods, when compared to Site X. The safety impact at both sites saw a 70% reduction in incidents and injuries.

This experience helped me identify the extremities of the business case for these systems in their infancy, although the more significant realisation was the dependency of automation systems on people and process. While technology will improve over time, we do not have the luxury of waiting for maturity to grow and deliver a return on the research and development funds sunk to create it. To overcome this challenge, I set an objective on increasing the competency of the personnel involved and embedding my team members at each site with more control to achieve this. Over the next six months, I concentrated my efforts to close this gap to less than 5% and set a baseline in capability based on following the application processes. The most significant challenge was bringing the teams together to function as one, between Caterpillar/customer/dealer, to deliver a common goal putting their employer and independent goals aside to achieve this outcome.

After this experience, I worked with a cross section of my team, so we could create a best practice document that allowed us to establish this system in a variable mining environment for the optimal outcome in each scenario. The gap that remains as we work to deliver the same outcome elsewhere is in the social, regulatory, weather and geographic issues that arise in other countries.

Case 4: 2016-2017 Duplicating desired outcomes with Continuous Improvement.

In late 2016, Caterpillar started a restructure of the mining organisation and I moved to a role of Global Operations Manager for Mining Technology in early 2017 being accountable for implementing, operating and optimising Mining Technology installations globally. This decision was based on my success with the autonomous system installations in Western Australia and the mining industry beginning to come out of a trough, driving significant new business. We were finalising contracts to start operations in Canada and Brazil with autonomous trucks going into operations in different commodities to those our experience in Australia had provided us.
With this restructure, I took the approach of building a global team that had the capabilities of supporting delivery of the desired outcomes from a global perspective, and not regionally, as it was previously aligned. I worked with my Line Manager to

establish the flexibility we required to operate in this type of environment, utilising experienced team members to relocate to these additional sites to deliver initial competence. During this phase, I spent time building strong relationships with our new customers and obtaining the 'buy-in' with their executives to have collaborative relationships to deliver the desired outcomes for all parties involved, as opposed to the previous transactional nature of the relationships. One project in a new commodity for the AHS was phased as a development project to align to the unique requirements in this environmental extreme in Northern Canada.

As we started to deploy these sites in Canada and Brazil, the sales team won additional work in Western Australia which then doubled our implementation effort. The additional work in Australia was not a technical challenge. However, it became a resource constraint that I had to overcome within my team. I searched the industry for possible partners to work with, as we planned to double the number of autonomous trucks we had in operation using a matrix I developed to identify those that would complement our strengths and weaknesses. This was heavily-resisted by our senior leadership with the mindset that we needed to be self-sufficient, although I argued over time that we could apply our long-standing business model and expect to deliver the desired outcomes our customers sought. After a year I was granted permission to engage with strategic partners that would broaden our operations' capability in their areas of expertise and allow my team to further develop in our core areas of expertise.

By taking on an aggressive plan to more than double the operational footprint of the autonomous truck fleet, we had (by default) also committed to growing the operations team substantially, given the dependence of the product on personnel. This was a challenging position to take on to obtain approval to add personnel, as the executive office sought to keep the operating structure flat, which saw a reduction during the four years prior in the mining sector downturn and trough. I developed a business plan that revealed the risks and contingency we would be accepting by taking this approach, and was able to obtain executive office and department head support based on these awareness communications that I had conducted.

I conducted a survey as a formal feedback loop from my team seeking to establish their top five issues where they required support, or that had to be removed to achieve the desired outcomes. After reviewing the feedback from my eight direct reports, I was able to align these requests to the elements of people, process and technology that I had to work on to enable their success. I diligently worked on these requirements with their owners to achieve alignment and support, which then enabled me to give fortnightly feedback to my team. This approach was more proactive than in the past, with the expansion of our Mining Technology team allowing us to move away from core resources traveling the globe as 'fire fighters'. This allowed us to spend more time with our customers and developing our team for the complex issues that we faced in these new areas.

The business risk of not achieving desired outcomes and social implications of a safety incident were the highest risks to the future of autonomous machinery operation in mining and to parallel projects in other industries. To help reduce these risks, I was assigned the role of lifting awareness of our autonomous machinery in the mining industry, public and with regulators. As a steward for the future, I began presenting our abilities and actual achievements at industry forums as a starting point to growing awareness of the step change with safety that we delivered with our customers in mining. This was my first exposure to taking this approach externally as throughout my career we have generally taken a passive approach to communicating the outcomes our mining technology products provided (and now acknowledge that this is a role I must play as an industry leader).

Research Questions

Applying the three research questions to each case created a summary of actions and behaviours as a response to each question in the following work. The frameworks that were introduced in Chapter 4 have both been applied in each response to provide a correspondence test on the results. A summary of the framework definitions has been provided as a precursor to the questions as they are applied to each case sequentially through the work.

Framework 1:

People- Those involved or affected in the task, from team members to stakeholders.

Process- The processes used and developed to adopt mining technology systems into the mining industry.

Self- Relating directly to me and my role as a leader in the mining industry with the adoption of disruptive technologies.

Framework 2:

Vision- The strategic position beyond routine managerial tasks and administration, towards the future.

Influence- The ability to steer and direct efforts internally and externally to deliver the desired outcomes with resources outside of my direct span of control.

Ethics- The moral and values-based principles that guide my actions.

Expanding on the work in Chapter 3 with the Employee Opinion Survey has also been utilised in this research with Appendix E representing the survey results applied over time against Framework 1, and Appendix F representing the survey results applied over time against Framework 2. With the cases providing time line and occurring at different stages, this provides a quantifiable feedback loop in the research for correlation in response to the research questions.

Question One

How was leadership applied in disruptive situations with mining technology?

Case 1: 2010-2013 Leading through an acquisition and divestitures.

Framework 1: The people factor was disregarded from a corporate perspective, with minimal communication or scope and handled locally. This diluted the effectiveness of change management until the second acquisition, where there was top down alignment and willingness to invest in change to retain people and lower the

disequilibrium. This latter approach resulted in an 18% improvement in quality and 15% improvement in inclusion in my work group, as voted by my subordinates in the employee opinion survey. With the first approach, the people element was left uninformed which resulted in personnel taking moral positions and actions as a result (e.g. resigning from the company). The outcome was a significant change from 2012 to 2013 with confidence in Officers of the company reducing 10%.

The initial process was flawed and was corrected during the second acquisition based on lessons learnt from the first, and the second acquirer having a willingness to invest in change and process during a disruptive situation. The initial acquirer made a calculated decision to disregard the disruptive forces at play and pushed the technology element as a technical remedy; use of an enterprise resource planning system as the only process element required and as an authoritarian tool to get 'control' of the business. Once understood and embedded, the direct feedback from my subordinates was a 10% improvement in production system feedback and a reduction, in their view, of the growth and development opportunities by 1%.

The self-element was consistent during this time, exhibited by behaviours of highlighting the gaps to the Executives and taking actions within my level of accountability and beyond to engage the local acquirer's leadership to build our own change plan. This behaviour was driven by my personal core values to support the team based on our relationship and their contribution to the company. This evolved as I took a personal approach to the second acquisition by being proactive with communications and transparency to prevent a repeat of the oversights from the first acquisition. This had the effect of a significantly lower impact on employee turnover, and personal stress levels were reduced, which resulted from my focus over the more technical elements of system deployment and integration. From 2012 to 2013, I received a 10% reduction in my strategy and execution rating from my subordinates and across the other seven self-elements in the employee opinion survey, I received positive growth ranging from 1% to 15% with an average of 9% for my actions.

Framework 2: The vision applied in the case was initially short-sighted and focused on the bottom line impact to the balance sheet and gaining business control using technology as the change mechanism. The vision in this case was tangible in the value applied in dollars and did not account for the intangible element of people or their actions in this situation. This changed as the second acquirer applied longer term vision of an even more complex situation and divesting the business into its global network of 196 independent dealers and lowered the disequilibrium created from the first acquisition. By communicating the vision and change plans concisely, the people factor was re-engaged as they understood the desired end state; which, under this framework, resulted in a positive move from 2012 to 2013 by 11% managing change and 3% for my leadership, with the latter approach and actions in the employee opinion survey. The delta was the reduction in three elements categorised into vision in the employee opinion survey by an average of 5%, the prior-mentioned strategy and execution elements and more concerning, customer focus.

Influence was a core behaviour I exhibited during the first acquisition as there was little top down communication or direction for managers to take, so my approach was at a regional level to engage my peers in the acquiring entity. Influence was primarily used to support and protect the employees involved and prevent the level of turnover that was emerging and the use of the technology as a binary management tool. As the second acquisition occurred, my use of Influence shifted to influencing the second acquirer to understand the lessons learnt from the initial acquisition and incorporating these into the change process. The span of my influence was shifted from reactive at a regional level (endeavouring to deal with present issues) to incorporating lessons learnt and communicating them at the regional and corporate levels within the business. Confidence in officers of the company reduced within Influence as my subordinates viewed their actions as misaligned to business needs, although the other six elements within Influence improved from 2012 to 2013 by an average of 10% with my communication seeing the highest gain of 15%. The change in communication directly links to my adjustment in the manner of how I applied and focused my influence from reactive to becoming proactive.

The ethics of this situation can be viewed as being contentious initially, as the first acquirer had little regard for the personnel involved, their workload and complexities introduced, which resulted in substantial employee turnover. This had a significant impact on my engagement in my work, witnessing the established team being dissipated. The second acquirer had a longer-term ethical position of divesting the acquired business to its dealers with whom it had built relationships for over 80 years; in some cases, doing the 'right thing' was the primary concern for this business from a social perspective. This approach aligned to my values and reinvigorated my willingness to contribute to the desired outcomes of the business and contributed to the change management project. After the first acquisition, the employee opinion survey results for ethics in 2012 proved to be some of the lowest the enterprise had faced for quality and social responsibility. The change after the second acquisition in 2013 resulted in all five elements improving correlating to my subordinates being aware and informed with the second acquisition.

Case 2: 2013-2015 Leading team through decline/restructure.

Framework 1: The people element was a significant consideration during the ongoing downsizing objectives as the reduction in workforce did not result in the reduction of tasks that had to be completed and was compounded by the increase in the workload on those who remained. The ability to have flexibility with the workforce and contract team members also created further disruptive forces, as this practice had not been undertaken previously with these teams. As a result, I was faced with two new elements – personnel reduction and contract team members incorporation into the team. The timing differential to peer business units in the same facilities created a disparity that I acknowledged and worked through utilising team members to establish the stretch targets desired to offset the reduction requirements. From 2013 to 2015, inclusion in my work group dropped 21%, leadership by 11% and customer focus by 1%, as rated by my subordinates in the employee survey. This was anticipated, and the employee opinion survey was reduced in size to target select feedback. (There is little that is positive when restructuring a business and affecting team members' livelihoods.)

The process of straight cost reduction for personnel was factually contested, the timing changed, and risk taken to increase revenue to offset the reduction requirements being applied across the enterprise. This became a more strategic approach to the problem at hand, rather than an administrative exercise delivering on a set process. Reducing personnel and deploying a new human resources management tool was a conflicted set of priorities that saw the processes for each divergence and revealed the inflexibility of a large global enterprise applying a single standard. As these differences were transparently communicated to the team, it was understood and also built confidence in my approach to the situation. However, the delta from this behaviour was that it also ratcheted up the pressure to perform as a team or face further reductions as a calculated risk. Due to the work load I had created for my team from these actions, their ability to attend training was significantly reduced which is reflected in a 19% reduction in growth and development in the employee opinion survey during this time.

The behaviours exhibited by me were to challenge the application of enterprise timing and reduction sizes to enable our business unit to continue delivering desired outcomes. However, the adverse effect that emerged from this action was knowingly increasing the workload of team members to accommodate this, resulting in the personnel involved in some cases exceeding their capability limits. Further complexity arose from supporting and adopting a human resources management tool at an unsuitable time, which saw the effectiveness of the team reduce due to the scope of their workload growing to an unsustainable point. I consulted the team and they accepted this increase in work load, although it was a diminutive approach to the situation which caused systemic issues months later. The resulting feedback was a 19% reduction in company values application and 11% reduction in my accountability for results from our team.

Framework 2: The vision element in this case can be evidenced by the behaviour of taking differing actions to achieve the corporate mandate in reduction that lowered the direct impact on the number of personnel being reduced. By working with my

peers and brain-storming the options within our control, we were able to minimise the impact of the reduction, although the short-term issue was knowingly increasing personnel's workload. Introducing the human resources management tool was an enterprise objective that complicated the disruption further and was an unnecessary variable introduced that did not contemplate the complexities of having two competing projects simultaneously. All four elements within vision for the employee opinion survey reduced an average of 13%. My subordinates viewed that there was no vision, as I reactively restructured the organisation twice during this time to align to the mining sector downturn.

My ability, and that of my peers, to influence the executive office to accept our approach to the reductions by portraying the actual constraints our business was under, was a key behaviour in delivering this outcome and maintaining critical mass of expertise to achieve desired business outcomes. However, my ability to influence was limited when endeavouring to delay the human resources management tool implementation, and was not accepted by the executive owner of the project. This can be attributed to my underestimation of the agenda and interrelated objectives of the executive owner with a global role view. From 2013 to 2014, job engagement dropped by 9% before being removed from the employee opinion survey; and from 2013 to 2015, my accountability for results dropped by 11% as my ability to influence the situation positively plunged to a new low, based on my historical results.

The ethics are inadvertently challenged with the reduction of personnel to achieve shareholder returns and what is deemed to be acceptable by market analyst; this also caused tension with my own values. While providing a new technology to help grow and support the development of the organisation's personnel had a strong ethical underpinning with sustainability of the workforce, it was compromised by the timing to do so, impacting employee morale towards the company, as referenced in the employee opinion survey results in Appendix F with Values decreased 16% during this timeframe. With a culturally-diverse team, these actions were also interpreted differently, with team members viewing this action as punitive based on their work performance. In aligning values of the employee opinion survey with ethics, it

decreased by 19%, which I believe is a response that is related to personal morals, as my subordinates' psychological contracts were violated, in conflict with the company values. (From my experience, a company doesn't choose to only follow its values when times are good.)

Case 3: 2014 Entering a new business; Mining Technology.

Framework 1: The people element of this disruptive change became the critical point once the technical capability of the technology was proven and was an inhibitor to success with the difference in the outcomes between the sites being tangible. The competence of people using the system and leadership to understand complex adaptive issues that cannot be fixed with technical fixes was a significant change to the culture to enable success. In several cases, I devised small experiments that were conducted to understand the effects these experiments would have on the system as a whole and reduce the variables, so the difference could be made tangible after the fact. This work resulted in both customers approaching this as an opportunity to up-skill people from driving trucks to work with a lower safety risk; no redundancies resulted from this action. My prior mining experience (when incorporated into this new team) gave me a 19% improvement in customer focus, and the other five elements in people improving by an average of 5% in the employee opinion survey. Confidence in officers of the company reduced 6% which resulted from actions being taken externally by my business unit by closing facilities.

The processes in place were established over time through best practice and deploying two systems in parallel did not allow for continuous improvement that would have been provided from undertaking these projects sequentially. The processes involved were created prior to commencement of the work and evolved over time as the underlying theories were proven or adapted. As I worked with the teams involved, I expressed that there was no binary right or wrong, as we were constructing these processes from theory and engineering designs. This behaviour provided the flexibility for the team to evolve the work rapidly when we started operation accommodating changes as variances were encountered. During this time, production system and

growth and development of my process elements both increased by over 12% in the employee opinion survey as I formed the business unit for Asia Pacific. The delta was a 12% reduction in compensation feedback from my subordinates as our business was growing, wage growth for the year was zero and bonuses did not trigger due to corporate measures.

The self-element was a behaviour of continuous learning and development as we sought to grow the competence within teams to be successful. Having a mutual decision right with one customer also created and emotional investment in delivering the desired outcome, as I had as much at stake with my career as they did. What became apparent was that my ability to manage change was limited by my technical ability and being in an area where I would not apply this meant I could not stabilise the environment in this situation. My subordinates decreased their rating for managing change in the employee opinion survey by 19%, although increased my teamwork by 19% and strategy and execution by 17% which related to my technical execution strength at this time.

Framework 2: The vision was clear to expand these sites once a foundation was established. However, the journey to get there was not clear, so I implemented the interim steps to achieve the vision with key personnel and invested in building a team to support this action. It was an iterative process that was managed through relationships, and we avoided contract management behaviours being applied, viewing them as counterproductive and the wrong culture to have in this disruptive environment. Collaboration amongst all parties was nurtured and when there were tough decisions to be made, we reverted to the guiding principles that the vision was built on to obtain agreement. Portraying this tangibly to my subordinates was difficult and drove negative feedback with a reduction of 19% in change management which correlates to my approach to build to the vision bottom up – a non-traditional approach within the business. The positive in the vision grouping feedback was that six of the other elements in the employee opinion survey improved by an average of 13% and the last one, inclusion in my work group, remains neutral year over year.

The influence exhibited in this case is significant due to many elements in this system being outside of my direct accountability in my role, and the only way to achieve the desired outcome is through influencing a lateral peer and those of the stakeholders involved in the project internally and externally. An example of this from the case is obtaining executive approval to add additional personnel to the project at a stage where we had not proven the viability of the system, which was in a development stage (not commercial) and had only had glimpses of the desired outcome that were not sustained over significant durations. Teamwork feedback grew by 19% and communication improved by 7%, although the delta was a reduction in compensation feedback by 12% and job engagement also decreased by 9%. My subordinates were vested in the project and delivering the desired outcomes (although they believed that for the effort exerted, they were underpaid compared to their industry peers). There was a minority within this subset that also challenged the sustained disequilibrium and rated their engagement lower.

The ethical element in this case was around the control logic of the machine acting in a role that a human machine operator had filled previously and the displacement of roles. Due to the initial infancy of the project, we did not have tangible facts for the improvement in safety that we had forecasted by introducing and engineering control systems, significantly reducing the safety risks and variables involved in machinery operation. The sentiment from the media was around job losses and hypersensitivity to any incident that involved technology with an undesired outcome (e.g. accidents) but the social impact was fewer injuries and a safer workplace for those involved. The feedback through the employee opinion survey was incremental improvement in safety, quality and social responsibility which aligned to the desired outcomes that I had communicated. The delta was a reduction in the values score by 3% as the reduction in operators, coupled with the media's messaging, played on my subordinates' minds, as we did not have tangible facts at this stage to support improvement we would yield in regards to the social elements.

Case 4: 2016-2017 Duplicating desired outcomes with Continuous Improvement.

Framework 1: Understanding the criticality of people in Case 3, the adoption of this technology into other countries and commodities required the use of expertise already gained through practical experience and having personnel from existing projects move to new projects. This reduced the technical variables at play with the system, although it only incrementally impacted the social, regulatory and regional specifics associated with replicating the desired outcomes. Significant planning was undertaken to account for these variables and as the projects have become established, there have been emergent issues that we are dealing with, as they arise. The employee opinion survey was not hosted in 2016, and when it was in 2017 (the fifth year of mining industry decline), it was reduced to a more selective set of questions seeking feedback. From 2015 to 2017 the people element of inclusion in my work group grew 34% and the only other element under this element with leadership also grew by 13%. I distilled this to the growing business unit providing opportunities for my subordinates and that I acted on these by promoting team members into new roles that aligned to their intentional career development plans and coaching they had received.

The operational processes to implement and operate the system are being duplicated from the initial two projects with changes to accommodate local operational practice and regulation, which we anticipated and subsequently allowed resource to support these changes. What was discovered in addition to this, is there are varying levels of process adherence that can be viewed as cultural in different countries and has been another variable that we have had to understand and work with. From 2015 to 2017 the only process element was growth and development which decreased by 11%, which related to those who did not receive promotions, providing feedback that they had limited opportunities. In follow up to this element after the employee opinion survey, it was revealed through working sessions that there was a sense of entitlement related to team members' tenure that they believed positioned them for a role above performance, that I had to communicate was not the case.

The self-element in this case has been to provide the ability to understand issues as they evolve, take time to dissect and establish the root cause before endeavouring to rectify or apply technical fixes. This has required a significant change in mindset as our culture is to always be responsive, which is suited to resolving technical issues and reinstating equilibrium. The ability to do this has come from applying systems thinking mindset to mature the situation to a point where it can be dealt with in a series of actions that helped contain the disequilibrium at the new sites within the threshold of tolerance for my subordinates and their team members. This saw job engagement from 2015 to 2017 grow by 12%, as we were no longer creating the process and strategy bottom up, as in Case 3; we were seeking to adapt what we had created across these new sites and refine what already existed at the operation sites.

Framework 2: The vision to replicate this system globally four years ago was a distant dream and today is becoming a reality as the rate of technology adoption in mining starts to increase, as the mining industry recovers from the most recent trough. In this case, Vision and Influence are very closely intertwined as they are one in the same with the adoption of this system into mining with the variables of being on a remote mine site and having autonomous machinery in operation; 360 tonnes of truck going 60 kilometres an hour down a haul road with no one on the machine poses unique adaptive challenges. For those who remained on the team, the inspiration this vision created provided a means to disrupt the mining industry and career paths that had not previously existed. The employee opinion survey reflected this from 2015 to 2017 with growth in inclusion in my work group of 34% and leadership by 13% as cohesively bonded together to achieve a Vision that, from its conception, was intangible.

Much of the existing leadership theory around the adoption of automation is in environments, such as manufacturing and petrochemical refining with less variability than mining. Accounting for the variables that emerge, and dealing with them, has created behaviours from me and subordinates that are far from those that are traditional within Caterpillar's culture. The influence element of the employee opinion survey with job engagement grew by 12% from 2015 to 2017, and under this lens it can be deduced that during this time (and functioning in a state of disequilibrium at new

sites) there was confidence that these new sites were achievable, as was previously achieved by my team.

The ethical issues around the change to autonomous machinery and vehicles are lowered when they are viewed as control systems following the applicable rules of today, such as traffic regulations. The complexity will emerge with the adoption of artificial intelligence onto the machinery. Today, it is a sound argument that to reduce the risk to personnel by using a control system is a defensible argument. In applying this framework to the employee opinion survey, there were no feedback loops incorporated into ethics from 2015 to 2017.

Question Two

How do the variables of people and process evolve within a disruptive environment with technology?

Case 1: 2010-2013 Leading through an acquisition and divestitures.

Framework 1: In this case the elements of people and process evolved organically as the initial acquisition had little direction around these elements and it was left to those in the regional areas to do what they deemed appropriate; a bottom-up change. It was discretionary on the individuals to do what they were comfortable to support, and in this case, it varied from doing little different to reaching out to peers in the acquiring business. This was detrimental due to no internal information about the acquisition plans and strategy, with team members being able to find information in press releases or media that were not aligned to what the regional leaders were trying to do. As the second acquisition was driven top down with a formal process and chain for communication with information released three times a week internally, and open question and answer sessions were held (that we had been prepared to host prior). This resulted in the people element evolving in parallel with the process design being applied, providing input to optimise the process as it progressed. This stemmed to several tangible improvements with 18% in quality, 15% with inclusion in my work

group and 10% with production system from 2012 to 2103 with the employee opinion survey people and process elements.

The disruption became focused on working through the short falls of the first acquisition which was a void created due to limited communication of information that had to be abridged to restore trust in the second acquisition strategy. In some cases, this was not achievable as a personal moral had been breached with the team members and some elected to leave the company based on this; the disequilibrium had exceeded their personnel tolerance threshold. The contrast between the people and process elements in both cases became one of awareness; the over communication in the second acquisition led the people to evolve and understand the process changes required to be successful and included my own self elements.

The bottom up approach of the initial acquisition was not successful as it was a corporate decision made at the highest level of the business and that fact could not be overcome from under-informed regional leaders. The second acquisition was top down and regional leadership were empowered to help the people and process evolve as a result of the disruption. This correlates to seven of the self-elements in the employee opinion improving by an average of 9% from 2012 to 2013. Surprisingly, the strategy and execution element decreased by 10% during this same time which I can only attribute to being a legacy of the first acquisition, as the behaviours from 2012 to 2013 with the second acquisition embraced structured evolution of people and process.

