SUBMISSION TYPE

Poster Session

TITLE

Data-Driven Leadership Development: Exploring Post-Pandemic Challenges With AI

ABSTRACT

Understanding leaders’ challenges and how they have evolved over the COVID-19 pandemic allows practitioners to effectively prepare today’s leaders for tomorrow’s problems. We leveraged advanced natural language approaches to track key leadership challenges for over 48,000 leaders prior to and following the pandemic. Results indicate an increase in challenges related to a dynamic business environment and creating organizational readiness amid uncertainty. This method is a valuable tool for providing quick and accurate insights for data-driven leadership development.

WORD COUNT

2553

Multidisciplinary Content Explanation: This research is the result of several years of collaboration between organizational science researchers, leadership practitioners, and data scientists. We highlight the data science methods used to collect, analyze, and visualize insights on leadership challenges in the poster and intend to include the data science team at the conference presentation.

Reproducible Research Explanation: We will provide the Python code required to reproduce our topic models in the form of a shared annotated notebook (Jupyter Notebook, GitHub repository) via QR Code on the poster. Session participants will be encouraged to save the link on their phones and share their results if they use the code to model their own leadership data.

Data-Driven Leadership Development: Exploring Post-Pandemic Challenges With AI

What are the most critical leader challenges that leadership development should address? To an I/O psychologist, this question harkens to the cornerstone of our field: job analysis (Cascio & Aguinis, 2005). Training and development programs are more effective when their content is closely tied to the knowledge, skills, or abilities people need to perform their jobs well (Singh, 2008). However, the learning and development needs of participants in leadership development programs are not always easily identified. What is needed to be a leader in the wake of a world-wide catastrophe can feel all the more murky, with broad generalizations about resilience, managerial support, and communication being far more imprecise than a typical job analysis. Today’s leaders function within a daunting professional landscape. They need just-in-time, relevant support to overcome the evolving challenges associated with leadership in a time of prolonged uncertainty (Kniffin, Narayanan, Anseel, Antonakis, Ashford, Bakker, & Wilmot, 2020). Leadership development can provide that support, but it is most likely to be effective when aided by concrete, shareable information about the challenges leaders currently face (Tonidandel, Summerville, Gentry, & Young, 2021). If I-O psychologists can more accurately understand the needs of leaders, then we can expand and adjust the focus of our development programs to meet those needs more effectively.

The current study is the culmination of a collaboration among researchers, practitioners, and data scientists to develop an efficient and accurate method for collecting, analyzing, and visualizing feedback from leaders about their most pressing leadership challenges. This collaboration emerged as a result of the need to understand the evolving challenges leaders face due to ongoing culture shifts, economic volatility, and social tragedies, even before the global COVID-19 pandemic. Using a sophisticated AI model, originally developed one year prior to the pandemic, we were able to track and share the challenges of leaders participating in leadership development programs throughout the evolving context of the pandemic. This AI-driven approach was particularly helpful in quickly and accurately capturing the leadership challenges that have shifted in the past several years, and it is equally helpful for exploring challenges that have emerged in the pandemic’s wake.

**Leadership Challenges Vary Across Time and Place**

Researchers have long recognized that the skills needed for effective leadership differ by organizational level (Jaques, 1978) and context (Johns, 2006). For example, the demands facing new managers are likely quite different from those faced by executive leaders (Mumford, Campion, & Morgeson, 2007). Individuals recently promoted to positions of leadership often cite challenges related to self-awareness and managing a team, while senior leaders identify challenges more related to organizational strategy. As such, leadership development programs are particularly effective when they are tailored to the challenges faced by leaders at specific levels (Collins & Holton, 2004). The current study’s AI approach tracks leadership challenge information across four levels: leaders of the organization, leaders of functions, leaders of managers, and leaders of direct reports.

More recently, the COVID-19 pandemic has created large-scale disruptions that reflect important challenges for leaders. These challenges remain dynamic, even several years after the initial global response to the pandemic. It is more important now than ever to keep abreast of leaders’ organizational and global context, in order to offer effective developmental support. A data-driven approach, assisted by AI, allows for an inductive and robust collection of continuous data directly from the leaders experiencing such challenges.

**Traditional Data-Driven Methodologies Are Limited**

Given that leaders are often faced with distinct and volatile contexts, leaders themselves are often a great source for identifying key leadership challenges. Much like interviewing incumbents in a job analysis, there is value in capturing the challenges faced those who are “in the thick of it” to continue providing empirically supported, effective, and relevant leadership development programs. In the past, researchers have gathered and summarized developmental needs using both qualitative and quantitative methods. For example, Gentry, Eckert, Stawiski, and Zhao (2016) identified six common leadership challenges faced by global leaders using thematic analysis. This approach involved iterative calibration and coding of leadership development participant comments by a team of researchers. However, thematic analyses, like other qualitative techniques, often require a tremendous amount of time and research expertise (Pratt, 2008). This is particularly true when attempting to uncover deep, broad insights that can be reproduced over time or across contexts.

A more recent study by Klus and Müller (2021) used questionnaire-based methods to link leadership skills to challenges identified in the emerging literature on leadership in the digital age. This approach was likely far more efficient than a thematic analysis. However, much like the traditional tradeoff between quantitative and qualitative methods, the depth and richness of these findings are likely limited compared to a more inductive approach, which allows for insights to emerge unhindered by prior assumptions. In the midst of an unprecedented professional and sociopolitical landscape, although time-consuming, qualitative methods provide an opportunity to investigate phenomena that arise organically from participants, rather than limiting them to pre-determined responses.

**AI Provides Quick, Accurate, and Comprehensive Insights Into Leadership Challenges**

Leadership development offerings must evolve alongside the evolution of challenges leaders face, across all levels and even in response to world-shifting events. However, it can be difficult and time-consuming to collect and accurately analyze information concerning the needs of leaders, particularly in a way that is comprehensive and dynamic. Fortunately, developments in data science allow for efficient, replicable, reliable, and valid approaches to categorizing large amounts of qualitative data.

The current study leverages data science methods for collecting leadership challenge information directly from leaders and analyzing it using a machine learning approach. As a demonstration of the utility of this approach, we consider how leaders’ challenges have shifted in response to the COVID-19 pandemic. Additionally, we describe a future direction for this research geared at uncovering emergent challenges from a post-pandemic subset of data using an updated and revised methodological deep learning approach (e.g., Banks, Woznyj, Wesslen, & Ross, 2018). The current study and its future directions represent an innovative and, now more than ever, accessible route toward sophisticated text analysis techniques useful to both research and practice in I/O psychology.

**Method**

**Participants and Procedure**

Prior to participation in a leadership development course, individual leaders were asked during an online intake questionnaire, “What are the three most critical leadership challenges you are currently