Framework 2: The vision of the first acquisition was ill-communicated and based on public press releases, to grow Bucyrus' business through assimilation into their processes and business model, expanding their product offerings. With the second acquisition, it too was about expanding their offerings, although it was communicated that this was being done to meet customer requirements and requests. The vision was succinctly communicated in the latter, and with a purpose that it was needed. This resulted in four of the vision elements within the employee opinion survey from 2012 to 2013 improving by an average of 10%, although it saw four elements reduce by an average of 5% during the same time. I can attribute this reduction to the personnel

within the organisation becoming internally focused on issues that emerged resulting in a reduction in customer focus and external execution to deliver on their needs.

Influence in both situations, along with the enterprise resource planning deployment, had varying effects, as with the first approach it was not welcome as the 'we are acquiring you' mindset applied, so it was pursued on a regional basis. However, with the enterprise resource planning integration this mindset started to decay as there was a requirement for input and influence for this system deployment to be successful; thus, the ability to affect change through influencing grew. With the second acquisition, the importance of influencing grew significantly as Caterpillar being a global enterprise and heavily siloed, it was a required mechanism within the matrixed business structure to work across cross functional groups. Feedback from the 2012 to 2013 employee opinion survey element of influence was positive with five areas giving an average of 10% improvement – communication being the highest of these with 15%. The reduction in confidence in officers of the company by 10% is attributable to the role of leadership, as addressed by Question One in the research.

The ethics of mergers and acquisitions creating fewer companies in the competitive landscape that are even larger than before, is well-documented in the 21st century and has led to the establishment of corporate social responsibility expectations. During the second acquisition in this disruptive environment, corporate social responsibility provided key guidelines that showed a difference in the acquirer's maturity as a global business in protecting Caterpillar's public image. This differing approach provided an environment conducive to the evolution of people and process to meet the changing requirements. This was a significant step which shows that through transparent leadership, all four elements within the ethics element of the employee opinion survey from 2012 to 2013 improved by an average of 10% directly from the second acquisition. It could be argued that this was in part due to the significant turnover experienced and that the detractors from the 2012 survey were no longer in the business to provide feedback. I can counter this; personnel who left during this time were spread across the organisation and my subordinates, with both positive and negative feedbacks loops, departing.

Case 2: 2013-2015 Leading team through decline/restructure.

Framework 1: In this disruptive environment, the people and process elements did not evolve in a positive manner due to the nature of the disruption and the negative impacts this had on their jobs and personal lives. In many cases, the people element was impacted by survivor's remorse for those who remained and due to the increased workloads on personnel who endured this change, resulted in process quality decreasing. Team members were required to do the same amount of work with fewer resources, and while I openly coached people to reduce 'non-essential' work, they deemed that everything was essential, as we were already a lean organisation. In applying this framework and duration to the employee opinion survey for people and process, there was an average reduction of 13% across four elements. The people and process elements did not evolve to accommodate the disruption and it can be determined from this that they stalled in a status quo.

The global economy was in decline at this time, which was not an isolated event in the mining sector or supporting regions of operation, so was acknowledged as the 'going norm' that had been created. It became a personal battle to sustain this climate until the industry improved, which was thought to be several years away at that time. While this disruption was not due to technology, there was a positive from these efforts in that the self-element was enduring the circumstance and tangibly seeing the way it bound the team together to be successful creating resilience towards challenging circumstances. The human resource management tool deployment was viewed as optional by team members who remained and uptake to using the systems as required during the first year was 35%, as team members did the bare minimum in the systems possible and utilised very little of the optional functionality and training for career development, so it was viewed as a compliance tool. My accountability for results during this time saw an 11% reduction, and impacted how my subordinates believed I applied the company values also suffering a 19% reduction under the self-lens.

Framework 2: In this case the vision was top down to meet shareholders' expectations on returns and having a profitable business. This is a transparent position that created

tension with influence as there is little that can be done to change the position internally within the company with a corporate edict. The deployment of the new human resources management tool was an enterprise initiative that did not have a meaningful vision portrayed which stagnated the initiative with my subordinates and me. When reviewing the vision element of the employee opinion survey, all four elements decreased by an average of 13%, showing the team was disengaged from the objectives. Inclusion in my work group decreased by 21% and growth and development also decreased by 19%. When coupled with the accountable for result element of influence also decreasing by 11%, it reveals that the technology introduction was detrimental to the evolution of the personnel involved, due to the restructuring actions taken.

I approached this by identifying the extremities of what could be done and to obtain the social 'buy-in' of my subordinates and team to achieve these actions and lower the impact to our business unit. While not ideal, it represented a higher level of reduction than the other divisions, and as the team realised this (and that we had taken this action to retain more roles in the team) they took it up as a personal challenge to achieve success. This was a direct approach, but still required influence with those who remained to ensure that there would not be more rounds of reductions. Understandably, the ethics in this case represent the complexities of internal corporate agenda and external mining sector downturn, which became a double negative. This resulted in a reduction of values from the employee opinion survey of 19% which aligns to actions taken; it is challenging to portray that people are a key resource in an organisation's values, when they are being retrenched. A shock from this survey was that social responsibility increased by 10%, which in the follow up of the survey, I came to acknowledge as resulting from a lack of understanding on the context of the question and could not be attributed to the evolution of the people or process during this case.

Case 3: 2014 Entering a new business; Mining Technology.

Framework 1: In the environment created by deploying a new cutting-edge technology into the mining industry, the people and process elements were initially strained. There was a level of change fatigue after two and a half years of planning to get the projects to go live, then having to revisit the process elements over again to validate their accuracy. As the processes were refined and the results became repeatable, communication started to convey basic metrics to the team to show the progress made to date and their role in achieving such progress. The single top-level metric was then distilled down to a micro level being used to align each measure with the roles of each team member to make their contribution tangible. This enabled the teams to become very competitive between the four crews at the sites and striving to set new records in safety and production. The process matured to a point of understanding and logic that was widely disseminated across the personnel involved, allowing for a significant evolution in their behaviours to embrace the disruption. This attributed to an average increase of 8% across the nine people and process elements in the employee opinion survey; the deltas being a reduction in compensation of 12% and confidence in company officers of 6%. There was a correlation from employee expectations that by facing prolonged challenges and disequilibrium, compared to their internal peers who were resolving technical issues, they believed their compensation should have been higher than that of their peers at the same level.

The process of achievement set in through collaboration as all parties strived to achieve the top line metric and could see their role in the project delivering the desired outcomes. The change with people and process yielded positive results for the businesses involved, although the delta was in the employee turnover in the first 18 months of operation being 10%, double that of the rest of my team. The exit interviews reveal the level of disequilibrium through intensity and regular 'firefighting' to deal with issues was not for everyone, and further exacerbated the hardship of being away from family for some team members on a remote site. This environment more consistently found its equilibrium as the understanding and use of the technology matured and the intensity levels started to recede, which aligns to what I

was also experiencing in the self-element by conducting small experiments towards the aspired goals. My subordinates challenged my managing change ability in this situation as the desired outcomes were not clear, such as the technical issues we had faced, and reducing my employee opinion survey by 19% in the self-element. Conversely, teamwork improved 19%, as did strategy execution towards the objectives for the year.

Framework 2: The vision in this case was very clear – to disrupt the industry and pursue a step change in mining practice; this vision encountered opposition as many personnel involved didn't believe this was possible given decades of incremental change in mining. There was a portion of 'believers' based on the project being technically possible, although the level of change required was under-estimated due to resistance from personnel when they felt or suspected their job was under threat. The difference between the sites became evident in their vision, as one site considered the project a technical trial and the other put this into operation with no mindset of a trial; the decision to proceed had been made. This is reflected in a 19% reduction from 2013 with my, and the company's, approach to managing change in the employee opinion survey which is plausible. Across the seven other vision elements in this survey there was an average 11% positive improvement from 2013 levels with customer focused being 19% and strategy and execution 17%. My subordinates evolved the required process elements to deliver towards the desired vision, but where negatively impacted by the 'learn as we go' approach to change management. I had under-diagnosed the enormity of the adaptive challenge that was before the team at this time.

Influencing with a complex system was a core dependency of these integrations in the case when coupled with the vision of the desired outcomes across three organisations at each project. The transition to becoming dependent on influencing across multiple parties required a different skill set for the team members at the working level, along with coaching to achieve the desired outcomes. As the team grew, we acknowledged this in the recruitment as we moved away from the majority of our focus centring on technical skills and education to behaviour-based with prior achievements. While not all parties involved in the project took the same approach, the change in the skill set

required started to lower the intensity felt by the Caterpillar team members which correlated to the desired outcome. This intensity resulted in a 9% reduction in the team's engagement during this time and left the team with the perception they were under-rewarded for their work and achievements in the employee opinion survey. Business knowledge and communication improved 5%, indicating that there was a growing understanding of the impacts to our business model that these projects were having and consistent metrics enabled a higher level of communication.

In this environment, the team adapted to the ethical changes over time as they became aware of the difference in the safety outcome as the change led to fewer incidents and harm to personnel in the field. By communicating the safety impact, the focus shifted from a threat on jobs to a reduction in harm to personnel – an ethical position that the team accepted. This increased understanding of the ethical impacts allowed the organisation to advance with the safety, quality and social responsibility elements in the employee opinion survey increasing by an average of 4%. The use of the technology was no longer a technical discussion; it had become a social argument over the lowering of risk that personnel were faced with in an open pit mining environment which was a defendable position within the industry and with the public.

Case 4: 2016-2017 Duplicating desired outcomes with Continuous Improvement.

Framework 1: Growing outside the initial geographic area, the evolution of the personnel and process was put under immense pressure by adding factors of culture, language and geographic differences increasing the variables at play. The system processes were well-established in Western Australia and validated to work in the localised environments. To overcome these additional complexities to change, a strategic decision was made to distribute experienced and competent team members from the existing operations overseas to these new projects at all levels, not just management. This action enabled the people to evolve quickly and gain confidence through the coaching experience brought to these new sites and sought to duplicate the outcomes achieved in WA. The effect of this action on the existing people and process was to grow into new roles and opportunities as the team expanded globally.

This increased the disequilibrium by changing the stability and pushed existing team members to perform at a higher level and seek opportunities to improve the processes. This positively impacted inclusion in my work group by 34% and leadership by 13%, as the people elements of the employee opinion survey and reduced the growth and development process element by 11%. Employees are accountable for their own growth and development plans with their leader supplying the resources for them to achieve their agreed plans. This was blurred by promotions and team members taking overseas roles which were perceived by team members to be exotic opportunities out of their reach.

The self-element was broadened with the growing understanding and logic of the additional complexities introduced through this expansion. This also ensured that I shifted away from focusing on technical issues and became more strategic with the adaptive challenges we encountered. This change also heightened the need to develop my subordinates and team to make the business sustainable and scalable across the globe. Job engagement increased in the employee opinion survey by 12% under the self-element and I attribute this to customers purchasing more of these systems which, after years of pursuing, my subordinates took as the highest level of success based on their feedback. The people and self-elements had evolved for all involved in these projects where the technical issues were greatly diminished and what remained were adaptive challenges that were systemic to the variables being introduced in new regions. My subordinates and I had a new set of tools to apply and processes to utilise as we worked through these adaptive challenges, distributing our knowledge to new personnel becoming engaged with these projects.

Framework 2: The vision to expand was clear and well-accepted by the personnel involved as they acknowledge that this was growing acceptance in the industry of their success to date. While automation technologies are becoming more socially acceptable in Western Australia, this was not the case in Brazil and Canada where the vision was understood but challenged initially on technical and commercial merits and social perceptions. With the grasp of the vision being contrasted as either neutral with further expansion or a delta with job losses, the personnel involved had to buy into the

cause of automation with the case for lower risk and consequentially lower safety incidents. This bound my subordinates together and the team grew resulting in a positive increase in inclusion and leadership in the employee opinion survey of an average of 24%.

This required differing approaches with influence as the stakeholders, customers, dealers and public had differing thoughts on expansion and the subsequent implications in their geographic area. In Canada and Brazil, being the first or a fast follower to the first, led to heavy scrutiny from the regulator who had to be convinced that there was a safety improvement based on this change; regardless of other outcomes elsewhere. Vital to this level is investing time in relationship which was established a foundation by relocating personnel to the new projects to establish capability and 'know how'. As we sought to duplicate our outcomes elsewhere, we utilised our technical capability and expertise to establish our reputation and lead into the challenges faced with these implementations. Engagement with my subordinates and team increased by 12% in the employee opinion survey which was impacted by reducing the disequilibrium in these projects and bringing new team members into expand by partnering them with experienced personnel.

The ethical position to reducing harm to personnel, providing upskilling and lowering environment impact are the social cornerstones of these projects that take away from the emotional position of job losses and the media's view of automation technologies. Each new region has a different take on this, and the beliefs on how they interpret this change will affect them. In this circumstance and timing, vision and ethics are closely intertwined as critical elements to orchestrating the change required in a transparent manner that allows for factual decisions to be made. In applying this framework to the employee opinion survey, there were no feedback loops incorporated into ethics from 2015 to 2017.

Question Three

How do I lead in this progressing environment in a methodical and adaptive manner?

Case 1: 2010-2013 Leading through an acquisition and divestitures.

Framework 1: In this environment, being my first exposure to a global acquisition and subsequent divestitures with the experience I have gained and knowledge from this course, I now know that utilising adaptive leadership and system thinking process to review the situation would have resulted in a different outcome. The people element would not have been as negatively impacted as the approaches I utilised, which were technical resolutions, locally deployed; understanding this would have resulted in a lower turnover rate of employees at the time. The employee opinion survey is an historic artefact in this research and I believe that if I made these changes at the time of Case One, the survey results would have reflected improved feedback, based on this approach.

The processes deployed during this time initially were not communicated from an executive level and lacked the subsequent detail required by the personnel at my level within the organisation to execute them. Therefore, many assumptions were made on what the desired outcome needed to be. By making these assumptions regionally, there was disparity between what was actioned, as opposed to what eventuated globally. This situation was polar opposite during the second acquisition where it was an introduction and welcome to the acquiring company; most importantly, decisions and unknowns were clearly communicated, although there was still an element of technical resolution deployed to resolve complex adaptive problems. The difference in the latter acquisition was the incorporation of formal and informal feedback loops that were acted on which was the decisive factor between the two. The necessity of these feedback loops and importance of acting on them in the application of technology and organisational change is solidified by this example.

The self-element was at an extreme level of disequilibrium during this time due to moving countries changing variables significantly and the uncertainties that presented

themselves going through acquisitions (e.g. employment security). This challenged my psychological contract and beliefs with the actions I was taking as my role transformed quickly due to elements outside of my control and my scope of decision-making was reduced significantly for a two-year period until my role stabilised. At times, this created a personal conflict, and leading a team to achieve the desired outcomes while maintaining their engagement in their roles became challenging. My personal values remained consistent, although the application of leadership in the roles varied widely as I did not have the contextual understanding of self-element that was required in each role.

Framework 2: In this situation, the Vision at the highest level was for a company becoming larger through consolidation. However, the use of buzz words such as 'synergies' and 'consolidation' created a negative environment with the acquired personnel immediately concluding this would result in job reductions. While these were key terms, shareholders only wanted to hear a reduction in operating costs that was announced in both acquisitions before the acquired businesses had been fully understood. During this period, realising these buzz words (synergies, consolidation etc.) was marred by the complexities of what was really occurring to deliver the desired outcomes and the vision would have been more accurately called an assimilation, as opposed to an integration. Conducting an acquisition while introducing technology created an opposed set of priorities as the projects were not integrated together, which led to interpretation being used by personal to assume the priorities.

During this time of change, influence was a vital skill which at the time I had underestimated, not knowing the complexities of matrix structured organisations when coupled with acquisitions. The critical behaviour I focused on was to invest more time and resource into diagnosing the situation as it evolved before diving into technical fixes and using influence to guide the desired outcome. Expanding the diagnosis would have subsequently allowed me to assign the work beyond my team to the most appropriate owners within the enterprise. My maturity as a leader was tested in this situation and there were times when I was challenged with ethical and moral dilemmas that my subordinates and team experienced; in many cases I had the

same concerns myself. In hindsight, the creation of our own process and methods to deliver the change bottom-up to fill gaps that were not accounted for, took a significant toll on personnel's psychological contracts and resulted in employee turnover, which was an undesired outcome.

Due to the organisational strategy, and my underestimation of the complexity of these acquisitions and the variables at the time, it appeared that it was an intentional ploy to burn out personnel through mental fatigue. This significantly improved with the second acquisition as I understood what to look for and had grown in my own capabilities, and when the pressure was too high, stepped in to diffuse the problem before it became detrimental. This highlights the importance of systems thinking and adaptive leadership to holistically approach these challenges, accurately diagnose the situation and take a methodical approach to the situation before bounding to action as a first step.

Case 2: 2013-2015 Leading team through decline/restructure.

Framework 1: The people element reflected in this case is the most challenging during a downturn and has the resulting effects of lower productivity and engagement towards the desired outcomes as revealed in the prior two research questions in relation to this case. Leading in this environment requires a focus on being transparent with the information at hand that is appropriate at that level of the organisation, to establish trust with team members and also establish informal feedback loops beyond the formal communications from the enterprise level. Being technically orientated diminished the empathy that was required in these situations which is systemic to not diagnosing the situation adequately and being very tactical, which represented as transactional behaviours.

Encouraging team members to focus on the tasks and problems is further complicated by the organisational reductions, even if the reductions were in other departments, and especially when in the same facility. This required the written process to be expanded in an informal manner to provide insights and information beyond the

scripted enterprise communications. Doing this gave insights to the requirements driving the decisions being made and the feedback to be heard; in several cases, challenging and difficult conversations resulted. An example of this was reducing cleaning in the facility so we could save two team members' jobs and required the team to do their own cleaning in their work space and collaboratively in the communal dining area and meeting rooms.

This was a creative approach and experiment to the issue identified and once the team understood the logic, they largely bought in and supported the approach as they now had additional tasks to do. In this example, the self-element must be most adaptive to creative thinking, sensitive to acknowledge and use the team's suggestions and feedback on actions being taken. In this environment, communication at multiple levels formally and informally to build trust was required and resulted in enduring relationships with those involved. Going beyond the written question and answer sheets and seeking alternatives to achieve the desired outcomes that did not affect employment of team members, succinctly embodies what leadership is, compared to administering the process as it was delivered.

Framework 2: The initial intent in this case was communicated via shareholders to reduce operating costs to meet specific economic ratios that are deemed acceptable to investors. These public communications did not reveal any specifics on how this would be achieved and created a sense of angst in the organisation to the impending changes. The workload was increasing across the team, mitigating the impact to head count reduction within my team and approaching the challenging conversations of reducing personnel as a result of what we could no longer stretch to achieve. Downturn and reducing the size of an organisation seems misaligned to vision, although this is a dependency that must be accounted for as business risk with a trough plan. Exposing subordinates to this behaviour gives a balanced approach to personnel decisions thereafter, especially when the business is in a positive cycle and growing.

At the core of this work is developing my ability to 'manage self' to keep my composure, reduce the risk of emotional decisions or diving into the comfort zone of potential technical details using my experience in those areas. In taking this approach through adaptive leadership, necessitates the need for a wider span of influence on peers and department heads to understand the risks and approach to achieving the executive and shareholders' cost reduction targets. This is only apparent internally within the organisation and requires the ability to diagnose the situation adequately, as there is a common objective and in many cases, there are competing and varying ways to achieve the desired outcome that have to be negotiated. Without the ability to 'manage self', there is limited to no ability as a leader to influence others in the examples provided from this case.

The ethical considerations in the case of business reduction from a social perspective are the most challenging, as they start to impact livelihoods of team members, families and their underlying circumstances that may or may not be known in the workplace. When weighing these actions against the expectations of shareholders, it is easy to avoid the hard decisions or outsource them to the human resources department to act upon. Leading in this environment requires a leader to be innovative in ways to achieve the desired outcome with the lowest possible impact on personnel. Easier said than done, but in reality, it is the ultimate desired outcome as shown in this case and avoided the 'one size fits all' approach applied globally.

Case 3: 2014 Entering a new business; Mining Technology.

Framework 1: Moving away from my core expertise with machinery into a new field allowed me to diverge from my previous technical capability and spend the majority of my time in a leadership capacity. This provided challenges as I had to work on my behaviours and transition from being tactical with the capability to direct people how to do the job, to enabling them to work it out for themselves and experiment while doing so. In this capability, the people element required a vision and then inspiration to work towards the desired outcomes with the latitude to make mistakes, learn from them and progress onwards thereafter. Working with autonomous machinery in its

early stages of adoption required complex adaptive issues to be overcome with no previous experience or processes developed. Nurturing a team environment, close interactions and the ability to experiment without repercussions, were key to leading in this type of environment with the right personnel involved. Creating this environment across three or four parties took time and mutual understanding, which from the case uncovered, was easier to achieve at one site than the other.

While the processes are being created and documented as they move from hypothesis to proven through operation of the system, the complexities become apparent in merging engineering design and practical experience with variables in the field. In reviewing automation of machinery as an enterprise critical system, the desired outcome was not always achieved – even when all elements were in the ideal configuration or use. This led to the requirement of further experimentation and development of the personnel and product to overcome the gaps identified with engineering controls that were a certainty, versus process controls that are reliant on personnel (variables) adhering to them.

In this role, the self-element focused on evaluating the situation, complexities and removing internal and external impediments that were adding to the complexity. This was my first identified interaction with complex adaptive systems and initial application of adaptive leadership as a result of this course. Motivating the team to continually face complex adaptive issues became my focus and one that has remained constant since. Taking the role of moderating the disequilibrium being faced by my subordinates and teams has allowed for the desired outcomes to be achieved and not at the sacrifice of employees with high turnover. Leading in this environment with technology implementation into the mining sector on remotes sites, has exposed the criticality of diagnosing the technical issues from the adaptive problems to establish the requirements to overcome either before commencing.

Framework 2: The vision in this case began as an aspiration that grew with momentum as it was proven technically possible and feasible, to introduce new people, such as myself, to grow the project. The initial vision was underpinned by key assumptions in

the safety and the business case as to the potential that this technology disruption could yield, and these key assumptions were exceeded in the first review conducted, although what was missing was the complexity of the type of change required to be successful in this environment. What had been accounted for was the technical elements of the system that aligned to our needs as a large manufacturing organisation without the appreciation of the variables at play and dealing with a complex adaptive system that was enterprise critical to the customers operation. A clear vision guided actions across all parties involved, although the requirements of each party had not been exposed until the project was in flight, which proved to be a key learning from the experience in this case.

To be consistent in this environment required extensive influencing with partners and customers and internally across the matrix organisation to achieve the desired outcomes. This was pivotal in getting the project to pass through governance gates, allowing for continued investment and expansion in the customer mines as the risk profile for the project was updated. With many unknowns as we undertook this journey, it was dependent on relationship management to enable influence to be used, as in many cases there was considerable risk to whether the experiments we were conducting would work; but never to safety. Establishing these relationships and sustaining them with stakeholders was requirement to work through adaptive problems and one that prevented technical behaviours emerging from all parties.

The ethical considerations in this situation are considerable given the impacts to employment. Given the reduction in safety incidents, machinery damage and injuries to personnel that resulted from the project, it aligned to my values and those of Caterpillar's. This was unquantifiable initially, but as we grew this became tangible with facts over time as data was created, when compared to the competing 'staffed machinery'. To lead in this example in a methodical manner, the appreciation of the social impacts had to come first and while it was intangible initially it was not the first item used in communication with internal or external parties, which needs to be incorporated into the role of leadership when implementing vehicle automation technologies in mining.

Case 4: 2016-2017 Duplicating desired outcomes with Continuous Improvement.

Framework 1: Expanding the operations globally with additional projects in new geographic regions provided similar challenges to those faced in Case 3 and were in addition to these new emergent issues that we had not previously encountered. Applying the use of autonomous machinery into new countries saw different social and regulatory challenges become evident that slowed the disruption initially. Taking the approach of utilising existing team members with experience was imperative to evolve the people element in the safest and shortest fashion to get the project operations with autonomous machinery in use. However, this increased some of the variables at play by having the expertise with expatriates focused on growing the local workforce in each area to being competent to undertake the operation themselves within two to three years, which added a cultural complexity. This made leading remote projects possible to have established relationships with the key project owners and myself before we commenced the projects, allowing for timely decision-making and effective communications in the project's infancy.

The process element evolved to suit the regional specifics. Interestingly, in some cases such as British Columbia in Canada, they chose to adopt the Western Australia Code of Practice on autonomous machinery in mining which reduced the regulatory issues that arose significantly. This subsequently allowed my team to focus on developing best practices in operation for autonomous machinery and establish centralised processes and materials to support the globally-installed base. This was a very stimulating time to take a system to a global operation after proving its viability tangibly as the self- element evolved to deal with different social and regulatory challenges that arose. Identifying these and guiding them along had become more of a focus with the experience gained from Western Australia by myself and subordinates.

Framework 2: The vision to expand our operational footprint and take the disruption to other dense mining areas in the world was materialising and becoming a reality. The challenge shifted from one of 'if it was possible' to 'how to replicate the achievements we had in Western Australia to other parts of the world'. To be consistent in leading

this change I centred my efforts on my behaviours with my team, building a common set of guidelines from which to work and expanding the governance with new customers. I started to apply adaptive leadership methodically focusing the majority of my efforts on understanding or diagnosing the situation before moving to action. I used these early applications of adaptive leadership in the DBL modules prior to this module, as part of my ongoing course work.

The span of influence I had grown (as I engaged initially with new projects through governance-building relationships with executives and trust through aligned desired outcomes with progress towards them) is a cornerstone in establishing a new autonomous haulage operation. Influence has cultural differences in South America as we started to grow the project there, which was a vital aspect learnt from this case, and one that needs to be incorporated into ongoing practice guidelines.

The ethics in this case around social impact were defendable due to the safety performance that we had delivered and personnel being up-skilled from their old roles and not being made redundant. The impact in these new regions was led by the media which endeavoured to portray extremities of what could happen to suit their own political agendas and used worst case scenarios from the automotive industry. As these emerged I focused our partners on taking time to respond in a meaningful way and not to react or issue statements in the shortest possible time, as in many cases this prolonged the attention.

Case Study Synopsis

The case study research has provided a mechanism to review historical events, learnings and how this can be applied to my practice guidelines. Accounting for the variables within the four cases highlighted the complexity of adopting technology into the mining industry and potentially exposing the likelihood of the industry being disrupted. Using the research process summarised in Table 4 of Chapter 4, the following material bares the findings from this work.

Types of Challenges

The first two cases involved technology elements that related to enterprise resource planning systems and had a differing level of complexity in comparison to Cases 3 and 4. Critically reflecting on the findings of the research questions, it became apparent that leadership decisions and behaviours within these technologies had less adaptive complexity. The application of the enterprise resource planning systems was no longer the 'disruptive' element and having been utilised in the mining industry for two decades, there are known processes and outcomes from these systems. Expanding on this through the frameworks, it became evident that the challenges in the first two cases were not central to the technology, although to the integration and change management approaches applied.

In comparison to Cases 3 and 4, the automation of vehicles has also been in the industry for a decade, as research and development, and only matured to a point of being technically possible on a large scale in the last three years. This state, coupled with the unknowns and variables at play, led to a different set of behaviours being exhibited in the cases which resulted from the 'unknowns' personnel were faced with at the working level and having to resolve these challenges bottom up. This contrast in the cases helped filter the analysis and findings through the use of triangulation to remove the outliers from the research and analysis. Providing insights between a technology with the enterprise systems in Cases 1 and 2, and the automation of machinery, starts to indicate that the latter is a complex adaptive system. The emerging complexities required a different set of leadership behaviours and skills to deliver the desired outcomes, while in all cases a clear vision was shown to be a

necessity. An example of this can be constructed from Cases 1 and 2, where external help with the enterprise systems, from a technical and change perspective, was available from consultants and suppliers with experience in undertaking these projects. Whereas with the automated machinery systems there was no ability to get holistic external help with experience; only expertise in segments of the project at hand, such as generic change management which was then catered to suit the projects.

In critically reviewing the behaviours, actions and desired outcomes from the Cases, it was apparent that the adoption of automated machinery was an adaptive challenge that was exposed in Cases 3 and 4, as there were periods of stagnation where repeated technical fixes were applied unsuccessfully to adaptive issues. This defied the leadership being applied at that point in time with behaviours exhibited during Cases 3 and 4 with issues re-merging, and not being able to concisely identify the root cause clearly or how to document the process to overcome these. This demonstrates the applicability of adaptive leadership in this environment with the diagnosis of the situation – and no clear ability to identify the technical root cause; the issue laid beyond this within the system as a whole. The first two cases were predominately technical challenges with a smaller portion that was the adaptive challenge and the last two cases were then faced with the majority of the challenges being adaptive challenges with the minority being technical challenges.

Systems Methodology

To develop and utilise adaptive leadership behaviours in an environment that potentially involves a complex adaptive system, the last research question exposed the need to apply a system thinking logic to the challenges as they arise to apply a differing approach to issue a diagnosis. The mining industry's, and Caterpillar's, behaviour of moving to rapid resolution of issues lends itself well to the technical challenges faced through history that have grown this capability. However, the adoption of technology as enterprise critical systems in the mine, and changing business models, has challenged the practicality of this 'reaction' to problems and surfaced the significant opportunity to spend time in the initial stages developing and diagnosing the problem

at hand before moving to action. By applying systems thinking in leadership and exhibiting the behaviours to the team, will reduce repeated events of the same issues and the toll on personnel who are endeavouring to overcome these challenges, is critical to the future of leadership in the mining sector.

Adaptability

As the cases revealed, a top down approach from the executive level, when considering technology, represents the opportunity for understanding a vision (if there is one) and enabling bottom up change to occur. There was a distinct difference that in the cases where a clear, aligned vision was clearly communicated, it enabled the experimental work to find answers to occur. Although a question from the research work emerged – 'How adaptable is the organisation?' as this directly correlates to the rate of change the business and personnel involved can sustain. This has become a topical question, as the adaptability from these four cases was slower than the rate of change in itself, exacerbating the leadership challenge, especially in Cases 3 and 4, with the implementation of automated machinery. Cases 3 and 4 also represent a different business model that does not align to Caterpillar's 92-year history, which is confronting to consider, given its successful history and directly impacts how quickly the business evolves to adopt new business models caused through disruption. This has compounded the complexity of changes leaving the initial process development to be done bottom up in a high-tension environment with a direct impact to personnel who are vital to delivering these new technologies into mining.

Frameworks

The application of Framework 1 is aligned to the present business practices within Caterpillar, providing clear insights from the cases and technical areas of accountability. However, in comparing these results to the Framework 2, there is a noticeable difference in the findings on two levels; the first being the framework of People, Process and Self is aligned to a tactical level of detail and did not clearly identify the more complex requirements that were exposed by the elements of ethics and influence in Framework 2. The second was that Framework 1 (when compared to Framework 2) potentially has a limited interval of applicability in this dynamic

environment from a maturity curve comparison. The delta of this logic is that the Self element is key to leadership, and the ability to reflect, develop and evolve are crucial to remaining relevant with leadership as the external mining sector environment and internal Caterpillar business transform.

The applicability of Framework 2 needs to be tested with my present subordinates and peers to validate that practicality in the current environment. The Self element, while not identified in Framework 2, represents a core pillar I would make a case to underpin the Vision element primarily, and symbiotically supports the Influence thereafter. My logic on this is that for these elements to remain relevant through change, being self-aware and evolving my leadership practise to support the Vision and enables the ability to Influence to deliver the desired outcomes required in the role. Without the ability to do this, my effectiveness as a leader would be compromised leading to a degradation in achieving the desired outcomes. To develop a sustainable set of leadership practice guidelines that will align to my career needs over the next decade, I believe Framework 2, with Vision, Influence and Ethics has a higher degree on longevity in comparison to Framework 1.

Gaps Identified from Research

The case research has provided a substantial amount of material for the comprehensions on leadership in historical disruptive situations, the advance of people and process and how to lead in this arena with technology in the mining sector. Before advancing to conclusions, there were four additional questions identified from this work that need to be investigated further in the present context shifting away from historical case research. These gaps emerged from the case study research resulting in the initial design of the case research being revised to accommodate the identified gaps that are necessary to complete this Critique (Yin, 1994, p. 52). These gaps could not be conclusively settled upon with information from the case research, triangulation or coherence tests, resulting in the following four questions being distilled:

1. How adaptable is the organisation I work within?
2. Is Vision, Influence and Ethics (Framework 2) a valid framework in today's context?
3. What is the distribution of technical, people and unknowns that are presently faced with mining technology?
4. Is the adoption of autonomous vehicles in the mining sector a complex adaptive system?

To answer these questions, it is beneficial to now introduce my present role and provide business context to that role, which will allow these four questions to be further elaborated on. By taking this approach, it will allow for the incorporation of a survey into the methodology to garner additional quantitative data that reduces the qualitative position these questions pose. This is an indispensable requirement to distil the research to an optimal position, providing superlative inputs for the leadership practice guidelines that result from this work.

Current Role

Significant complexity and variables arose when I moved into the Mining Technology business unit four and a half years ago to lead a team to implement technologies that provide operator assist and control functionality to customers as highlighted in Cases 3 and 4. The pinnacle of these technologies is automation systems for mobile machinery at mine sites in large scale, which has disrupted the industry and led to a new business model emerging that deviates from the traditional Caterpillar strategy in place for 93 years. A current example is the automation of large mining trucks across a single mine moving over 90% of the material movement on site and transitioning from independent decisions made by truck operators to centralised decision-making. This is provided that there is consistency in mining operations with higher utilisation of machinery, lower safety incidents and greater throughput from the system. Although a delta from this action is the centralised failure points of the system with human interaction and of technical consolidation, as the system is dependent on radio networks and servers (as prerequisites) to be operational.

The business case for these automated technologies is built on improved safety, increased utilisation of capital and a consistent rate of productivity as the major drivers. There are numerous minor customer specific drivers that arise depending on environmental, operational and social drivers, although the three major drivers identified remain consistent across all operations. These minor drivers tend to be emergent as the system is being implemented and operated, over time, creating data that can allow for the comparison to their former operation methods and processes.

There have been complex technologies in mines for the last 20 years leveraging global positioning systems (GPS) and material positioning. When they have failed the operator has always had the ability to persist with operating the machine without the technology assisting. By automating the trucks, the reliance on the technology to work is vital to the customer's enterprise with the mine depending on it to deliver the production requirements hour by hour. This has seen technology in mining shift from being support systems within the operational content to enterprise critical systems that have a direct impact on the outcomes on multi-billion-dollar mining operations. Due to this change, it has also augmented the skills of the personnel required to support and maintain the system away from those who are traditionally based on the mine site. The automation system is now an enterprise critical asset to customers and downtime is measured in minutes, so the highest level of support is required to respond to and deal with these emerging issues, which has been a significant learning process for all parties. This was a significant departure from the flexibility resulting from reactive behaviours on a mine site with the ability to make changes as the need arose on site, hour by hour, forcing a proactive methodology to planning for the operation.

During the last four and a half years, we have consistently proven that the technology performs as designed 100% of the time and getting the automation technology to deliver the desired outcomes becomes solely reliant on people and process after the technical implementation. Developing on this statement with an example; more than 200 connected staffed assets are in the system, and an additional 54 of them automated – all operating together in an operational area of 37 square kilometres. The

system is highly complex and reliant on people to interact seamlessly with technology that operates as designed 100% of the time. In every incident we have experienced, the root cause has come back to people and process, which have a lower rate of compliance to job task than the technology.

In reviewing the automation technology in its present state, the variables at play and complexities, I drew parallels to complex adaptive systems from the case research with automated mining technologies, as the sum of the individual pieces does not equal the whole. While we have control of the individual pieces within the context of the automated systems, it does not mean that we are assured the delivery of the desired outcomes. As I have been on this journey, there have been emergent learnings coming through that we never anticipated with this relationship between people, process and technology. The type of leadership required in this environment has changed significantly, which has grown somewhat organically during this time prior to my entry into the DBL and my growth through practical experience as we embarked on these challenges for the first time as an enterprise, and in many cases, as an industry.

To further develop on this linkage to complex adaptive system and answer the question from the case study, the meaning of 'complexity' must first be established, which is a property of open systems that consist of a large number of diverse, interacting components called agents (Rzevski, 2015). Expanding on this, Pascale (1999) proposed four tests that an entity must meet to be deemed a complex adaptive system which I have made tangible for machinery automation for one mine site. These are:

1. Comprising many agents:
   Two hundred and fifty-four instrumented machines, 600 personnel participating, random variable agents such as wild animals, untrained personnel, weather, geology or material properties.
2. Continuously shuffles building blocks generating multiple levels of organisation and structure:
   Given the integrated approach of such a technology, the building blocks exist outside of the mining technology, in other symbiotic or interrelated systems

that are also prone to ongoing sustained change creating differing organisation structures at all levels over time.

3. Winding down over time unless replenished with energy:
   The infancy of the technology, ongoing software iterations and evolution of the technology are the replenishment that prevent the death of the system complexity.
4. Exhibits a capacity for pattern recognition and employ this to anticipate the future:
   The agents within the system recognise patterns from feedback loops, utilising this to orchestrate future events, seasons or prevent occurrence to enable the desired outcomes sought.

With these criteria, the use of mining technologies to automate machinery qualifies as a complex adaptive system. It is prudent to state that today these technologies do not incorporate 'artificial intelligence' which would compound on the already existing complexity and introduce a fresh set of ethical challenges thereafter. To further expand on this determination, Rzevski (2015) has expanded beyond Pascale's four tests with seven features that also help to understand the variables at play; and based on my experience to date, these seven features provide invaluable insight to the challenges that these machinery automation systems introduce. In applying Rzewski's features, this provides the following observations:

I. **Connectivity**, agents are interconnected, and complexity increases with the interconnection of agents:
   Agents are all interconnected formally with technology, processes and informally through interactions and prevailing events grouping those faced with the issue together.

II. **Autonomy of Agents**, agents are limited by norms, rules, regulations and laws; the increase of autonomy of agents increases complexity:
   Agents work with in safe work procedures for technology, design protocols, government regulations and mine site rules to ensure the safe operation of autonomous machinery. These are the bounds that prevent random behaviour.

III. **Emergent Behaviour**, behaviour emerges from the interaction of agents and is not predictable, and yet not random:

The machinery in operation as a system creates an environment where there are emergent outcomes that were not foreseen and also emergent behaviour from the situation.

IV. **Nonequilibrium**, perpetual change resulting from disruptive events that vary in velocity and frequency impacting complexity directly:

There is planned ongoing change with the technology evolution, which impacts the system creating further disruptive events that were not predicted and sustain disequilibrium of the system (adaptive challenges).

V. **Nonlinearity**, relations between agents are nonlinear:

An event can be amplified into far greater consequence to other agents than the original event. These have resulted from people and process related issues that have a magnified impact on machinery.

VI. **Self-organisation**, having a propensity to react to disruptive events by autonomously self-organising to eliminate or lower impact:

The people and process elements of the system adapt to the systems as it evolves and prevailing environmental conditions to deliver the desired outcomes.

VII. **Co-evolution**, with their environments in an irreversible manner:

As the ecosystem and psychical environments evolve, so does the system through the technology, people and process in a continuous manner enabling improved system outcomes as a result of co-evolution. These are irreversible once adopted and sustained as part of the ongoing change.

Applying this construct to the automation of mining machinery that is out in the mine site and not in a fixed location, reveals the multi-dimensional variables at play. It also exposes why technical fixes in this environment have limited applicability to impacting the outcome, as in many cases the effects they result in cannot be planned for, or evaluated, prior to arriving in the situation of use by agents. The automation of

machinery on a mine site (while in a contained area in remote locations) is a complex adaptive system that needs to be approached, as such, from a leadership stand point. The advancement of my capability as a leader in this environment, where the inevitable conflict, chaos and confusion of change are the result of the disequilibrium is positive rather than destructive is indispensable (Heifetz, Grashow, & Linsky, 2009). This determination that there is a complex adaptive system in this environment provides the answer to question four ('Is the adoption of autonomous vehicles in the mining sector a complex adaptive system?') and was identified as a gap from the initial case research, and with this understanding allows progression of the survey.

Quantitative Survey

With three questions remaining from the case study synopsis requiring additional research to resolve, a survey was constructed to produce another formal data set for input to correlate against. Given that the cases all occurred over a seven-year period, it was not practical to apply the survey retrospectively across the cases, given the significant variables that would be introduced from this approach against the initial longitudinal approach. To ascertain quantifiable data, the survey was constructed with formal questions that sought ratings on a scale from one to seven being completed by my subordinates, internal and external peers. This offered a means to then connect relations between variables encountered from the case research and provide a data set from which usable knowledge could be deduced (Miles & Huberman, 1994, pp. 275-276). The remaining three questions are:

1. How adaptable is the organisation I work within?
2. Is Vision, Influence and Ethics (Framework 2) a valid framework in today's context?
3. What is the distribution of technical, people and unknowns that are presently faced with mining technology?

To provide quantifiable input on question one, it was further dissected into five characteristics of adaptability, with 11 statements contained within, which were adapted from the work of Heifetz, Grashow and Linsky (The Practice of Adaptive Leadership, 2009, pp. 107-108). This progression, coupled with the prior expansion on

my current role, provides a means to obtain feedback that does not have the considerable variables introduced across the same period of time that cases covered. Further to this, it also provided a means to isolate opinions, impressions and vivid feedback on this emotive topic, which strengthen the validity of this Critique and theory building from the research holistically (Eisenhardt, 1989, p. 538).

Question Two was spread across the Framework 2 elements of Vision, Influence and Ethics with five statements being utilised as a subset of the elements. Developing on from Question One, these statements also sought ratings from one to seven, ranging from disagree to agree seeking tangible feedback through numerical rating. Question Three was broken into two portions, the first being a motivation statement being added specifically for the survey as a variable to test validity of the case research findings on this topic. The second portion required the input from the survey respondent and where they allocated the percentage of their time to challenges in the areas of technical issues, people/process, and variables/unknowns. This sought to draw a correlation between motivation and where time is allocated with the survey respondents to form a hypothesis for Question Three. The survey that was distributed is represented in Appendix J, Research Survey.
As per the signed Contributor Approvals and Ethics Statement at the start of this Critique; the following Ethics Statement reflects that each survey respondent was:

- Provided with a clear explanation as to why the particular information, documentation and/or artefacts were being sought;
- Informed that it was their right to withdraw their participation in the research at any stage;
- Assured that any information or personal details gathered in the course of the research are confidential and that neither their name nor any identifying information will be used or published;
- Assured that the information, material(s) and/or instruction(s) provided would be held in a safe, secure location whilst being utilised and after use would be destroyed or disposed of in a manner that would not jeopardise its confidentiality;

- Advised that a recording device was to be used whenever this was necessary, and their permission was obtained prior to this use; and
- Advised that if they had any concerns or complaints about the research to contact the Australian Graduate School of Leadership Dean, with contact details being provided.

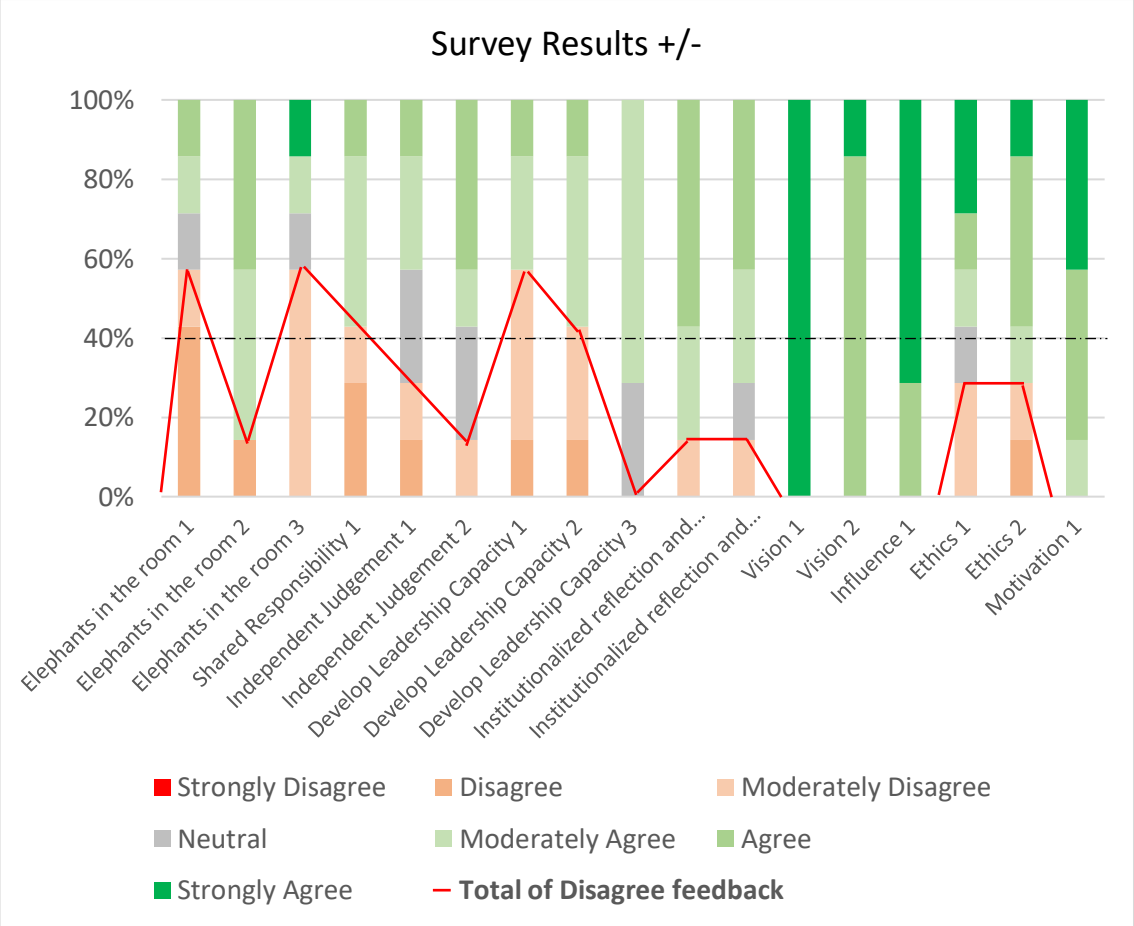
For the survey data that has been correlated into this Critique, each respondent completed the Research Respondent Consent From as represented in Appendix I. The majority of the seven respondents gave permission for information provided by themselves in the course of the research to be published, provided no identifying information is included. This resulted in all survey respondent data being anonymised to allow the consistent representation of the findings to be applied and represented from the analysis of the responses. Appendix O is a representation of the respondent's experience in the mining sector as an overview.

Survey Findings

The survey responses to the statements utilised a seven-point adaption of the Likert Scale (Likert, 1932, pp. 46-47) and was used in the survey providing a more aggregated level of information for analysis and wider data set range than the five-point scale. There were seven surveys completed; five by subordinates, two peers who are working in the mining technology business unit at Caterpillar and the raw feedback represented in Appendix K. By coupling the framework of Heifetz, Grashow and Linsky for organisational adaptability (The Practice of Adaptive Leadership, 2009) the original statements from this work were modified to meet the criteria developed by Likert as "expressions of desired behaviour and not statements of fact" (A Technique for The Measurement of Attitudes, 1932, pp. 44-45). To further gauge the desired behaviours, Appendix L was created that represents the Likert Scale survey results being filtered against their years of experience with autonomous vehicles in the mining sector; that the respondents had to provide another means to identify patterns or trends or possible correlations.

Figure 9 below provides an overview of the results from the survey laid out in seven categories from the Likert Scale, ranging from 'strongly disagree' through 'neutral' to 'strongly agree'. A qualifying criterion was added at a total of 40% in the three 'disagree' categories, as a perquisite to focus deeper on this survey category and proof-test the statements provided. Then, a red trend line was added to the table to visualise the total for 'disagree' feedback across all the questions where 'disagree' feedback was provided. In taking this action, I acknowledge that it is acceptable and positive to get feedback that falls in the 'disagree' category, and that the diversity of variables across the operations the respondents are faced with is logical.

Figure 9: Likert Scale Survey Results



There was a correlation with 'neutral' and 'disagree' feedback, which was to be expected given the sensitivity of the questions, showing that respondents potentially avoided the association with negative computations in 'disagree' responses, opting for 'neutral'. Of the 17 questions, there were 'neutral' responses recorded in seven of

them by five of the respondents. As defined in the following breakdown of the questions, due to this correlation; if the 'neutral' and 'disagree' responses exceeded 40%, they were further expanded through the investigation methodology.

In the first category relating to the adaptability of the organisation with the three statements around 'Elephants in the Room' statement, one and three had 57% 'disagree' feedback. The first statement related to the time it takes for informal issues and conversations to get into a formal setting internally, which exposed that there is an unwillingness to progress these to a formal setting with the hierarchy. The third statement in this category, which is symbiotic to the first, was that there are structure, incentives and support for 'speaking the unspeakable'. This exposed that by not having the processes and means to raise challenging issues, that they resultantly are left as informal discussions to avoid the focus drawn in a formal meeting. The second statement in this category had 86% 'positive' feedback, which exposed that when crises are identified, the bad news surrounding them is discussed. My hypothesis is that once the organisation is in a crisis (and the pain is immense spreading to the customer), that the organisation is structured to deal with this, which is systemic of dealing with technical issues and the organisation's self-perceived engineering prowess. This is reflective of a culture that avoids negativity and bad news until it is no longer avoidable.

The next category was 'Shared Responsibility' where a 42% disagreement was responded to on the statement of; Senior management in the organisation, act from the perspective of and for the betterment of the whole organisation, as opposed to worrying about and protecting their individual group or silo. While only 2% above the 40% cut off, it exposes that there is a predisposition by some of the internal supporting business unit stakeholders to take action that aligns to protecting their own motives (e.g. career progression and tenure longevity). This input, when triangulated with the case research, now also provides the insight that the internal business partners are not entirely aligned to the desired outcomes required in practice. By using a coherence test it can be concluded that this outcome is reflective of a gap in internal objectives between departments, pursuing bottom up change and communication.

The ‘Independent Judgement’ category did not have in excess of 40% ‘disagree’ feedback for the two statements, although it did have the largest ‘neutral’ position for the entire survey with 29% for each of the two statements. This feedback came from both my peers and two subordinates and shows that it is not solely a function of the environment my leadership plays. This category shows that the respondents do not feel that the organisation values their capacity to ‘divine the boss’ preferences’, or that when they take a reasonable risk in service of the vision and it doesn’t work, it will be seen as a learning activity instead of failure. This is a function of the matrix structure of the present organisation with headquarters in North America; and decisions being made are scrutinised heavily by internal parties trying to understand how the action correlates to their objectives. This ‘neutral’ response reveals that the adaptability of the organisation is stretched to give the respondents the confidence that the organisation ‘backs’ their decisions. This creates a convoluted position for the respondents in making bottom up decisions to support the adaptive challenges being faced and trying to interpret their boundaries in the situation as it evolves. This provides an indispensable comprehension of how the team perceive they are valued and supported in their role that must be addressed in the leadership practise guidelines.

In ‘Develop Leadership Capacity’ category there were two responses with over 40% ‘disagree’ feedback in the first two statements; people know where they stand in the organisation and their potential for growth/advancement, and that they have an agreed-upon plan for how they will reach their potential. Being in a field that has evolved (as Cases 3 and 4) reveal to adapt a complex adaptive system, the definition of roles and responsibilities has been in a fluid state as they take a differing role at each site, given the role taken and technological adoption maturity. This has consequently led to more of the leadership development occurring through learning through experiences and challenges taken on with the adaptive challenges at each site. What has become very transparent through Cases 3 and 4 is that the formal education and skills of my subordinates on each site varies widely, and yet their ability to deliver desired results is comparative. Their behaviours with customer focus, adaptability and

willingness to sustain the disequilibrium to achieve this, complement each other's requirements, given the challenges they are faced with and ability to network among themselves. The formal leadership capacity to date has grown organically, although Cases 3 and 4 show the ripeness has grown to a point that has exposed (in Case 4) the replication of the success sustained is now a significant business risk. The growth of the team to achieve this and replicate the adaptive leadership approach required is now the critical path to success that requires the highest priority on leadership capability development.

The final element in the adaptability of the organisation series of statements is 'Institutionalised reflection and continuous learning' which out of these five elements had the highest 'agree' feedback. The two statements in this element were; the organisation allows time for the individual and collective reflection and learning from experience, and that the organisation allocates time, space and other resources to get diverse perspectives on how work could be done. This is an important diagnostic finding from the survey that uncovers a strength in the organisation's adaptability is the ability to reflect and learn, which may originate from a core continuous improvement capability developed through the organisation's manufacturing history. From this feedback I have deduced that this element of adaptability has been the concentration of what has delivered the transition from Case 3 with proving the technology out, to Case 4 in endeavouring to replicate it creating the present scalability challenge, as outlined in my present role. This has also enabled the element with the next highest response with 'Independent Judgement'. These two elements are closely intertwined when reviewed in the same filter as the case research methodology, that the institution provides time to reflect, learn and improve before taking on the same task. In succession, this must be circulated back to my subordinates faced with the adaptive challenges to exercise their independent judgement in a supported manner, so they are empowered in their role.

The next series of questions relate to Framework 2 broken down into the elements of Vision, Influence and Ethics. The objective of this series was to build an understanding of the respondent's position on these elements gauging whether they saw alignment

with these and their present roles in mining technology. The framework of People, Process and Product has been in use and widely-accepted for a decade, although as exposed from the case research, has a limited longevity when coupled with adaptive challenges in this environment. As my current role surfaced, the adoption of automated machinery is in fact a complex adaptive system which further stretches Framework 1, and its original derivative of people/process/product. The vision element received the highest range of feedback in the entire survey with all respondents giving the first statement – that a strong vision is required to deliver autonomous machinery on a mine site 'strongly agree'. This was then further supported by the second statement that the vision must be applied as guiding principles to achieve the desired outcomes with six respondents agreeing and one with a 'strongly agree'.

The element of Influence received similarly agreeable responses with five 'strongly agrees' and two 'agrees', with the statement necessitating the need for the leader involved with autonomous machinery deployment and operation of autonomous machinery being dependent on their ability to influence internally and externally. This also extends the findings of the case research around the variables of people and process when considering them in the role of adoption of technology in mining. The 'agree' feedback on the elements of Vision and Influence are interrelated as with the project deliverables, although show that there is a difference in the level of the organisation's adaptability to these now clearly-identified needs as part of being successful with the adoption of autonomous vehicles.

The ethics statements in this series were the only ones to receive 'disagree' feedback, while not in excess of 40%, the first statement reached 42% when coupled with a 'neutral' response and two 'moderately disagrees'. This statement specified that the ethics around autonomous machinery operations are discussed and planned for with the deployment and operations of this technology. This response could be biased by the fact that all respondents are (and have been) involved with implementation and operation of this technology, potentially skewing their view by being closely involved, motivated (remuneration incentives), and vested in making these projects successful.

The second ethics statement of these conversations being openly discussed received one ‘moderately disagree’ and one ‘disagree’ response from the respondents. This ‘disagree’ feedback was provided consistently by the two respondents who provided ‘disagree’ feedback with the first ethics statements; one with 20 years of mining technology experience and one with five, showing this was not due to their experience or understanding. What also becomes evident in this feedback is that we could be doing more to support the implementation of these systems and that there is also a potential personal values conflict with the work we are undertaking moving to wider deployments globally. The responses on this series clearly show that the elements in Framework 2 are widely understood and deemed necessary by the team involved.

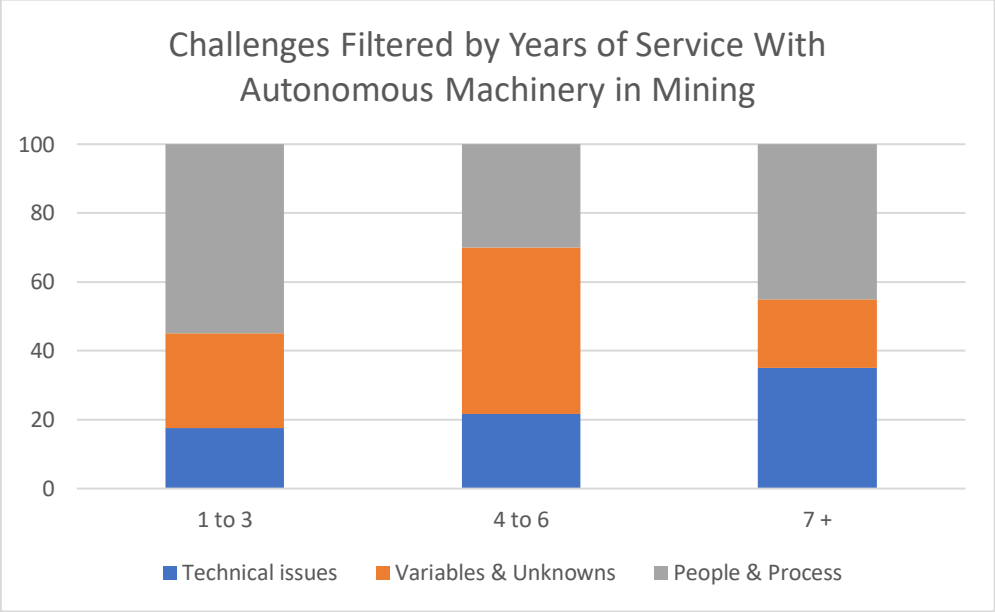
There was a statement provided on motivation fit, as part of a separate series, that was added to prove or disprove the hypothesis that organisational adaptability may be correlated to the individual’s willingness to achieve desired outcomes. While the feedback was all agreeable, ranging from three ‘strongly agree’, three ‘agree’ and one ‘moderately agree’, there were no further correlations that were derived through patterns or consistent trends. This disproved this hypothesis showing that a high degree of motivation is required to be successful with an autonomous machinery in mining; it did not provide further insights that were initially intended.

This concludes the use of the Likert Scale for the purposes of the survey as part of the research which provided significant insights on the first two series of inquiry. There was significant finding across the use of the seven-point scale that was utilised with no ‘strongly disagree’ responses recorded. The confidential nature of the survey and context provided in accord with the survey, provided a means to obtain feedback that was unbiased and with no further repercussions, as it is to be utilised for self-development and leadership research.

The final stage of the survey was sought to elicit feedback on where the challenges faced by respondents lay as a result of the percentage of where they allocated their time. This initial feedback is compiled into a chart visible in Appendix M that shows the initial raw distribution of the results with an average added to provide context to the

breadth of input received. The analysis of this input was reviewed under several different filters and lenses and the most meaningful input that can be distilled from this data was when it was grouped into years of experience with autonomous vehicles in mining. Figure 10 represents three categories extrapolated from the data by grouping years of experience with autonomous vehicles in mining with two respondents in 1 to 3 years, three in 4 to 6 years and two respondents in the 7+ years of experience grouping the average of results in each. This also provided a method to expose the transition over time in their field without seeking additional historical information.

Figure 10: Responses on Challenges Filter by Experience



In the first category of one to three years 55% of survey respondents' time was allocated to dealing with people and process issues as they started to be faced with adaptive challenges coupled with establishing their own teams and gaining experience. They then rated 28% of their time to dealing with unknowns, which I attribute to the two respondents in this area moving into a new role and business unit. This change in accountabilities, coupled with no formal leadership program in this field, increases the complexity faced as I attained new subordinates from internally within Caterpillar. The respondents in this category rated the allocation of their time to technical issues the

lowest of all respondents at 18%, which reveals the minority of their time is spent dealing with technical challenges. I can attribute this response to the fact that there is a dedicated support and engineering team that concentrates on the software challenges or issues that arise to deliver the highest level of system availability. Beyond this, the survey respondents are faced with technical integration challenges that are specific to each site and dealt with on a case by case basis.

In the next category of four to six years, the respondents revealed they spend 48% of their time dealing with unknowns in their roles because they are new and undefined. Further expansion on this showed that there is an association with the maturity of the project they are working on, and that as they sought to expand across the entire mine site, the unknowns faced expanded significantly. My hypothesis on this is that the disequilibrium increased again as more people became involved in the project and new adaptive issues arose that were site specific. This stems into 30% of their time then allocated to people and process they had experienced with the systems involved, due to their tenure in this field which allowed them to lead larger teams with a growing span of influence. Technical issues were then rated at 22% as the desire to expand led to wider challenges, such as scalability and system integration within the customer's environment. I propose that there is also an organically-grown capability for those who achieved this duration of tenure to cope with adaptive challenges and acclimatise to the elements of a complex adaptive system. Those who have not achieved this have moved into other business units or taken other roles externally, seeking well defined roles, responsibilities and structure with less variables.

The final grouping of experience of seven years or greater with autonomous machinery in mining provided a counter-intuitive trend to that of the first two groupings, as the people and process element grew reducing the variables and unknowns. The trend of technical issues across the three groups remained the same, continuing to grow progressively. People and process was where the respondents allocated 45% of their time which, upon further inquiry, is the category that both of my peers fell into. I can attribute this change they are both faced with to their roles moving back to pursuing new, autonomous technologies in the field on other machines and already having the

benefit of substantial experience with autonomous machinery in mining. Not directly executing these projects in the field, the respondents centre their efforts on influencing and gaining support for this new work. As they are faced with new projects that are not replicating the work that is represented in Case 4, their allocation of time to technical issues increased as they sought to achieve their objectives. Due to this change in objectives and their work not being executed on the mine site, I attribute these to the decreasing of variables and unknowns to 20% when coupled with their experience, know-how and evolved ability to prioritise their work.

Research Findings

The following findings have been established from the empirical inquiry through case study research and overlaying of the survey that provided adequate data for these findings to be constructed.

Through the case research it was obvious that organisational change was a constant factor in all four cases and technology provided an additional intricacy that did not resolve the challenges created from the change. The technology in all four cases provided a technical capability to have process control through the organisational change, although the requirement for leadership beyond administrating the technology was a necessity. When applying the criteria from Table 3, Distinguishing Technical and Adaptive Work (O'Malley & Cebula, 2015), there were adaptive challenges present in all four cases and also in my present role. The differentiation that was discovered through the research was that in Cases 1 and 2, the adaptive work represented the minority of the challenges with the majority being technical that could be overcome with known remedies. With Cases 3 and 4, the adaptive work was the majority as many of the challenges and issues faced had unknown remedies and that these had to be ripened at the working level by those confronted with the challenge through experimentation. While in these latter cases, there were still technical issues, they represented the minority of the challenges and did not create prolonged disequilibrium. The requirement to have the capability to apply adaptive leadership to adaptive challenges faced is tangible from this work and a necessity to move forward into the future.

A revelation that came through the case research and resulting gaps was that applying the research to my current role with the automation of machinery on a mine site is a complex adaptive system. By relating Pascale's four tests (1999) and Rzevski's seven features (2015) of complex adaptive systems, the synthesis from these two critical reflections was the confirmation of the hypothesis that a complex adaptive system was present. From this research I have also drawn a parallel between the existence of a complex adaptive system and requirement for adaptive leadership to be applied to deliver the desired outcomes from the projects in an optimal manner to control the level of disequilibrium. Applying Hogan's adaptive leadership maturity model (2008) with this understanding, the skill sets and decision-making for managing knowledge, holistic vision and creating synergy become vital requirements to diagnose challenges that arise and growing leadership capability in this environment. There is an adeptness that is required to transcend these levels of maturity that must be accommodated in my Personal Contingent Leadership Paradigm.

The adaptability of the Caterpillar organisation was brought into question as a result of the case study research and critical reflection, which was not an initial consideration of the research work. The application of Heifetz, Grashow and Linsky's adaptability criteria survey (The Practice of Adaptive Leadership, 2009) provided the broadest range of feedback from survey respondents. The institutionalised reflection and continuous learning received the most positive agreement within the survey for the adaptability of the organisation, which is attributable to the strong continuous improvement culture engrained through the adoption of Six Sigma since the turn of the century (Gillett, Fink, & Bevington, 2010). Taking into consideration that the survey respondents are far from corporate facilities at remote mines and regional branches, the reality that this has flowed into feedback is a decisive indicator of the organisation's ability to learn and improve. This has traditionally been a capability that the dealer network has evolved, although technology challenges this with the supply of enterprise critical systems.

This stems into the survey's respondents next 'most agreed' feedback with the organisation's ability to support their independent judgement. This field did yield the highest-level 'neutral' feedback, as respondents make decisions to support work on adaptive challenges at these remote locations to support progress of the work without the consultation of wider stakeholders' groups that are based in North America. On further inquiry, it was noted that the feedback on these decisions is by exception when they have not delivered the desired outcomes or are not widely understood, so perceived to be negative. Operating with autonomous machinery at mines (as evidenced in the case research work) is complicated by a significant portion of the challenges being adaptive and pressing the need to respond that is outside of the organisation's core strengths. This reveals it is a stretch for the organisation to allow the flexibility and understanding of the decisions being made to deliver the desired outcomes with this technology.

The adaptability of the organisation is then conflicted by management's ability to act in a holistic manner and set aside their individual group and silo objectives. The respondents revealed that by not entirely being supported with their independent judgement, conflicts with stakeholders' objectives, leaving a grey area in the leadership of these projects. This then compounds the ability of respondents to 'speak the unspeakable' of the challenges with which they are being faced, and taking weeks to progress to formal discussion with stakeholders due to the structures, incentives and support to do so. This is not an intentional behaviour for the organisation. It is, however, attributable to the manner in which large matrixed organisation's incentive for compliance to business unit objectives (Hoandra, 2017, p. 59). The organisation's adaptability is over-extended with the breadth of objectives and variability across the work being undertaking in the enterprise. Being a small business unit faced with adaptive challenges that are not relatable to the core competence of the organisation in engineering, manufacturing or logistics, shows from respondents' feedback that they experienced in their work.

The organisation's commitment to developing leadership capacity saw disagreement that they know where they stand with their potential for growth and advancement and

having agreed upon plans to achieve their capability. Unfortunately, due to five consecutive years of decreasing sales (a first in Caterpillar's 93-year history) the focus on developing leadership capacity was reduced as a conscious decision. Combined with the counter cyclic growth in mining technology and being an emerging field that has no formal education to support the respondents in this area, the feedback was disagreeable to the statements provided. This feedback (in the confidential manner it has been provided) has been a critical disclosure for me; I must develop an experienced based coaching methodology for my subordinates and advocate for their development in this field. This is the largest business risk faced with the adoption of autonomous machinery in mining, and the one with the longest lead time to develop being measured in years. This aligns to my development through this research, applying new tools and methods coupled with my personal core values as I seek to help others grow and develop from this work with my capabilities.

The applicability of Framework 2 with Vision, Influence and Ethics provided a substantial finding that was supported by the survey respondent's agreement with the element's role. When coupled with the case study research, this was confirmed through a higher-level linkage with Framework 2 than that of Framework 1. (There is a higher level of longevity with Framework 2 as the adoption of technology in mining evolves.) Leading the ethical element into the future is truly an adaptive leadership challenge as the automation of machinery in mining grows into new geographic areas that need to be accounted for, let alone the implications for other sectors such as agriculture, heavy transport, public transport and private vehicles. In a sense, the mining sector is the custodian in these early stages of vehicle automation and laying the foundation for what it will hold socially. I acknowledge that this framework does challenge my personal behaviours to develop a long-term vision and ability to innovate within the constraints of this field. The case research highlighted my resourcefulness in achieving desired results and also aligned to the development objectives when there were few in play, which I can attribute to my Influencing behaviour.

The distribution of time that survey respondents allocated to the challenges faced provided an input that when filtered by the years of experience the respondents had

with automation of machinery in mining, provided an observation on the evolution of leadership in this field. While the respondents are all in the same business unit with the same systems being utilised, it was distilled that from the variables they faced and their growing ability to cope with adaptive issues, they experienced differing distribution between variable/unknowns and people/process.

My hypothesis from this research and survey is that this is attributable to the levels of ability to diagnose and prioritise a challenge before it exceeds the limits of tolerance with disequilibrium. Or simply put; as the team gained experience in this field their ability to diagnose an issue in these fields became more proactive before the issues ripened to a catastrophic point. Subsequently, the time spent on technical issues grew consistently through the time groupings as respondents expanded their capabilities with the unknowns and people elements, and then allocating more time to technical issues. As this survey was one sample, it did not account for the reduction of technical issues over time. In applying a correspondence test, this has existed over time, without being disproven or modified. Further to this, I applied a consensus test to this hypothesis with my peers who were not survey respondents, and there was agreement that capability over time initially focused on unknowns and people issues from behaviours exhibited.

There were two additional observations that emerged from the critical reflection during the research inquiry and examination of the findings, the first being that there were work avoidance behaviours exhibited through the cases. This is recognised as a resulting behaviour due to the adaptive issues faced, which was graphically represented in Figure 3, The Productive Zone of Disequilibrium. Although these behaviours were dealt with as employee performance issues, in hindsight they were symptoms of underlying issues from technical fixes being applied to adaptive challenges and failing. Consequently, these were leadership issues in the majority of cases, as there was a failure to diagnose the issue and understand the multi-dimensional complexities involved. The second observation is that there is an inherent risk to Caterpillar with ‘group think’ and complacency that has the potential to limit the effectiveness of those faced with an adaptive challenge and leadership in these

circumstances (Luciano, Bartels, D'Innocenzo, Maynard, & Mathieu, 2018, p. 1422). There was a high level of ethnic diversity, although gender diversity was sub 15% in all four cases and the quantitative survey. Reviewing this fact adjacent to the behaviours and outcomes that resulted in the cases circumstances, the outcome would likely have differed if there was a higher rate of gender diversity. The mining industry has a 'masculine' culture that has been created over decades of male leadership and a 'stereotype' of leader in this environment. This presents a risk in the decision-making and experimenting capability of the teams in this environment and provides a significant opportunity for a leader to methodically transition towards a more diverse team to overcome adaptive challenges.

The isolation of traits from the research work and critical reflection (while time-consuming) enabled the research findings to centre on behaviours that espoused the underlying leadership methods at the time in the cases. The application of theory based on data can usually not be completely refuted by more data (Glaser & Strauss, 1999, p. 4) and taking the cases to a behaviour level allowed for the cross examination of the theory being applied. This also provided a method to remove preconceived ideas and develop hypotheses based on qualitative and quantitative inputs with the findings. This approach has shown that the concentration on behaviours is a critical element to diagnosing the challenge being faced when accounting for people as a variable. Using this tactic was necessary with the longitudinal case study approach to evaluate how the four cases as they were. This analysis has also proven the relevance of the leadership methodology applied with the ongoing adoption of mining technology.

Chapter 6: Personal Contingent Leadership Paradigm

This chapter expands on the research with the development of a Personal Contingent Leadership Paradigm understanding my present capabilities and Proposed Personal Contingent Leadership Paradigm that the research findings have led to.

Initial Personal Contingent Leadership Paradigm

By synthesising the framework and historical feedback loops, it enabled the development of a foundation of understanding of my behaviours and practices, which outlined my initial Personal Contingent Leadership Paradigm. Over the first four subjects in the Doctor of Business Leadership, prior to this Critique, I was able to apply theoretical underpinning to my experiences and behaviours. For a visual perspective, Table 5 was compiled as a holistic view of this work summarising my Initial Personal Contingent Leadership Paradigm in this journey. Seldom does the opportunity arise to take the time out from day to day work to critically reflect on one's journey, drawing linkage to the supporting theories and what the years of practical experience have actually created. This also afforded me the opportunity to correlate the formal leadership training and feedbacks loops I have been provided via my employers in the last ten years to make the journey I have been on quantifiable.

Table 5: Initial Personal Contingent Leadership Paradigm

Personal Core Values	Family, Persistence, Integrity, Safety and Teamwork
Theoretical Underpinning	Manipulative Leadership Transactional Theory
Leadership Assumptions	Challenge the norm Deliver outcomes Execute the plan and deal with the fires
Guidelines	Customer value delivery Tactical- focused on delivering up to 12 months out Fire fighting to stakeholders' needs
Adaptive Behaviour	SF34 and Insights survey Performance review feedback Customer feedback

My initial Personal Contingent Leadership Paradigm was heavily dependent on my Personal Core Values, which had become instilled into my leadership organically over the last ten years, although the seeds for these values were initially planted when I entered the workforce. In reviewing these, it also became evident that these values closely align to my last two employer's values statements. While my experiences and development of these values is much more personalised (based on my practical experience) than those of my employers as global enterprises, it does show a convergence of thoughts as I have not actively or intentionally evolved my values. With this view in mind, it also challenges the roles of Personal Core Values in Leadership and their role.

The Theoretical Underpinning in my Personal Contingent Leadership Paradigm is the result of spending my career working in large, globally-matrix-structured organisations, which have evolved with my initial leadership approach being based in transactional leadership theory. The behaviours sought within these organisations were based on creating a climate based on rewards and praises in exchange for alignment and compliance to the organisation's objectives (Hoandra, 2017, p. 59). This can be further aggregated into a manipulative style of leadership that is commonly nurtured in large organisations (Byrt, 1978, p. 176), where decisions are approached through consensus with wider cross functional groups.

This results in no-one having complete autonomy in their role, tending to be linked together in their work by technology and management systems requiring many individuals to move together in the same direction to make progress (Kotter J. P., 2011, p. 47). The need to negotiate and bargain with internal business units to deliver results that I am accountable for, has led to a transactional approach to my leadership style where influence is a core skill to deliver the desired business needs. Manipulative and transactional leadership theories, as an underpinning, are also supported with a technical background in my experience, as deep subject knowledge is leveraged as a core negotiating tool.

A summation of my Personal Core Values and Theoretical Underpinning is in how tactical my leadership assumptions are focused on fixing issues quickly and dealing with the collateral implications as more information comes to hand resulting from the decision. This type of mindset is a core pillar within the mining industry as 'tonnes moved safely pays the bills'; with customers operating mines having this culture as a historical legacy of operations prior to the wide adoption of technology. Although this is a very reactive approach to leadership, with short-term focus and has a direct impact on the satisfaction of the personnel involved, the outcomes delivered support the short-term production outcomes sought.

The shortfall of my approach is many technical iterations of decisions that are made quickly so the true root cause of an issue may never be exposed, and it challenges relationships on site as the requirement to change items quickly can counter what other business units are trying to achieve. Due to the environment created, it can be conducive to 'group think' where like minds are continually working together to overcome the issues faced.

Proposed Personal Contingent Leadership Paradigm

After considerable self-reflection, ongoing review during the first four modules of the DBL and the research conducted in this Critique, I was able to establish a proposed Personal Contingent Leadership Paradigm that will enable my capability as a leader to grow, delivering the outcomes I need with the rapid adoption of technology in mining.

A pivotal piece of work that qualified the creation of my proposed Personal Contingent Leadership Paradigm was the strategic arena process shown in Appendix N, that I conducted in module DBL704, allowing me to concisely map the supply and demand systems, emerging issues, uncertainties and future scenarios. This body of work provided a methodical review of what the next ten years may hold in the mining industry sector and the challenges that we may be faced with a degree of certainty forming a foundation. The use of this process was pivotal to changing the logic applied to my personal leadership requirements when coupled with the research work in this Critique. For comparison purposes, Table 6 was compiled to show where my initial and

proposed Personal Contingent Leadership Paradigm has evolved, after incorporating the findings from the research conducted in this critique and the Leadership Portfolio developed in parallel with this work.

Table 6**:** Personal Contingent Leadership (PCL) Paradigm Comparison

	Initial PCL Paradigm	**Proposed PCL Paradigm**
Personal Core Values	Family, Persistence, Integrity, Safety and Teamwork	Family, Persistence, Innovation, Safety and Teamwork
Theoretical Underpinning	Manipulative Leadership Transactional Theory	Systems Based Theories Adaptive Leadership
Leadership Assumptions	Challenge the norm Deliver outcomes Execute the plan and deal with the fires	Challenge the norm, rupture stereotypes Business opportunities vs. risk profile Systems Thinking
Guidelines	Customer value delivery Tactical- focused on delivering up to 12 months out Fire fighting to stakeholders needs	Customer value delivery Move to strategic actions from tactical Systemic thinking to stakeholders Commercial risk and principles
Adaptive Behaviour	SF34 and Insights survey Performance review feedback Customer feedback	Fixed feedback loops (SF34 & Insights) Adaptive spiral inputs and review Grow external feedback loops

The green items in Table 6 represent the significant departures from my initial paradigm that centre on developing innovation as a core value, shifting to a theoretical underpinning of visionary and adaptive leadership to account from my present and future circumstances. This reflection has also had an impact on my leadership assumptions as I seek to move from tactical execution by using system thinking as a tool to establish an understanding of the challenges at hand, weigh off the opportunity versus the risk and rupture stereo types that restrain the organisation from the required change.

My guidelines are reflective of these fundamental changes and establishing the behaviours that will support this change, based on the findings of the research conducted in this Critique. To enable my adaptive behaviours, I have ascertained that I

will also need to grow my formal feedback loops to those outside of my network already in this field in other businesses, as a steward for introducing autonomous machinery to other industries, but also to help challenge my enterprise centric views. There is also an implied dependency of this work on the company I am working for being able to accommodate these changes.

There is significant business risk entailed with not changing and continuing to grow my leadership approach gradually without a defined purpose, which would only see incremental change on my initial Personal Contingent Leadership Paradigm. This risk could result in a failed autonomous vehicle project causing irreparable brand damage for Caterpillar mining technologies and impacting the livelihoods of the personnel involved in the worst-case scenario. The personal toll would also be significant, as I would not be able to develop others through my learning from this Critique and evolve with purpose that has been developed through this body of work.

This evolution does not seek to have a binary outcome; it is concentrated on establishing a set of leadership practice guidelines, coupled with the proposed Personal Contingent Leadership Paradigm to provide the 'purpose' context for my ongoing leadership evolution. A core piece to this work is to share my learnings from this Critique within my organisation so we can establish a valid understanding of the changes we are faced with implementing and operating within complex adaptive systems on mines with our customers and the flow on effects to our business model. There is an inter-dependency from this finding for change; within Caterpillar, customers and in time across the mining sector.

Chapter 7: Leadership Practice Guidelines

Progressing from the work in Chapter 2 on leadership theory, coupled with the case research in Chapter 5 and subsequent personal leadership paradigm in Chapter 6, this chapter is centred on providing a set of guidelines for the practical application of these pieces of work when overlaid with each other. By utilising a foundational understanding of leadership theory, coupled with longitudinal case study research, a desired Personal Contingent Leadership Paradigm was created. The leadership practice guidelines embody my Personal Contingent Leadership Paradigm, providing a construct to apply these findings to my everyday leadership, evolving with purpose and adapting over time to remain relevant in my career path.

This chapter commences with a brief methodology from learning theory and how these guidelines will be adapted into practice, so they can be sustained over time. There is a progression to the practise guidelines that have been structured around Framework 2 in the elements on vision, influence and ethics. The guidelines have been structured towards interactions between people and situations (e.g. challenges, issues) that are derived towards the adoption of technology in the mining sector. Each guideline will incorporate a present example of how it will be applied in practice that relates to my current role, as outlined in Chapter 5. “Leadership often involves challenging people to live up to their words, to close the gap between their espoused values and their actual behaviour” (Heifetz & Linsky, 2004). This necessitates the need for self-awareness and the ability to challenge others consistently through these guidelines.

Learning Methodology

The underlying requirement of this research and Critique is the learning opportunity generated from this work that must be accommodated in the resulting leadership practice guidelines, coupled with the research methodology and theory to encompass a learning process that allows for another dimension to be considered in the formation of the practice guidelines. To provide longevity to the practice guidelines that can be applied over a decade, there is a requirement to have formal and informal feedback loops to continually validate the long-term objectives and suitability of these in a

changing environment. The Caterpillar learning philosophy is that 10% of learning comes from formal education, 30% from coaching and mentoring, and 60% through experiences on the job. This case research method provided the ability to combine all these elements together and critically reflect on historical experiences.

Kolb (1984, p. 38) provided a working definition of learning from his initial work with "Learning is the process whereby knowledge is created through the transformation of experience". Expanding on this definition Kolb & Kolb (2008, pp. 2-3) defined experiential learning theory "as a dynamic view of learning based on a learning cycle driven by the resolution of the dual dialectics of action/reflection and experience/abstraction" that is applicable in business and more broadly in life. There is direct alignment between experiential learning theory and the leadership practice guidelines in this chapter, as they will be practically applied day to day in the working environment. By adopting Kayes (2002) experiential learning cycle in Figure 11 with the leadership practice guidelines at the core, the evolution of learning begins with experience and continues in a virtuous cycle. As managers resolve the dialectal tensions in each process step, they progress their way around the experiential learning cycle (Kayes, 2002, p. 140).

Figure 11: Experiential learning coupled with leadership practice guidelines.

Adapted from (Kayes, 2002, p. 140)

The experiential learning cycle will form the basis of the adaptive behaviours outlined in the proposed Personal Contingent Leadership Paradigm and by adding the dimension of time to this model, it will sustain my adaptive spiral. The intent of this approach is to continually widen my leadership capabilities and behaviours over time through experience, observation, concept and experimentation to remain relevant in my chosen pursuits in life and business. The principal element to achieving this are reflected in the following leadership practice guidelines that will guide decisions, actions and behaviours.

Vision

Vision was summarised as the strategic position beyond routine managerial tasks and administration, towards the future in the case research. The importance of having a vision for the objectives at hand was identified during the case research, revealing how critical to success a well-communicated coherent vision was. The feedback from survey respondents on the need for this element with the implementation of autonomous machinery was decisive and the following guidelines have been constructed to develop the vision element and assist with the delivery of the vision.

1. **Manage Self:**

   The most critical leadership practice guideline is 'manage-self', which is formed on the basis of self-awareness and personal health. This guideline has a symbiotic relationship with reflection and abstract from the experiential learning cycle underpinning the importance of this guideline that must be sustained, as it is the base dependency to the influence element.

   Working within a complex adaptive system with adaptive challenges that emerge and over time create an abnormal degree of disequilibrium results in a high-pressure environment that has an elevated level of stress and eustress. Moderating the disequilibrium within the productive zone of disequilibrium is necessary to avoid distress and resulting degradation of behaviours. To apply leadership in this environment requires that psychical and mental health are maintained proactively to prevent illness or the emergence of unbecoming behaviours and actions. This

closely aligns to the personal core values of family, safety and teamwork which are all interdependent on leading by example, living the espoused Personal Contingent Leadership Paradigm and delivering these guidelines. There is always additional work and new priorities with which to be dealt, which (if unmanaged) can overload mental capacity resulting in attention deficit trait, inhibiting a leader from clarifying priorities, making smart decisions and managing their time (Hallowell, 2010, pp. 79-81). The critical point here is acting by managing time to set aside periods for activities that support psychical and mental health. Not following this guideline over time may jeopardise the desired outcomes of objectives of the leader's credibility by continuing in a sub-optimal psychical or mental condition.

The case research exposed the critical nature of diagnosing a situation that is evolving with the adoption of technology in the mining sector. Taking this down to a micro level, there is also a need to diagnose the intentions of others in formal and informal interactions to comprehend their function in the situation. This is the fundamental basis of being self-aware, understanding what is really driving others' actions and behaviours before acting or giving in to temptation, which destroys the capacity to lead (Heifetz & Linsky, 2017, pp. 166-167).

Cases 3 and 4 revealed the multidimensional complexities of implementing autonomous machinery into mining and having four parties delivering on a single project overlays another dimension of personal needs and wants. To use Heifetz and Linsky's (2017, pp. 62-64) metaphor of moving to the balcony from the dance floor, the ability to lead in this environment requires the skill of being able to understand what the intentions are behind the interaction, stepping back from the immediate interface. Acknowledging that you cannot be in two places at once, this is moreover about stepping back from the verbal interaction to assess behaviours, body language, relationships and motivations that underlie the interaction.

Applying this logic may appear superficial on the surface, although when faced with an adaptive issue, it is a critical point to avoid jumping to a technical resolution or mis-diagnosing the situation. By taking time to distil these elements, various

perspectives are then accounted for, allowing for a more holistic decision logic to be applied that accounts for multiple future states beyond the direct interaction. This helps lower the disequilibrium resulting from change as more scenarios are interpreted and the likelihood of applying a technical fix that will result in re-work, and the increased pressure created is avoided. This also correlates to the complex adaptive system elements of emergent behaviour, autonomy of agents and self-organisation; as these elements ripen to a point to emergence, there must be a holistic systems view applied, instead of dealing with the elements in isolation.

The summation of these elements towards 'manage self' is in emotional intelligence, with self-awareness, empathy, rapport with others and external temperament being clearly linked to leadership performance (Goleman, Boyatzis, & McKee, 2010, pp. 171-175). Soliciting feedback on my own emotions is an ongoing process in leadership to attain information on how I am perceived, and the extremities of perception from behaviours that provides a more grounded position from which to experiment. By 'managing self', I can directly impact the climate created from my actions and behaviours to those I engage with directly in interactions, and indirectly to those affected. By exhibiting an optimistic persona and behaviours that match the situation at hand, it has been shown that this logically flows onto the team involved and nurtures a positive climate (Goleman, Boyatzis, & McKee, 2010, p. 178).

In Practice:

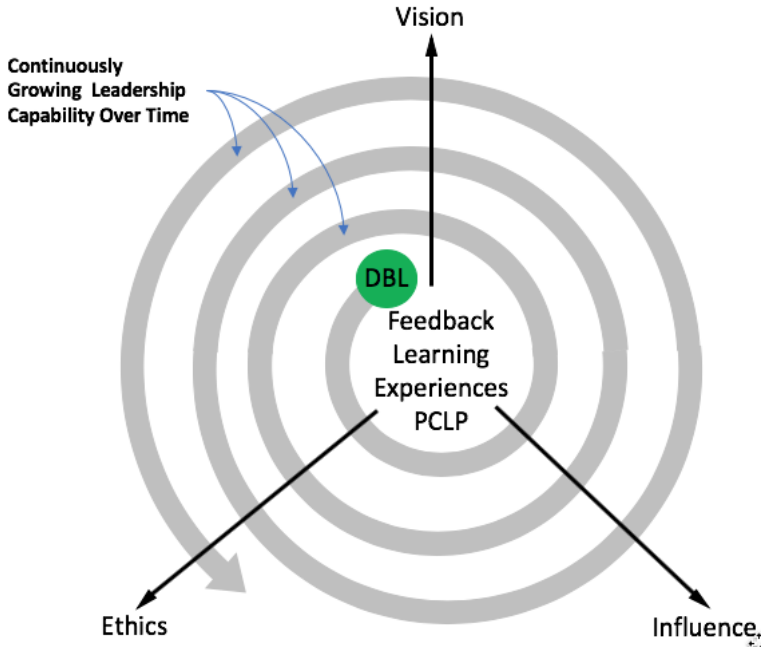
I. Plan time to exercise three times per week, eat a balanced diet and meditate. Meditation provides a means to 'get on the balcony' and reflect on my development contemplating Kegan's Theory of Adult Development through Morad's (2017) elucidation. Reflect on my actions and recognise behaviours that are resulting from stress or fatigue; such as irritability, low compassion in a given circumstance or reduced patience with people (O'Malley & Cebula, 2015, pp. 98-99). Heed these early warning signs and manage time to accommodate personal requirements to be mentally and psychically healthy.

II. Take time to consciously pause mentally in complex situations, step back from the 'heat of battle' to establish what is at stake for those involved on a personal level. Avoid the pressure being applied by groups faced with adaptive stress and seeking those in authority to solve the problem they perceive to be the cause (Heifetz & Linsky, 2017, p. 71). Before responding or acting, take time to use the available data, observe the situation and methodically apply a ladder of inference, a system thinking tool to diagnose the situation (Ayers, 2002, pp. 290-293). As a secondary tool in rapidly revolving situations with limited time, apply a coherence test to the information and facts at hand. Thereafter, respond to the situation in a collected format.

III. Beyond the short-term business needs, establish my present action logic based on the work of Rooke and Torbert (2011, pp. 139-145), through and external provider. Use this formal feedback loop to support my self-awareness and provide a consistent methodology to evolve with over time that is independent from my employer.

IV. Maintain a self-adaptive spiral for my leadership development (visualised in Figure 12), seeking regular informal feedback through specific inquiry after situations from a broad range of attendees in a systematic and unsystematic manner. Couple these informal feedback loops with formal feedbacks loops such as the employee opinion survey and making great leaders from Chapter 3. Critically reflect on these elements on a monthly basis, to ensure I am living what I espouse from this work, making small experiments to gauge progress with this feedback towards growing leadership capability with purpose. Never lose sight of the need for feedback to sustain self-awareness and critical reflection on behaviours.

Figure 12: Self adaptive leadership spiral, with the leadership practice guidelines applied over time growing leadership capability.



2. Grow and Embrace Change:

Change has been a consistent element exhibited through the case research in Chapter 5 and will continue to be with the expansion of autonomous machinery in mining and other industry sectors into the future. There is a significant opportunity to grow leadership capability, coach and mentor personnel through the experiences when coupled with experiential learning in this situation. As the case research revealed, this change cannot be directed top down and must be enabled to occur bottom up with adaptive challenges; within the boundaries of a complex adaptive system. In a study conducted by Beer, Eisenstat and Spector (2011, p. 180) they established that leaders in this environment focused on creating a climate for change, then communicated these lessons of success or failure to enable the organisation to progress. By design, this enables the fulfilment of a corporate vision through the ability to apply innovative solutions.

Clearly diagnosing the challenges at hand, and differentiating between technical or adaptive in these situations, is a fundamental leadership requirement as it directly impacts the level of disequilibrium that results. To enable change to occur with the technology adoption in the mining sector (and not at the sacrifice of one's career),

change supporters and stakeholders must be uncovered and engaged prior to acting on the change. By utilising the following questions from Heifetz (1994, pp. 258-262) the complexity of the change can be surfaced through evaluating methods to regulate the disequilibrium incurred, and advocates in support of the change identified:

- *What are the characteristic responses of those faced with the change; on future direction, external threats, breaking norms (etc.)?*
- *When, in the past, has similar distress appeared at breaking point with the system? Did it become destructive in this context?*
- *What are the work, and work avoidance patterns?*
- *What mechanisms to regulate distress are currently within my control?*

I would position that these questions are necessary with planned and unplanned change as the progression of the circumstances occur so rapidly that the responses to the questions morph over time. To constructively direct the change and create a climate where personnel are willing to answer these questions, the capacity to 'manage self', while diagnosing the system, is imperative. Interpreting how to regulate the disequilibrium after observation then requires the accountabilities of the team to be lowered from a purely technical foundation to allow experimentation to thrive. The cases revealed this was done in pockets, although not consistently across the department. To enable the rate of change required, I must nurture these behaviours consistently across my leadership span and energise others to take on these challenges.

In Practice:

I. Create a climate where change is enabled through experimentation to resolve issues faced and unknowns, with lessons shared concisely in a common format. Lower the tactical and technical focus on annual goals in performance reviews for team members faced with adaptive challenges and provide recognition of success and failures (with documented lessons learnt) as a visible behaviour in front of those working in this environment. Apply the recognition equally internally within Caterpillar, and externally

with customers and business partners, to ripen the situations in a stable manner.

II. Identify and engage the proponents of significant adaptive changes; stakeholders and sponsors that are willing to support the change, understanding their role in doing so. Constructively challenge the organisational culture on the broad use of decision-making by consensus and total alignment. Communicate observations and situational diagnosis to sponsors outlining a 'map' of the next steps to progress the change and test coherence of decisions before dispersal.

III. Evaluate change proactively as a mechanism to provide learning experiences to grow team members' and my own capabilities, then tailor coaching or mentoring for individuals through these experiences. Maintain career plans with willing team members who are reviewed on a quarterly basis providing opportunities to develop with purpose. Take organisation structural changes as prospects to reconfigure work to activate team members' strengths and neutralise weaknesses by partnering team members with complementary strengths, where possible (Buckingham, 2011). Ensure change provides opportunities for growth and conversely establishes resilience through the industry cycles.

3. Communication:

All the leadership practice guidelines within this Critique are intertwined by multiple factors, although the most consistent across all guidelines is the need for effective communication to facilitate relationships. Having a globally-dispersed workforce, working within a complex adaptive system with a high number of adaptive changes, has greatly reduced the ability to have direct 'in person' interactions with subordinates, customers and business partners. This has led to my leadership being dependent on written and verbal communication utilising technologies to bridge the distance, ideally with video conference, although more regularly through phone calls. As the written and verbal behaviours were demonstrated in the cases, I have deduced (through self-reflection) that there is an

opportunity to expand my listening skills from 'listening to respond' to a more cognitive level when diagnosing challenges.

Breaking down the listening process as a behaviour into a set of steps at a macro level, there is a pre-interaction, interaction and post interaction that allow for the information that was heard to be processed. The research work of Halone and Pecchioni created a theoretical model for relational listening, (2001, pp. 65-67) and expanding the interaction piece of the listening process to a micro level as displayed in Table 7. By applying this theory to listening as a relational process, the supporting behaviours and actions are surfaced that correlate directly to these leadership practice guidelines. To truly enact leadership within the context of my role and accountabilities, I need to cultivate the cognitive elements of listening to avoid responding to the technical or 'obvious' portions of the interaction, and establish an appreciation for what is really being discussed or asked.

Table 7: Theoretical Model of Relational Listening

Micro-Level Processes		
Cognitive	*Affective*	*Behavioural*
• To understand • To pay attention • To absorb • To comprehend • To get the meaning • To see it from their view • To know what they mean • To focus/process • To concentrate • To interpret • To consider • To evaluate • To not judge • To assimilate	• To sympathise • To empathise • To care • To listen with your heart	*Verbal* • To (not) give advice • To (not) give opinion • To ask questions • To tell them how you feel. *Interactive* • To help • To problem-solve • To listen to feelings • To show interest *Non-Verbal* (if physically there) • Make eye contact • Silence • Acknowledgement

Adapted from (Halone & Pecchioni, 2001, p. 66)

The effective and behaviour elements were identified as strengths through feedback, and self-reflection on my leadership behaviours, providing that I was aligned at the cognitive commencement of the process. Clear and concise communication is an imperative in today's world that is complicated by the number of mediums that are available (e.g. Email, social media, messaging, video conference, phone calls, etc.) and the strategies to use them which can be conflicted by cultural boundaries. However, I position that by having a strong foundational capability of listening, when coupled with verbal and written communication, is a more critical set of leadership behaviours and capabilities, than the decision path to choose which media to use to communicate. This prioritisation also relates to the nondisclosure provisions that customers and business partners dictate when undertaking projects with autonomous machinery.

In Practice:

I. Taking from Heifetz and Linsky's (2017, p. 55) metaphor "listen to the song beneath the words". Apply a cognitive filter to the interaction thinking through what is at stake, the climate within the stakeholder group and the contributing needs and wants while forming a reply. Understand the context to the key words in the communication and the application of these to expose the requirements and map out the decision logic applied to these in order of priority. This will reduce time spent trying to establish the context of communication, and what may be the basis underlying the communication.

II. When listening in a verbal exchange, consciously take a pause prior to responding; in cases that are being diagnosed or where the relationship is in its infancy, apply a ladder of inference to distil a pragmatic response. Avoid responding to the technical portion of the communication at the sacrifice of the adaptive or social portions that may have created the need for the communication. Introduce this in established governance sessions and seek feedback with peer group and customers individually to ensure that this is having the desired impact.

Influence

Influence was summarised as the ability to steer and direct efforts internally and externally to deliver the desired outcomes with resources outside of my direct span of control in the case research. Once the vision leadership practice guidelines are embedded, expanding beyond these requires the influence element to mobilise people to tackle tough or adaptive challenges and thrive while doing so (Heifetz, Grashow, & Linsky, 2009, p. 14). Continuing to innovate within the mining technology sector requires an investment in the personnel, once the climate to make such change is created and ensure the composition of the team is sustained through the evolution of the projects (Kanter, 2011, pp. 127-128).

4. **Inspire others:**

   To sustain and cultivate the team's growth with the technology opportunities presented, while overcoming the new challenges faced with this growth, requires the leadership approach to inspire the team on their membership. There are defined management and technical training plans within Caterpillar that are structured to the team member's career plan. Although, from the survey, a clear finding was that there is a gap with the educational opportunities provided and purposed through development of others. I value the relationship I have been able to create internally and externally in the mining industry over my career. From this research and through induction, I have realised the growing importance of these relationships over the last four and half years towards achieving desired outcomes.

   Portraying a vision such as 'creating a fully autonomous mine with humans in the mining operation' is easy to articulate. However, constructing a cross-functional team that is inspired to achieve this is a leadership challenge. The technical challenge will be insignificant when compared to the adaptive challenges that will arise when creating this level of system and the sustained disequilibrium over time. Creating a climate that is conducive to experimentation or 'fast failure', learning and moving on quickly is only half of the formula towards establishing engagement by those involved. Inspiring those to take the inevitable challenges was revealed in Case 4 with the requirement for duplicating knowledge and sharing expertise to

achieve global outcomes. The intrinsic element that was demonstrated in this case was that the adoption of autonomous machinery increased the volume of business units affected in each organisation.

To lead in this situation requires the ability to portray what has occurred in a transparent manner, which to date is mostly deduced from positive outcomes and not the deltas. Showing that we are on a journey leading the disruption of the industry also requires the humility to talk through outcomes that were not desirable in an open forum and share experiences and feelings towards this outcome. Furthermore, by behaving in this manner with internal and external parties in a similar manner for the positives and deltas, enables the establishment of a collective purpose towards change. Celebrating the little wins with team members who achieved them and recognising their efforts is fundamental to this change.

In Practice:

I. Take on the role of sharing the deltas for our current experiences, making them personable and the learnings from them tangible down to a functional role level in the business. Use an informal story-telling method to communicate to the team via video and tele-conference so the behaviours and outcomes are shared in a timely manner. Support the same from team members in regard to the positive outcomes in the same forum and format and give praise for their efforts in both scenarios. Answer questions in both scenarios openly, without prepared question and answer statements and align the conclusions to the present goals/desired outcomes that are being targeted.

II. Identify the cross functional teams (interconnected agents) that will be involved at the onset of a project or adaptive challenge and map these out visually taking time to review, as time progresses. Create collective purpose across the team by explaining their contribution towards the vision and the breadth of disruption this enables. Where possible, build momentum by inviting the teams to dream about a concept and contribute to a shared

vision of where the technology will lead the mining sector (O'Malley & Cebula, 2015, pp. 142-144). This does not mean total agreement on all items; there will be challenges and working together with a common understanding enables these to be raised and encountered in the most effective manner.

5. **Meaningful Work:**

Within the complex adaptive system that has been created with the use of autonomous mining machinery, the self-organisation and co-evolution elements create a variability in the tasks. To continue to inspire others to on their work and contribution in this evolving environment for a sustainable period, will require that the work is viewed as meaningful with a sense of pride in contribution. A degree of the employee turnover from the case study work was resulting from team members feeling they were not contributing to the 'enterprise' or project specific vision. In addition to this, the work became more challenging without the realisation (intentional or otherwise) and re-distribution of the work thereafter, based on the team's capabilities, was required. This is related to the inherent nature of the challenges being adaptive and co-evolution of the systems and personnel faced with the challenge without formal task analysis methods applied.

Leading in this environment requires that I ripen the situation to a point where it is understood, and initial steps forward are created; unlike a technical issue, an adaptive issue cannot be solved by hierarchy alone (O'Malley & Cebula, 2015, p. 173). As the issued is ripened, there is a need to assign the work to team members who are capable of taking it on and intentionally provide it to some of the team as a 'stretch' goal to proactively grow their capability through experiential learning. Assigning work cannot be a 'set and forget' task through hierarchy; the leadership elements of this approach are the ability to observe the situation and intervene skilfully (Heifetz & Linsky, 2017, pp. 134-135).

The behaviour to support meaningful work is based on showing interest in the work, regular interactions and supporting those doing the work directly, and

indirectly by removing obstacles to their progress. It is also necessary to show team members that their contribution goes beyond their job and in many cases has a global effect within the industry beyond their specific project. Making the work meaningful is about engaging the team at a level that gets their psychological 'buy-in' to the project and recognition of their contribution. In reviewing Malandro's (2009, pp. 236-241) five levels of alignment in Table 8, 'buy-in' can be expanded to a contextual level, proving a tangible manner to evaluate what is sought by inspiring others and providing meaningful work to align their efforts to the work at hand.

Table 8: The Five Levels of Alignment

Level	**Title**	**Example**
1	Resigned (not aligned)	"I am resigned about…."
2	Concerned (not aligned)	"I am concerned about…."
3	Complying (not aligned)	"I am going along with the decision because…."
4	Intellectually committed (partially aligned)	"I am only intellectually committed because…."
5	Emotionally and intellectually committed (fully aligned)	"I am fully on board and I am not holding anything back."

Adapted from (Malandro, 2009, p. 236)

Team members who have progressed through Cases 3 and 4, and completed the surveys, are in levels four and five, while the new team members who have come on board in Case 4 (and after) are in levels two to four. Level one concerns have not been evidenced, although level two shows new team members are concerned with unintended consequences and insufficient resources. This is a natural position to start from when entering this business unit. Building through these levels is dependent on building trust, providing an accommodating climate and showing that the work is meaningful to the team. Level five represents that through alignment the individual has a high level of pride in their work, which is the desired state for those involved in these projects.

In Practice:

I. Identify challenging work as it arises, providing guidance to season it and then assign the work based on capability (not organisation design) with stretch targets. Regularly communicate the importance of this work to the business unit and to the enterprise vision, ensuring that the external impacts, such as social perception and industry sector, are appreciated by the team as their contribution, beyond their role. Give recognition and reward in relation to these tasks fostering pride in the team's work.

II. Establish where team members are with their alignment to the tasks at hand based on Malandro's (2009) five levels, and work with the team through action one above to progress their 'buy-in'. Acknowledge that not everyone will reach level five alignment when faced with the disruption that the introduction of autonomous machinery is creating and that level four over time is acceptable.

6. Customer Focus:

To continue to be relevant and aligned to industry needs, a leader in this environment must have a concentration on understanding external customer needs firstly, and then internal customers' needs subserviently. A finding from the case research was that when the technology was aligned to the customers' needs and technically possible, adoption of the technology increased with customers at a compounding rate year over year. The source of competitive advantage over time for a corporation such as Caterpillar is in its ability to consolidate corporate wide technologies and production skills into competencies that empower customers to adapt quickly to changing opportunities (Prahalad & Hamel, 2011, p. 225). To sustain this (and not become focused on short term objectives) a focus on customer needs – present and into the future – is essential.

A significant observation from this work is that the focus on customers (internal and external) cannot be made at the sacrifice of the personnel who are executing the work. It is imperative that those who have been engaged with the external customer in other business segments be brought into and 'given a voice' in the

disruption. The five prior leadership practice guidelines are predicated on this guideline and also on developing capability to deliver the change that is centred on self-development and those involved in these projects to sustain the behaviours required to deliver the desired outcomes. This also encompasses my leadership assumption that there is an ongoing need to rupture stereotypes and challenge the norms to remain at the forefront as a leader with technology adoption.

An integral part of this practice guideline is delivering on commitments of all parties involved with a bias towards the entity that is 'paying the bills'. There is a need to avoid applying a deadline and then directing the work at a micro level that has been evidenced by making great leaders' feedback in Chapter 3. The pace-setting behaviours I exhibit for the work need to be focused on progress, as opposed to the management of a time to a dead line. This will enable the communication of progress to the parties involved, along with experiments and creative avenues to be explored, while accounting for a delivery of the vision driven by a consistent cadence.

This may be contested as a sub-set of servant leadership (relational based theories, Table 1). I would argue this position, as I will take an active role in establishing the needs and requirements with customers, then work on these with the broader team, not being subservient to the team. Understanding external customer requirements is a fundamental requirement to being able to influence the future direction and strategy of the enterprise. Focusing on customer needs externally will also facilitate building a level of resilience with internal customers as they come to understand and appreciate the cyclic nature of the mining sector that is driven by commodity price. These cycles also dictate what external customers view as 'valuable to their business', especially in a trough requiring sorting of the 'nice to haves' from the 'must haves' to remain in business.

In Practice:

I. Distil requirements clearly, partnering with internal and external customers to deliver the desired outcomes sought in a sustainable manner. Use the requirements to grow the organisation's knowledge of mining customers' business cycles and needs, growing our expertise aligned to inspiring others and meaningful work. Filter these requirements to further understand potential and future industry trends on the leading edge of adoption and develop personnel's capabilities to support these as the trend matures.

II. Be biased towards delivering on our commitments by applying systems thinking through the use of dynamic and structural thinking tools (Kim, 2000, p. 10) to be pre-emptive with expectations. Grow organisational understanding of systems thinking tools to shift away from 'fire-fighting' using a common methodology and terminology across my business unit. Lead by example in deploying these tools so they are seen in action and understood, based on their merit and not a top down edict.

Ethics

Ethics was summarised as the moral and values-based principles that guide my actions in the case research. This element is also heavily overlaid with my personal core values from my desired Personal Contingent Leadership Paradigm that forms the basis of this guideline. There is also an ethical imperative to improve the perception of the mining industry through the adoption of technology to reduce the environmental impact, improve safety, reduce waste and increase workforce diversity. Today the resources being mined are required to improve and sustain the standards of living being sought around the world, although the impact of achieving this has risen as a social focus over the last decade. As a leader in this industry, it is vital to commit to improving the legacy this industry creates and will leave into the future sustainability.

7. **Social awareness:**

   To improve the social awareness around mining technology, with autonomous machinery as an example there is a requirement to release more facts around the achievements to date that go beyond what is publicly available with production

information. In lieu of this, the argument for moving to autonomous machinery centres on the removal of machinery operators which is a fact, although what is not evident is the percentage of how many are up-skilled to a new role or cross-trained into another function. Removing operators from truck cabins takes them out of a high-risk environment within the mine, lowering the potential of serious injury or loss of life, allowing them to pursue lower risk alternatives for work.

The use of factual information to show the benefits of technology adaption with new job opportunities, lower safety incidents and environmental impact will shift awareness from being myopically focused by the media on job losses. The Australian Government has established, through a research project, that technology in general will drive economic growth, transform the workforce, can be leveraged for social and economic benefit and must be planned for on the future horizon of 5 - 15 years (Williamson, Raghnaill, Douglas, & Sanchez, 2015, pp. 8-11). This report misses what has been achieved in Australia with the mining industry that has the highest level of mobile machinery automation globally and is acknowledged widely as leading this transformation for the mining sector. However, the report from this research does acknowledge, as a finding, that "Attitudes towards technology do not always reflect behaviour. Effective government policy to encourage new technologies should reflect the different reasons people have for engaging with technology" (Williamson, Raghnaill, Douglas, & Sanchez, 2015, p. 32).

Being at the forefront, this technological change has challenged regulation, which occurred after the initial adoption and public perception to embrace this change in all regions in which it was introduced. My hypothesis is that this stems from not being exposed to autonomous cars in our everyday lives and the information that comes out of the automotive industry, flaring the media's attention when there are issues.

In Practice:

I. Lobby customers and mining industry forums to become proactive in supplying information on achievements beyond production and cost centric measures for shareholders. Now, with five years of data in hand, there is a means to compare the impacts of autonomous operations to traditional operations that needs to be disclosed publicly. There is a customer aversion to share this information as it is viewed as highly confidential and a source for competitive advantage with each mining company. Failure to take action will continue to be at odds with the adoption of technology and its benefits that can aid in improving the social perception of the mining sector.

II. Work to establish Caterpillar's transition as a manufacturing organisation that adopted automation in factories 30 years ago; and portray the learnings from this transition. While this information is dated and has far fewer complexities than the present autonomous machinery adoption, the social impacts at the time may be applicable to the present ones faced. This may present an opportunity to learn from the lessons of these transitions and how the social impact was handled.

8. Empowered Environment:

As a leader in this field there is a need to field the best team through the encouragement of diverse ideas that are heard and valued, along with the sharing and seeking of knowledge and empowerment to achieve the desired outcomes. The research revealed the low rate of gender diversity which is an inhibitor to fielding the best team available and also poses a risk to having 'group think', as previously identified. Upon further reflection and review, the ethnic diversity saw 22 nationalities represented in my business unit, although the demographic across these nationalities was male and largely between 30 to 60. I have concluded that there are two factors that have created this; Caterpillar's mid-western United States origin, and the mining industry as a whole being a male dominant industry.

As a whole, this has created a very masculine environment that is not tolerant of failure and struggles to deal with weakness which may been seen as backing down in a conflict, for example. This is particularly evident on the psychical mine sites as the work being undertaken is viewed to be psychically demanding, high pressured and suited to individual contributors. This has resulted in an engrained culture with low empathy, arrogance, 'too large to fail' attitude and a competitive streak that at times pits different groups in direct competition with one another. To an extent, there is also the existence of privileges that some viewed they are entitled to, based on their tenure, employment status, hierarchy in the organisation and gender. Caterpillar is not viewed as a technology company or tech savvy employer.

The introduction of this technology has provided a means to foster a less traditional mining culture, seeking to grow the gender diversity by leveraging the industry leading roles available. The 'stereotypical' machine operator is shifting from sitting in a truck or bulldozer for 12 hours a day to remotely operating these machines from the safe environment of an office and controlling multiple machines per person. This has seen the gender diversity on my team reach highs of 22%, although we have struggled with this situation, due to ongoing organisational changes (which I do not accept to be the cause).

To change social perception, field the best team with diverse thinking and deliver the desired outcomes from this work, it is imperative that gender diversity grows and is sustained. I will not put a target on gender diversity, as having a large engineering core competence in my team, we will achieve the target, although it will not be in a sustainable manner. The value of gender diversity comes in the form of a more diverse thought logic and set ideas being tabled to overcome technical or adaptive issues. This lowers the risk of 'group think', will see solutions to challenges faced vary and likely have a higher rate of success given the breadth of logic being applied. However, there is a limit to the advantages of gender diversity in high performing teams, as evidenced by the research of Delgado-Márquez, Castro, and Justo, (2017, p. 427) into the boundary conditions of gender

diversity in top teams. This state is not present in my team, nor has it become detrimental, as found in this research work due to the lower rate of diversity.

In Practice:

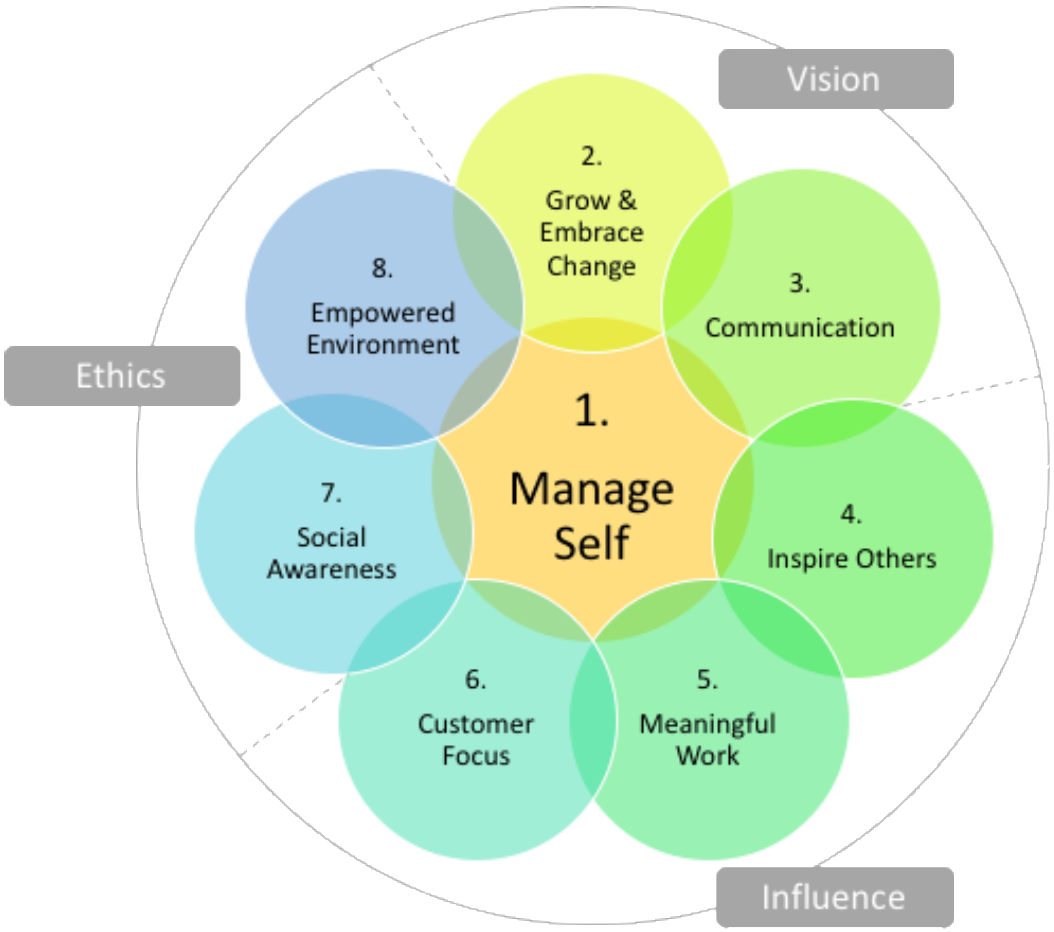
I. Foster participative decision-making exposing gender diverse team members to the mechanics of the situations and the underlying logic being applied (Delgado-Márquez, Castro, & Justo, 2017, pp. 437-438). This also builds the inclusiveness in the organisation and exhibits that there is a potential career path without isolating the female team members, as a minority in this masculine environment. Take time to conduct job shadowing with me and subordinates, providing a wider set of experiences to our existing and new female team members.

II. Review the gender equity for compensation within my team and ensure that it is consistent across the team with no gender-based variance. Align the performance reviews based on employee performance in those roles annually using the last two years of results and information for consistency. Remove unconscious bias from end of year performance reviews as a result by conducting consensus across my organisation and where possible anonymising personal identifiers.

III. With the introduction of new team members at entry level and at manager level, ensure that the gender diversity within my team grows for the right reasons. Seek out gender diverse candidates proactively through targeted approaches on LinkedIn, and the Women in Leadership organisation within Caterpillar. Participate in the interview process and ensure that we have an internal female participant from another business unit also attend the interviews and selection review. Change Caterpillar's image as a manufacturing employer to a technology driven employer that is demonstrating industry leading results.

In conclusion to this work with the leadership practice guidelines, Figure 13 was constructed as a visual representation, delivering a holistic view of the framework utilised with each guideline depicted. Critically all the guidelines centre around my ability to 'manage self', as this is an essential foundation for the guidelines and Personal Contingent Leadership Paradigm. The guidelines are interwoven into each other and fundamentally as a suite of eight, provide a complete model to grow my leadership capabilities, and behaviours overtime through self-awareness. In isolation, a single guideline would provide limited coverage for the leadership required in this sector, although as a suite they provide a far-reaching set of parameters to evolve within, and beyond.

Figure 13: Leadership Practice Guideline Visualisation



Chapter 8: Conclusions

The research conducted in this Critique revealed that the application of leadership with mining technology (when faced with a disruptive situation) was spontaneous beyond the portrayal of a vision. This was due to the nature of the challenge being faced, with technical issues being approached and dealt with on a tactical level as the processes, tools and knowledge to do so already existed. The majority of challenges became adaptive issues, with no clear process or tangible path to resolving them, so the leadership behaviours applied were spontaneous, as technical resolutions in this environment failed. A further complexity to this was identified in the research survey findings around the adaptability of the organisational culture not fostering these conversations or shared responsibility for the issues across internal business units.

The identification of these issues was a substantive finding that led to the incorporation of adaptive leadership theory underpinning the proposed Personal Contingent Leadership Paradigm. The research also revealed that 'leadership' cannot be codified into technology as a process or decision path, and that the requirement for leadership in this environment multiplies with the multidimensional complexity of the issues being faced. To overcome the adaptive issues in an organisation that is not akin to the solutions coming bottom up from those faced with the challenges, form the requirement for my leadership to influence the adaptability of the organisation over time.

The variable elements of People and Process have evolved organically through the adoption of technology with a growing rate of technology adoption over the last five years compounding with the implementation of autonomous machinery. Reviewing the systems in operation under these circumstances, the research and review established that the adoption of autonomous machinery becomes a complex adaptive system. The sum of the individual pieces does not equal the whole; this is due to the variables at play and there is a direct correlation with the adaptive issues that arise. In this atmosphere, the need for adaptive leadership within the complex adaptive systems construct is symbiotic to achieve the desired outcomes. It is acknowledged

that this finding is relevant at this point in time and as the technology matures this symbiotic relationship may change state and evolve or cease.

The adoption of a framework was deemed necessary in the construction of the research methodology. Although this work concluded and progressed into a survey, it also revealed the present framework has a limited durability, over time. Transitioning to the framework of vision, influence and ethics was established to provide the longevity required from this work and was tested through the use of a survey for validity. When developing a vision or innovative solution to issues faced, this framework also has applicability to align resources, process and systems. Therefore, it is not solely a theoretical construct for this Critique and is also provides a means to further evolve over time.

Leading in this progressing environment and staying relevant over time within the systems and constraints identified from this research, led to the creation of the leadership practice guidelines. The leadership behaviours and actions necessary to deliver the desired outcomes cannot be taught through ongoing education; they must be deduced and inferred through experiential learning. The leadership practice guidelines were formed to guide my actions and behaviours based on the research findings and supported by the construct of my proposed Personal Contingent Leadership Paradigm and self-adaptive leadership spiral. This is dependent on remaining self-aware and adapting over the coming decades with purpose, as technology drives the behaviours of the mining sector and identifying barriers to successful execution as they potentially arise.

There is a material business and personal risk to not applying the findings of this research that reveals the limitations of organically growing leadership capabilities in the field through osmosis when not supported by a theoretical underpinning. The business risk is the potential failure of an autonomous machinery project with significant commercial implications and potential irreversible brand damage in the mining sector. The personal risk is not failure in leadership; it is the risk of continuing to evolve without a defined purpose and becoming obsolete as the technology evolves

at a rate higher than personal development. This would consequently reduce job satisfaction, as I would no longer have the opportunity to coach and assist others in their development and growth.

The adoption of autonomous machinery will in time, stem into other industries once it becomes commercially viable to a point that it can be added to personal vehicles, transport and farming machinery. Until this time, the mining sector is the custodian of the change that this technology will yield and an early contributor to the regulation and practices being established to gain consistency in different regions of the world. Being at the forefront of this change, and contributing to leadership theory from being a practitioner, is a once-in-a-career opportunity that necessitates the highest level of leadership.

Contributions to leadership theory

This research and criteria have provided an inimitable body of work with the role of leadership with automated machinery in the mining sector being exposed. In the last five years, Caterpillar autonomous machinery (haulage trucks) have driven over 30,000,000 kilometres in surface mines on three continents and have shared many parallels with the future adoption of autonomous machinery or vehicles into other industries (e.g. Agriculture, transportation, energy, etc). This work forms the basis of understanding and appreciating the changes this evolution of technology holds for leadership theory and its practical application in the field.

By going beyond the theoretical testing of a technology's technical capabilities and concepts, to practical experience as evidenced in Cases 3 and 4, there is a pragmatic involvement underpinning this research. The mining sector has a growing rate of maturity with disruptive technology, such as automated mobile machinery through practical experience, and by researching the impacts of this change there is a tangible linkage to the impacts on leadership in this environment that can be applied in other industries, as they face similar disruption.

The establishment of a connection between complex adaptive systems and adaptive leadership is a unique contribution to the application of leadership theory. The majority of complex adaptive systems material that was attained by the researcher during this work centred on the medical industry and application in hospitals. The identification and existence of complex adaptive systems with automated machinery was an important finding, as it exposed the complexity that is incurred in numerous systems being integrated.

The emergence of adaptive challenges within the complex adaptive system drew a direct correlation between the two and necessitated the application adaptive leadership theory. Six of the seven elements of a complex adaptive system that Rzewksi (2015) identified are contributors to adaptive challenges with the seventh, being non-equilibrium (disequilibrium) considered the outcome of the interspersion of the initial six, when adaptive leadership theory is applied.

Limitations of Research and Opportunity for Further Research

There is inherently a limitation in this Critique with the case study being a qualitative research method, and the researcher working on case study material that has been provided and potential biases from this work. This risk has been dealt with through the design of the research methodology to reduce this to as low as practically possible with the following overview.

The initial research questions were refined from the leadership theory review in Chapter 2 to expose gaps that reside with technology adoption in the mining sector. The questions were also constructed on 'how' or 'why' based lines of inquiry, which are vital to case research with historical events. A selection criteria was developed for the case selection based on the work of Yin (1994) and Patton (1990) on case selection to ensure that the qualitative inquiry through case research was meaningful to the case questions, had consistent information and met the qualifying criteria represented in Appendix G. This work resulted in the initial nine cases identified being distilled to four, following the line of investigation.

In the early stages of the longitudinal case research design, the need for four cases to supply a basis for triangulation of findings was established to remove any potential bias and increase confidence in understanding the behaviours and actions that were taken. The use of triangulation also enabled the findings to be challenged before supporting theory was established and the further application of correspondence tests under a post positivism paradigm were applied. These tests provided verification and validation of the findings across historical cases that covered a period of eight years, and excluded personal opinion and emotion of the researcher.

From the case study research, there were several gaps identified that had insufficient data to be functionally used in the case and were identified as critical to this Critique, resulting in a survey of present incumbents in the mining technology sector to gain more qualitative and quantitate data. The survey methodology also led to the use of a critical realism paradigm with coherence and consensus tests to distil the findings from the material and supply additional insights, removing statistical bias from the small

number of respondents. This provided a richer level of information from the survey findings that was used to support the post positivism paradigm that was constructed on the initial case research methodology. The final filter to reduce unconscious bias from this research was the evaluation of the findings from the case research and survey. The following criteria was applied to obtain a consistent position for the research findings; construct validity, internal/external validity and reliability (Yin, 1994, p. 33).

With the core of the proposed Personal Contingent Leadership Paradigm centring on the use of adaptive leadership, it is recognised that, as with any leadership theory, there are limitations to adaptive leadership. The limitations were surfaced in the leadership theory literature review in Chapter 2 and have been used to strengthen the proposed leadership paradigm by coupling with other theories and behaviours. This stemmed into the resulting leadership practice guidelines, not seeking to avoid these limitations but acknowledging and accounting for them.

The use and advent of artificial intelligence (AI) has been excluded from this research as it is not being applied in the field of autonomous machinery in the mining sector; this statement excludes the use of analytics. If and when this occurs, there is a potential to conduct another line of research and inquiry into the effects on leadership in this environment understanding that AI will have significant impacts to the mining sector. The impact on complex adaptive systems that reside with automated machinery in operation on mine sites will have also matured in the future, and the distribution of adaptive challenges may differ at that time.

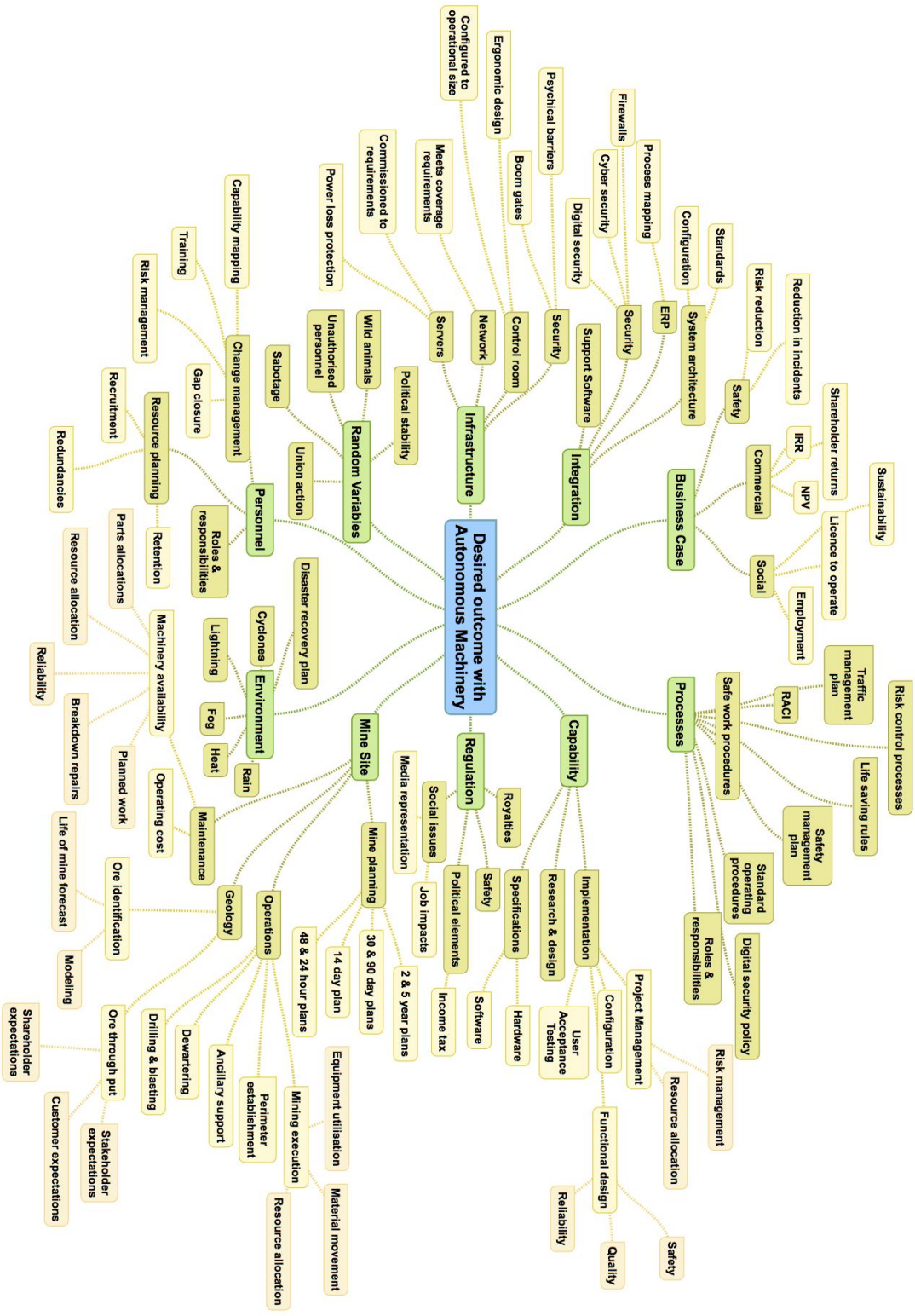
This future research could encompass the changes technology maturity may have on adaptive challenges and the social impacts on machinery utilising AI to make decisions that could impact the safety of personnel and the environment. This evolution would also provide a mechanism to review the correlation drawn from this Critique between adaptive leadership and complex adaptive systems. The transition of automation of machinery, as an engineering control system to one with ‘intelligence’, poses another lens to view leadership under and how this adoption occurs.

Appendices

Appendix A- Leadership History

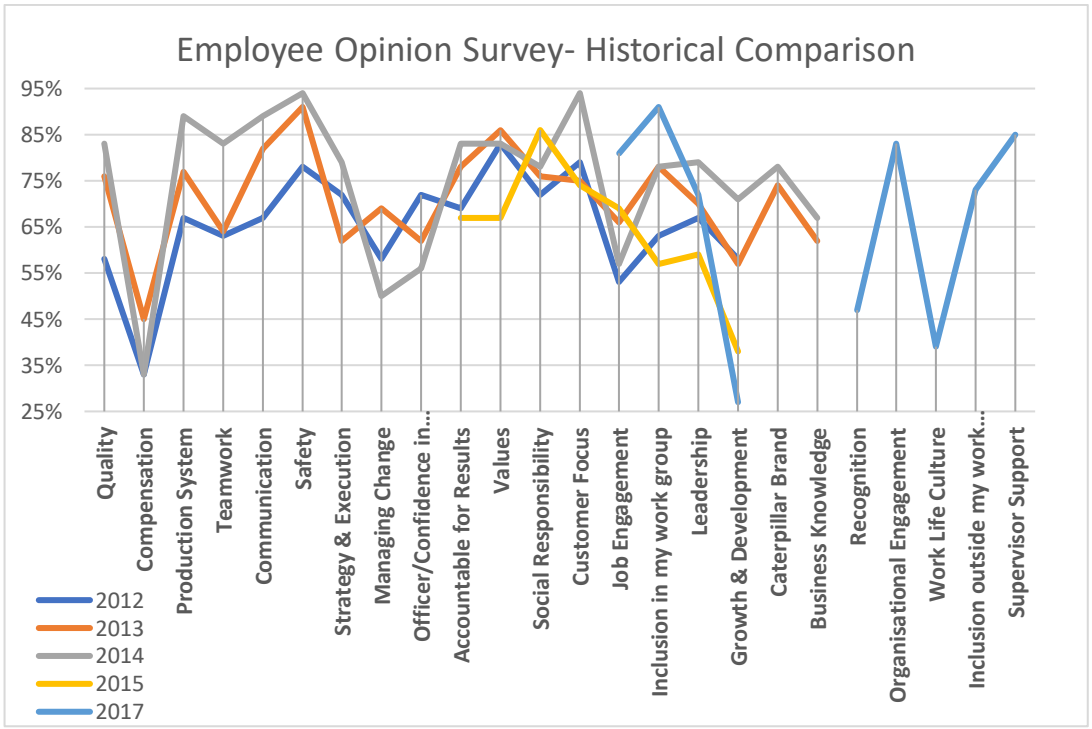
Role	Employer	Team Size	Duration	Term	Location
Global Operations Manager- Mining Technology	Caterpillar	70		Apr 2017 – Present	Perth Australia
Technology & Solutions Region Manager- Asia Pacific	Caterpillar	45 - 70	3 yrs 3 months	Jan 2014 – Mar 2017	Perth Australia
Product Support Manager- Western Canada	Caterpillar	8	1 yr 3 months	Oct 2012 – Dec 2013	Edmonton Canada
Service & Operations Manager- Canada	Caterpillar	140 - 195	1 yr 2 months	Aug 2011 – Sep 2012	Edmonton Canada
Service Manager- Canada	Bucyrus (now Caterpillar)	140 - 195	7 months	Jan 2011 – Jul 2011	Fort McMurray Canada
Western Branch Manager- Canada	Terex Mining (now Caterpillar)	45	1 yr 6 months	Jul 2009 – Dec 2010	Fort McMurray Canada
Maintenance Superintendent	Leighton Contractors	40 - 78	2 yrs 2 months	May 2007 – Jun 2009	Mackay Australia
Shovel & Drill Superintendent	Freeport-McMoran	80	6 months	Nov 2006 – Apr 2007	Papua Indonesia
Site Manager	Terex Mining	42	1 year	Nov 2005 – Oct 2006	Papua Indonesia

Appendix B- Desired Outcome with Autonomous Machinery Complexity Mapping



Appendix C- Historical Making Great Leaders Capability Comparison

Appendix D- Historical Employee Opinion Survey Results Comparison



Appendix E- Employee Opinion Survey in People, Process and Self Framework

		2012	2013	Year to Year Trend	2014	Year to Year Trend	2015	Year to Year Trend	2017	Year to Year Trend	Frist to Last Data Point
Self	**Teamwork**	63%	64%	1%	83%	19%					20%
	Communication	67%	82%	15%	89%	7%					22%
	Safety	78%	91%	13%	94%	3%					16%
	Strategy & Execution	72%	62%	-10%	79%	17%					7%
	Managing Change	58%	69%	11%	50%	-19%					-8%
	Accountable for Results	69%	78%	9%	83%	5%	67%	-16%			-2%
	Values	83%	86%	3%	83%	-3%	67%	-16%			-16%
	Job Engagement	53%	66%	13%	57%	-9%	69%	12%	81%	12%	28%
	Recognition	44%							47%		3%
	Supervisor Support								85%		
People	**Quality**	58%	76%	18%	83%	7%					25%
	Officer/Confidence in Company	72%	62%	-10%	56%	-6%					-16%
	Business Knowledge		62%		67%	5%					5%
	Social Responsibility	72%	76%	4%	78%	2%	86%	8%			14%
	Customer Focus	79%	75%	-4%	94%	19%	74%	-20%			-5%
	Inclusion in my work group	63%	78%	15%	78%	0%	57%	-21%	91%	34%	28%
	Leadership	67%	70%	3%	79%	9%	59%	-20%	72%	13%	5%
	Work Life Culture								39%		
	Inclusion outside my work group								73%		
Process	**Production System**	67%	77%	10%	89%	12%					22%
	Compensation	33%	45%	12%	33%	-12%					0%
	Caterpillar Brand		74%		78%	4%					
	Growth & Development	58%	57%	-1%	71%	14%	38%	-33%	27%	-11%	-31%
	Organisational Engagement								83%		

Appendix F- Employee Opinion Survey in Vision Influence and Ethics Framework

		2012	2013	Year to Year Trend	2014	Year to Year Trend	2015	Year to Year Trend	2017	Year to Year Trend	First to Last Data Point
Ethics	**Safety**	78%	91%	13%	94%	3%					16%
	Quality	58%	76%	18%	83%	7%					25%
	Social Responsibility	72%	76%	4%	78%	2%	86%	8%			14%
	Values	83%	86%	3%	83%	-3%	67%	-16%			-16%
	Work Life Culture								39%		
Influence	**Communication**	67%	82%	15%	89%	7%					22%
	Teamwork	63%	64%	1%	83%	19%					20%
	Business Knowledge		62%		67%	5%					5%
	Officer/Confidence in Company	72%	62%	-10%	56%	-6%					-16%
	Compensation	33%	45%	12%	33%	-12%					0%
	Accountable for Results	69%	78%	9%	83%	5%	67%	-16%			-2%
	Job Engagement	53%	66%	13%	57%	-9%	69%	12%	81%	12%	28%
	Recognition	44%							47%		3%
	Supervisor Support								85%		
	Organisational Engagement								83%		
	Inclusion outside my work group								73%		
Vision	**Strategy & Execution**	72%	62%	-10%	79%	17%					7%
	Production System	67%	77%	10%	89%	12%					22%
	Managing Change	58%	69%	11%	50%	-19%					-8%
	Caterpillar Brand		74%		78%	4%					
	Customer Focus	79%	75%	-4%	94%	19%	74%	-20%			-5%
	Inclusion in my work group	63%	78%	15%	78%	0%	57%	-21%	91%	34%	28%
	Leadership	67%	70%	3%	79%	9%	59%	-20%	72%	13%	5%
	Growth & Development	58%	57%	-1%	71%	14%	38%	-33%	27%	-11%	-31%

Appendix G- Case Study Selection Review

Reviewed Case	a	b	c	d	Total
C1	1	2	1	3	7
C2	3	3	3	2	11
C3	3	2	2	2	9
C4	2	2	1	1	6
C5	2	3	3	3	11
C6	3	3	3	3	12
C7	2	3	2	1	8
C8	1	2	1	1	5
C9	3	3	3	3	12

Appendix H- Framework Comparison for Employee Opinion Survey

	People, Process & Self	Vision, Influence & Ethics
Quality	People	Ethics
Social Responsibility	People	Ethics
Work Life Culture	People	Ethics
Business Knowledge	People	Influence
Inclusion outside my work group	People	Influence
Inclusion in my work group	People	Vision
Leadership	People	Vision
Customer Focus	People	Vision
Officer/Confidence in Company	Process	Influence
Compensation	Process	Influence
Organisational Engagement	Process	Influence
Growth & Development	Process	Vision
Caterpillar Brand	Process	Vision
Production System	Process	Vision
Values	Self	Ethics
Safety	Self	Ethics
Accountable for Results	Self	Influence
Job Engagement	Self	Influence
Communication	Self	Influence
Recognition	Self	Influence
Supervisor Support	Self	Influence
Teamwork	Self	Influence
Strategy & Execution	Self	Vision
Managing Change	Self	Vision

Appendix I- Research Respondent Consent Form

This form is to be signed by each individual respondent.

The information, and anything else you may provide, is required in connection with research that is being undertaken as a component of a professional doctorate.
It is your right to withdraw your participation in the research at any stage.
Any information or personal details gathered in the course of the research are confidential and neither your name nor any identifying information will be used or published without your permission. However, such information may be provided in confidence to appointed examiners.

The information, and anything else you may provide, will be held in a safe, secure location whilst being utilised and after use would be destroyed or disposed of in a manner that would not jeopardise its confidentiality.

You will be informed whether interviews are being recorded and your signature below implies your consent to this recording.

Please select ONE of the options below by signing your initials in the space provided:

	I give permission for information provided by me in the course of the research to be published
	I give permission for information provided by me in the course of the research to be published provided no identifying information is included
	I do not give permission for information provided by me in the course of the research to be published

If you have any concerns or complaints about the research please contact:

DBL Admin, AGSL within Torrens University Australia Phone: 02 82110634

Email: admin@agsl.edu.au

I agree to participate, given the above conditions.

Signed:_____

Name:_____

Date:_____

Appendix J- Research Survey

How adaptable is your Organisation?

Criteria	Description	Rating 1- disagree to 7- agree
Elephants in the room	1. Conversations take weeks to get from people thoughts to the water cooler and then into meeting rooms.	1 2 3 4 5 6 7
	2. Crises are identified, and bad news discussed.	1 2 3 4 5 6 7
	3. There are structures, incentives, and support for speaking the unspeakable.	1 2 3 4 5 6 7
Shared responsibility	1. Senior management in the organisation, act from the perspective of and for the betterment of the whole organisation, as opposed to worrying about and protecting their individual group or silo.	1 2 3 4 5 6 7
Independent judgement	1. People in your organisation are valued for their capacity to divine the boss' preferences.	1 2 3 4 5 6 7
	2. When someone takes a reasonable risk in service of the vision and it doesn't work out, this is seen as a learning opportunity rather than a personal failure.	1 2 3 4 5 6 7
Develop leadership capacity	1. People know where they stand in the organisation and their potential for growth and advancement.	1 2 3 4 5 6 7
	2. They have an agreed-upon plan for how they are going to reach their potential.	1 2 3 4 5 6 7
	3. Senior managers are expected to identify and mentor their succession.	1 2 3 4 5 6 7
Institutionalised reflection and continuous learning	1. The organisation allows time for the individual and collective reflection and learning from experience.	1 2 3 4 5 6 7
	2. The organisation allocates time, space, and other resources to get diverse perspectives on how work could be done better.	1 2 3 4 5 6 7

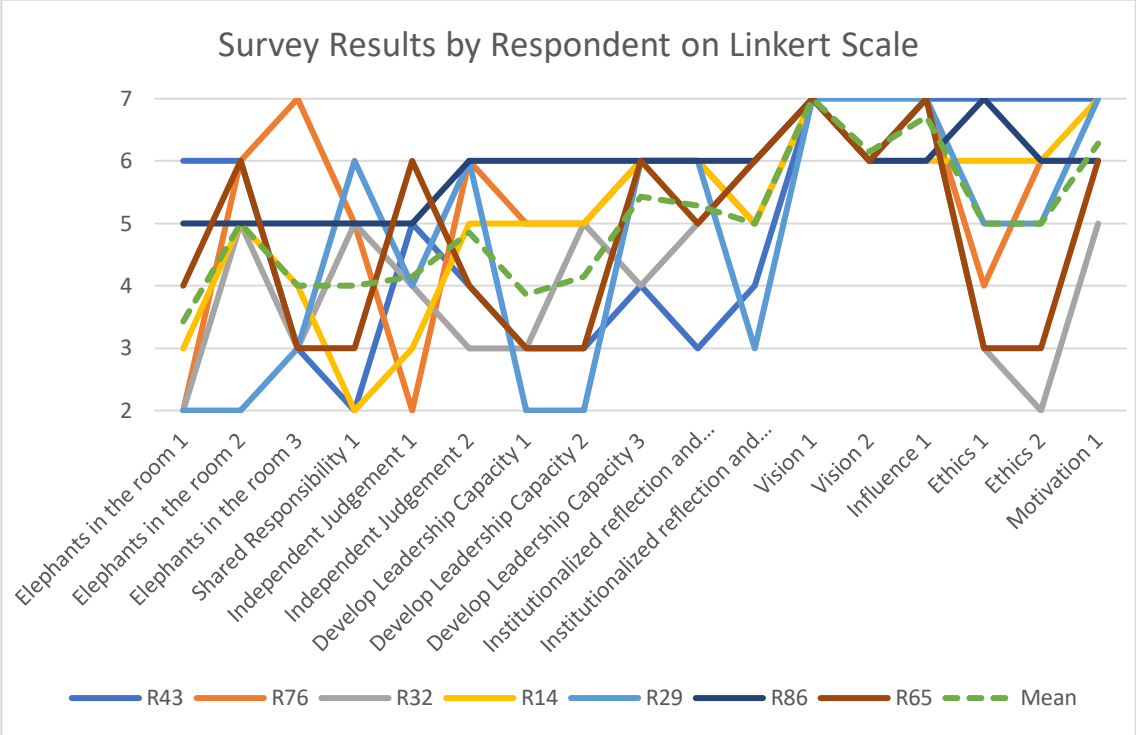
Adapted from (Heifetz, Grashow, & Linsky, The Practice of Adaptive Leadership, 2009).

What is the role of Leadership with autonomous technology in mining?

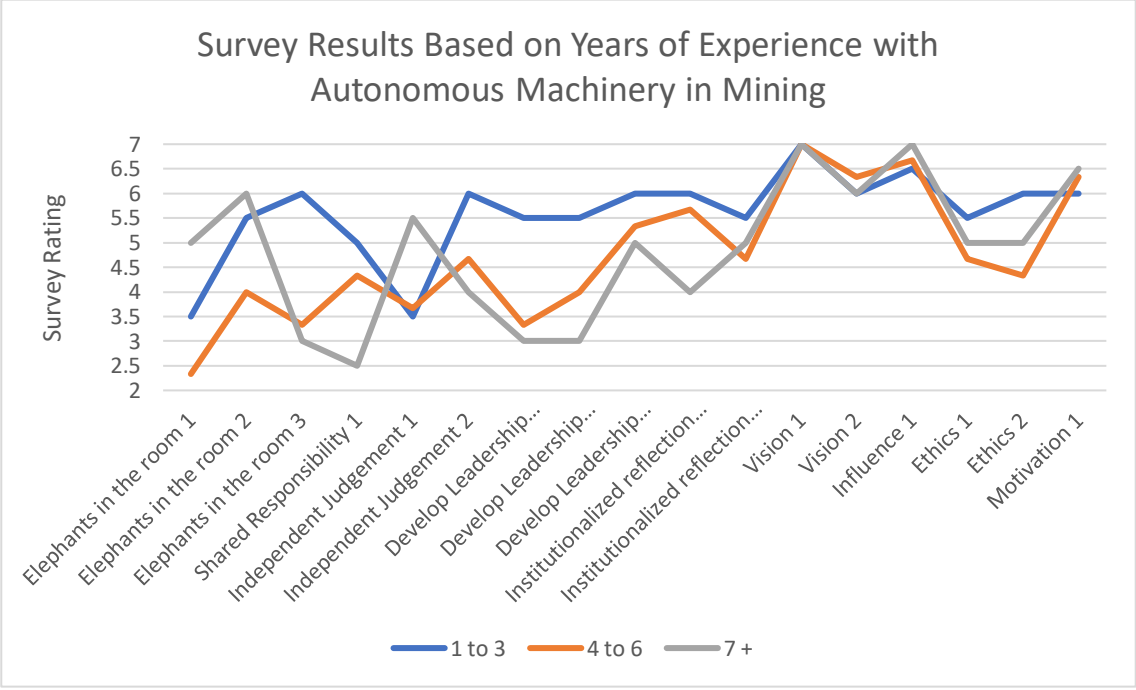
Criteria	Description	Rating 1- disagree to 7- agree
Vision	1. A strong vision for deploying and operating autonomous machinery on a mine site is a necessity.	1 2 3 4 5 6 7
	2. The vision being applied as guiding principles in decision-making is required to achieve the long-term desired outcomes.	1 2 3 4 5 6 7
Influence	1. The ability of a leader on a mine site to influence others internally and externally in deploying and operating autonomous machinery is a vital behaviour.	1 2 3 4 5 6 7
Ethics	1. The ethics around autonomous machinery operations are discussed, and planned for with the deployment and operation of this technology	1 2 3 4 5 6 7
	2. These conversations are openly discussed.	1 2 3 4 5 6 7
Motivation	1. A leader in the field of autonomous machinery must have a high level of motivation and commitment to achieve the desired outcomes in this field.	1 2 3 4 5 6 7
Challenges	With the challenges you face with the use of autonomous machinery, what amount of your time do they consume-	
	Technical issues	_____ %
	Variables & unknowns	_____ %
	People & Process	_____%
		100%

Do you have any additional comments in relation to this survey?

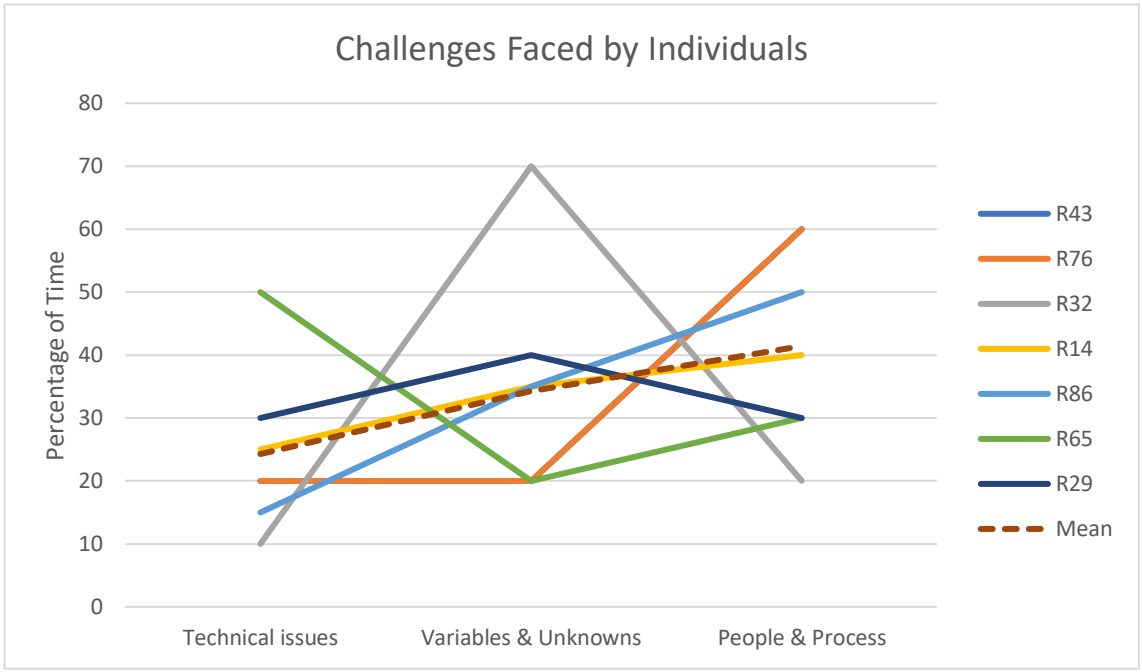
Appendix K- Survey Results Distribution



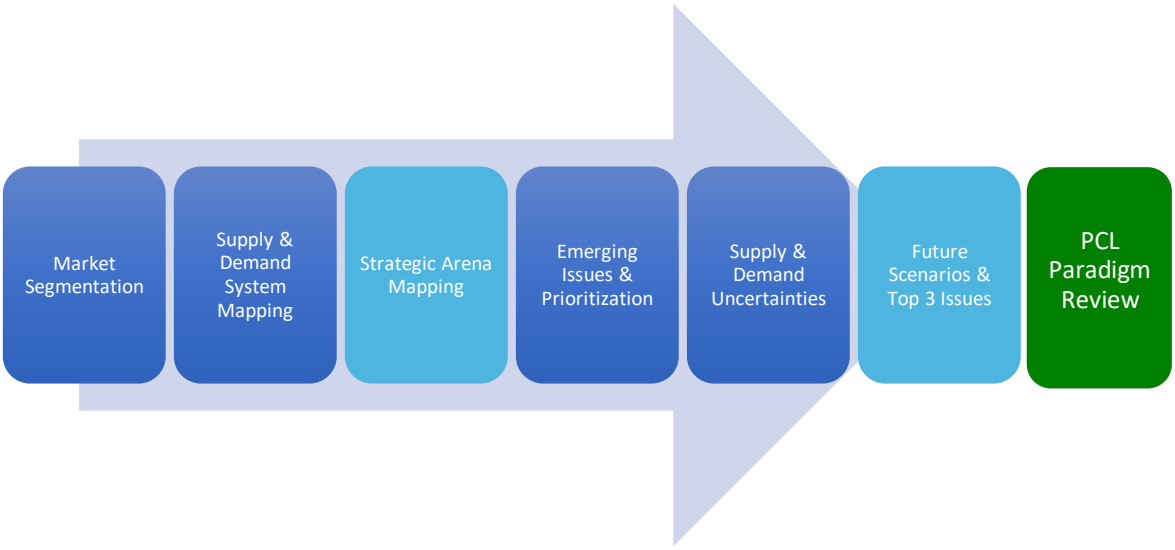
Appendix L- Survey Results Filtered by Years of Service



Appendix M- Challenges Faced by Individuals as a Percentage



Appendix N- Strategic Arena Mapping Process



Appendix O- Survey Respondents Mining Sector Experience

Respondent	Years of service with Mining Technology	Years of experience in the Mining Sector	Degree Qualification
R43	7	7	Y
R76	3	10	Y
R32	5	11	N
R14	5	7	Y
R86	1	12	Y
R65	20	20	Y
R29	4	24	Y
Average Years of Experience	**6.4**	**13**	
Total Years of Experience	**45**	**91**	

Leadership Portfolio

This supporting Portfolio was created from historical published and unpublished leadership-related materials that advanced my leadership development over the last decade. The creation of this Portfolio occurred in parallel with the development of this Critique and underpins *My Leadership Journey* in Chapter 3. It is fundamental to establish that the items in this Portfolio are not a complete representation of all the experiences that have contributed to my leadership development and represent those that are most tangible.

The following table provides a catalogued view of these events and artefacts with a brief summary of each as a foundation for the Portfolio.

Portfolio Reference Number	Portfolio Item	Implications on Personal Contingent Leadership Paradigm
2008-1	Caterpillar Applied Failure Analysis	• Identification of technical issues and analysis methods, tools and research processes to identify the root cause of failure. • Using process-driven tools such as Six Sigma and Continuous Product Improvement to quantify the issues and priorities for resolution as a manager. • Creating reports on technical failures with mechanical and hydraulic systems. Utilising these reports for warranty claims and product improvement with centralised engineering resources.
2008-2	Queensland Mine Supervisor S1, S2, S3 & G2 Risk Assessment training	• The application of formal risk management processes in decision-making as a department head (maintenance) in the contract operation. • Effective and consistent communication of information by leadership in a mining operation. • Conducting health and safety investigations when an incident has occurred and critical requirements to incident reporting.
2008-3	Performance review providing formal feedback on alignment to company values and achievement of strategic objectives	• Review against Leighton Holdings performance review process for senior leaders and development opportunities undertaken for the year. • Review of 2008 objectives with measures and achievements. • Structuring of 2009 objectives and measures. • Performance reviews for my direct reports, feedback and structuring of their goals.
2009-1	Certificate IV in Frontline Management: 3 day workshop and executive report out at conclusion of project	• My first formal supervisory course with a large company aligning to their strategy, vision and code of conduct. • Introduction to Leighton Holdings leadership expectations with responsibilities and accountabilities. • Consistent leadership and the value that this creates in a team environment; as expanded on and proven using simulation in decision-making.

		• Project undertaken in my role over four months following this course with final executive report out as examination.
2009-2	Performance Review introduction to Terex Mining	• Review of my achievements to strategic goals with financial profit and loss for the Western Canada region. • Achievement of strategic customer objectives assessed, based on outcomes. • End of year performance report completed and reviewed with executive panel for North America. • Performance reviews conducted for my direct reports, feedback and structuring of their goals for 2010.
2010-1	Alberta Occupational Health and Safety Code: Training for Leaders course	• Introduction to the Canadian safety regulations for the business unit I was managing running after moving there, and ensuing liabilities. • Methodology used in the code and governing standards around safety within the provincial regulator. • Accountabilities in the annual reporting process to the regulator and requirements as the business unit head within Canada. Expectations for incident and accident reporting. • Significant differences to Australia with standards, which also created a moral dilemma for me around expectations, in some cases.
2010-2	Performance Review introduction to Bucyrus International	• Review of my achievements to strategic goals and financial acquisition metrics based on Bucyrus acquiring Terex. • Review of my achievements to strategic goals and financial profit and loss for Canada service operations business. • Performance reviews of my direct reports, feedback and structuring of their goals.
2010-3	Consolidation on Terex and Bucyrus facilities and service organisations	• Rationalisation of facilities based on leases, size and consolidated business requirements. Commenced 24-month consolidation plan. • Sought service business requirements from customers and rationalised their contracts and charge rates.

		• Established a functional organisation structure to deliver customer requirements. • Constructed and executed a communication plan to stakeholders and affected team members.
2011-1	TTI Success Insights: Behaviours and Motivators Review by peers and direct team members (subordinates)	• First anonymous review by peers and team members to profile my behaviours. • The importance of formal feedback loops and incorporating feedback to reinforce behaviour or change. • Created an action plan to incorporate tools and strategies to evolve the gaps identified from the report. Sought informal feedback on gaps thereafter.
2011-2	MBA: Strategic Management (SMTM500)	• Investigation on the concept of strategy; measuring the outcomes from it with goals, values and performance. • Industry specific fundamentals that I had identified in the manufacturing environment for mining. • Analysing and developing resources and capabilities case study work in a team environment. The learning from different perspectives within the teams across the industry, and sector experience being utilised to complete the assignments.
2011-3	Performance Review introduction to Caterpillar Inc.	• Review of my achievements to strategic goals and financial profit and loss for Canada service operations business. • Review against divestiture metrics and risk management of contracts in place. • Performance reviews for my direct reports, feedback and structuring of their goals for 2012.
2011-4	Development of Bucyrus to Caterpillar plan post acquisition and divestiture to Dealerships	• Participated in the development of a project methodology to transfer the business to Caterpillar and subsequent divestitures thereafter. • Designated the executive owner for the service and maintenance contract workstreams within the project. • Worked through action and communication plans over an 18-month period delivering desired outcomes. • Structured the divestitures with Canadian dealerships; transferring facilities and

		personnel to the dealership in each geographic region.
2012-1	Employee Opinion Survey (EOS): Caterpillar enterprise initiative with leader, peer and team member feedback	• Formal feedback loop with linkage to enterprise strategy and career development plans. • Importance of stakeholder engagement, communication and influencing highlighted in the Enterprise, based on feedback. • Managing expectations between business units and customers. • Worked on specific action plan and training in areas identified for improvement. • As covered in Chapter 3 within Historical Feedback revealing methodology and results shown in Appendices D, E and F.
2012-2	MBA: Human Resource Management (HRMT502)	• Understanding of linking the people with the strategic needs of the business; cases where this has led to the best and worse outcomes. • Peer debate on the importance of building trust and use of motivation to deliver engagement of teams. • Internal reflection of culture within an organisation; the importance of diversity and past learnings I reflected on from this material and assignments. • Performance management systems, the positives and deltas from usage in the field and my personal experiences reviewed.
2012-3	MBA: Operations Management (OPMT505)	• The need and development of a Strategic Framework was studied which I applied to the field service business unit I was managing. • Decision-making and risk review from an executive level on how to measure attitudes and opinions as my first theoretical exposure to emotional intelligence. • Problem-solving tools and process introduced to aid in the delivery of long-term strategic outcomes versus short-term technical issue resolution. • Evolved understanding of relevant theories underpinning operations management.
2012-4	Performance review under Caterpillar Inc. Process and Policy	• Review of my achievements to strategic goals and financial profit and loss for Canada service operations business.

		• Review against divestiture metrics and risk management of contracts in place. • Customer and dealer satisfaction also sought in this performance review due to the complexity of projects being undertaken. • Performance reviews for my direct reports, feedback and structuring of their goals for 2013.
2013-1	Employee Opinion Survey: Caterpillar enterprise initiative with leader, peer and team member feedback	• Formal feedback loop with linkage to enterprise strategy and career development plans. • Importance of stakeholder engagement, communication and influencing highlighted in the Enterprise based on feedback. • First feedback with a new team and significant difference from the 2012 results. Storming phase of team development revealed after the formation of the team from the previous year. • As covered in Chapter 3 within Historical Feedback revealing methodology and results shown in Appendices D, E and F.
2013-2	MBA: Strategy and Organisational Analysis (STOA603)	• Case study work on Nucor steel and their business turnaround that yielded desired outcomes. • Comparing the competitive landscape in the Mining Industry was a deliverable from this work, which saw me go beyond direct manufacturing competitors. • The emergence of opportunity-based or disruptive organisations and how to compete with these organisations. • Application of Porter's Five Forces model based on my business experience for the assignment submission.
2013-3	MBA: Ethical Decision-Making (MEDM 604)	• Moving beyond industry and organisational decision-making into Social Issues with present examples in the media and courts. • This was also an in-depth introduction to Corporate Social Responsibility and the linkage between Strategy and Society, as I reflected on my personal working experiences.
2013-4	Performance review under Caterpillar	• Review of my achievements to strategic goals and financial profit and loss for the Western Canada region.

	Incorporated process and policy	• Review product support metrics on quality and timeliness for issue resolution; customer and dealership feedback also sought as input. • Performance reviews for my direct reports, feedback and structuring of their goals. • Last performance review in this business unit in my role of Product Support Manager in Western Canada.
2014-1	Making Great Leaders (MGL)	• Caterpillar leadership critique from my team members, peers and manager that provided feedback on the working environment I created. • Formal feedback loops that also provided learning experiences and coaching for the deltas identified as continuous improvement. • Identified a coach to aid in my leadership development based on MGL feedback to align to practical application of criteria in the role. • As covered in Chapter 3 within Historical Feedback revealing methodology and results.
2014-2	Employee Opinion Survey: Caterpillar enterprise initiative with leader, peer and team member feedback	• Formal feedback loop with linkage to enterprise strategy and career development plans. • Importance of stakeholder engagement, communication and influencing highlighted in the Enterprise based on feedback. • Managing expectations between business units and customers. • As covered in Chapter 3 within Historical Feedback revealing methodology and results shown in Appendices D, E and F.
2014-3	MBA: International Business (RIBL687)	• Review of the complexities of international laws, sovereignty and issues that emerge through the gaps of interpretations of these for the countries I work across. • Working session held with peers for one week with panel of experts giving practical examples of corruption issues that had emerged with other Global Enterprises and case research of these historical events. • After working on four continents, this course was invaluable to giving a theoretical understanding to my

		experiences and understanding of emerging risks.
2014-4	MBA: Implementing Strategy Through Management Evaluation (EISM622)	• Peer exercise on case study analysis in the Civil Construction industry as an actual scenario developed; actions that could be taken proposed, and the simulation progressed through these. • Active reflection on the decision we chose as a group, versus the actual outcomes of the case and self-reflection of my own logic and influence regarding the outcomes. • The correlation of strategy utilising feedback loops to guide and enhance actions through tangible data.
2014-5	MBA: Services Management (ESMT614)	• Case study review of services providers, strategies and deliverables. Future view as the global trend shifts from products to services and requirements. • Different perspective shed on the services business I was overseeing with 200 employees and our approach to differentiation. • Critical reflection of my leadership approach to my role at the time and shortcomings of being focused on measures alone. • Assignment created from this experience that was based my role at this time and service business issues I was faced with.
2014-6	Performance review under Caterpillar Incorporated process and policy	• Review of my achievements to strategic goals and financial profit and loss for the Mining Technology business unit in Asia Pacific. • Employee Opinion Survey results incorporated as one third of review process and leadership of personnel. • Performance reviews of my direct reports, feedback and structuring of their goals. • New business unit and establishment of my role and accountabilities within this structure being assessed.
2014-7	Eight autonomous hauling governance sessions with customer executives	• Project and milestone reviews. • Technical, Social, Regulatory and Process issues reviewed, and action strategising conducted. • Resource allocation and budget aligned to prioritised actions.

		• Highly confidential in nature with the Minutes bound by non-disclosure agreements, due to sensitivity.
2015-1	Paving the Road to Success Phase 1: hosted in China for 1 week	• Caterpillar department head development course focused on a present business issue the Enterprise was faced with that needed resolution. • Worked with five peers from within the Caterpillar Enterprise to understand an emerging issue at a factory in China while there, and developed a project to resolve these. • Executive coaching sessions held with Vice and Group Presidents from Caterpillar and supplier businesses on their experiences and overcoming challenges along the way.
2015-2	Paving the Road to Success Phase 2: hosted in Japan for 1 week	• Report out on our recommendations from the work in Phase 1 of this course (per 2015-1 above) to Executive table for critique and rating. Developed an action plan for the adoption of these recommendations with the facility management team. • Toyota factory tour and introduction to Toyota leadership team and their focus on quality through culture. • Walt Disney School of Leadership attended at Tokyo Disneyland; with the focus of service delivery at their resorts. Conducted surveys and guest interactions in the theme park to see the methodology in action. • Experienced the Disney service culture through immersion in the park and understanding their processes prior to doing so.
2015-3	Employee Opinion Survey: Caterpillar Enterprise initiative with leader, peer and team member feedback	• Formal feedback loop with linkage to Enterprise strategy and career development plans. • Importance of stakeholder engagement, communication and influencing highlighted in the Enterprise based on feedback. • Feedback on significate organisational change within business units and effects of the change management approach.

		• As covered in Chapter 3 within Historical Feedback revealing methodology and results shown in Appendices D, E and F.
2015-4	Global Mining Standards Group: Industry working session on requirements for global standards and requirements from mining technology	• As a leading supplier to the industry, I represented the Caterpillar Mining Technology's interest in the adoption of a global standard that would foster and encourage innovation. • Conveyed my experience as a practitioner in the field and debating the practical merits of the concepts being tabled, versus theoretical positions being sought. • Material and notes from this session available to members thereafter on the member portal.
2015-5	Performance review under Caterpillar Incorporated Process and Policy	• Review of my achievements to strategic goals and financial profit and loss for the Mining Technology business unit in Asia Pacific. • Employee Opinion Survey results incorporated as one third of review process and leadership of personnel. • Performance reviews of my direct reports, feedback and structuring of their goals. • Development of an emerging team in a downsizing industry that was centred on becoming a performance-based culture.
2015-6	Nine autonomous hauling governance sessions with customer executives	• Project and milestone reviews. • Technical, Social, Regulatory and Process issues reviewed, and action strategising conducted. • Resource allocation and budget aligned to prioritised actions. • Highly confidential in nature with the Minutes bound by non-disclosure agreements due to sensitivity.
2016-1	DBL: Business Leadership Theory & Practice (DBL701)	• Significant change in mindset to leadership with the development of a foundational understanding to leadership theory. • Self-reflection enabled the development of a gap review and where my own journey had emerged from, when aligned to the applicable theories. • Development of initial Personal Contingent Leadership Paradigm.

2016-2	DBL: Case Analysis (DBL702)	• Critical review of General Electric (GE) case study between two Chief Executives and methodologies for case review. • Understanding the fundamental differences in tenure between leaders, time and styles that delivered varying outcomes. • Evolved my understanding of case analysis and the positives and deltas of the approach. • The importance and evolution of a leadership style when linked to tenure in an executive position. • Theory and decision-making over differing periods of time and relevance to strategy and vision within the context of GE.
2016-3	Roads Australia: Autonomous Vehicle Review in Australia	• Presented the challenges we had faced with autonomous trucks in Western Australia after three years of operation. • Explained that there were three key areas in my experience with technology adaption in People, Process and Technology; the type of leadership required to be successful in this environment and the benefits from a safety perspective. • Material and presentation from the session made available to industry members, and question and answer session held with representatives of Roads Australia and representatives from all States and Territories road authorities and toll road operators.
2016-4	Performance review under Caterpillar Incorporated process and policy	• Review of my achievements to strategic goals and financial profit and loss for the Mining Technology business unit in Asia Pacific. • Performance reviews of my direct reports, feedback and structuring of their goals. • Established the need to transition to a globally-structured business for operations and sales to deliver consistent outcomes in the field. Concept structure drafted and proposed in this session.
2016-5	Twelve autonomous hauling governance sessions with customer executives	• Project and milestone reviews. • Technical, Social, Regulatory and Process issues reviewed, and action strategising conducted.

		• Resource allocation and budget aligned to prioritised actions. • Highly confidential in nature with the Minutes bound by non-disclosure agreements due to sensitivity.
2017-1	Making Great Leaders	• Caterpillar leadership critique from my team members, peers and manager that gave feedback on the working environment I create. • Formal feedback loops that also provided learning experiences and coaching for the deltas identified as continuous improvement. • Improvement from 2014 results and identification that I had started to shift away from being so technically focused. • Development of my team from 2014 had moved from formational to foundational/stable. • As covered in Chapter 3 within Historical Feedback revealing methodology and results.
2017-2	Insights Survey: Caterpillar enterprise initiative with leader, peer and team member feedback with revised methodology from EOS	• Formal feedback loop with linkage to Enterprise strategy and career development plans. • Importance of stakeholder engagement, communication and influencing highlighted in the Enterprise based on feedback. • The impacts of changing methodologies and the previous Employee Opinion Survey and ability to make change in this new format. • As covered in Chapter 3 within Historical Feedback revealing methodology and results shown in Appendices D, E and F.
2017-3	International Mining and Resource Conference: Presentation to mining industry attendees on the benefits of technology and the inherent risks with adoption	• Presented the results experienced in the Australian mining industry as early adopters of technologies that are disrupting the industry. • Explained the deep level of partnership and integration required to be successful with technology systems in the mining environment. • Discussed benefits of technology adaption in mining and technical success, although the entry barrier to an extent was mining organisation's ability to affect change with

		People and Process in the field and that leadership was required to achieve this. • Presentation and material made available to attendees after the conference.
2017-4	DBL: Critical Reasoning & Ethics for Business Leaders (DBL703)	• The use of applied ethics and critical reasoning to review my Personal Contingent Leadership Paradigm, which led to several modifications of my Paradigm. • The theoretical methodologies applied in arguments, their application and appropriate uses within my business environment. • Self-reflection of my methods of Critical Reasoning based on historical experiences and the opportunity to improve this application incorporated into my adaptive spiral.
2017-5	Farm Machinery and Industry Association of WA: Review of adoption of autonomous technology in mining	• Presented the detailed the journey we had been on in the mining industry with automation, the key business drivers and challenges we had faced. • Discussed the importance of being a custodian of the future for other industries as we establish standards, processes and personnel to undertake this work. • Explored what the future may hold for these types of technologies next and the leadership required from the industry to be successful. • Discussed the importance of the mining industry's role as an initial custodian of this technology until it is widely adopted into other industries and creating practical regulation to enable this.
2017-6	DBL: Business Leadership Issues (DBL704)	• Development of my understanding of scoping, mapping and analysing the strategic arena when applied to my working environment. • Use of a formal response process when completing a holistic strategic arena map and evaluating priorities, uncertainties and future scenarios. • From this work, I developed a differing perspective to approaching emerging issues and responses that I had not considered previously.

		• Sharing the developed process with my work peers and manager to get their input and understanding was a highlight of this work!
2017-7	Performance review under Caterpillar Incorporated process and policy	• Review of my achievements to strategic goals and financial profit and loss for the Mining Technology service operations business globally. • Employee Opinion Survey results incorporated as one third of review process and leadership of personnel. • Performance reviews of my direct reports, feedback and structuring of their goals. • Providing peer review for a global organisation's performance reviews to ensure consistency and non-biased reviews for all team members.
2017-8	Fifteen autonomous hauling governance sessions with customer executives	• Project and milestone reviews. • Technical, Social, Regulatory and Process issues reviewed, and action strategising conducted. • Resource allocation and budget aligned to prioritised actions. • Highly confidential in nature with the Minutes bound by non-disclosure agreements due to sensitivity.
2018-1	Mining3 Transforming Mining: Breakthrough Innovation and Technology industry working sessions	• Participated as operational representative from Caterpillar in these mining industry sessions around technology development and delivery to end users. • Provided feedback on innovations to industry and university members and presented progress to date. • Tabled business risks that are emerging through technology adoption and potential opportunities to reduce these risks. Raised leadership through technology-enabled change as a risk with the present culture, established to use 'awareness' systems and not 'control' systems.
2018-2	Vocational Education & Training Industry Session to launch training requirements for Autonomous Mining	• Participated as experienced operational representative from Caterpillar in this session. • Discussed present industry gaps and requirements to methods to upskill the present labour force.

		• Concisely stated the present challenge that the industry is faced with a shortage of expertise in the autonomous machinery field and short-term tactical actions being taken are surfacing. • Worked on framework to establish Certificates II and IV in automation support.
2018-3	Vocational Education & Training Industry Collaboration session for Autonomous Mining	• Working session on skills and competency required to enable the mining industry to become self-sufficient with skills development to support autonomous machinery. • Defined scope of the project and potential timing required to resolve the skills gap. • Developed strategy for circulation to industry with peers on training for the future and fundamental priorities
4-2018	Sixteen autonomous hauling governance sessions with customer executives (year to date)	• Project and milestone reviews. • Technical, Social, Regulatory and Process issues reviewed, and action strategising conducted. • Resource allocation and budget aligned to prioritised actions. • Highly confidential in nature with the Minutes bound by non-disclosure agreements due to sensitivity.

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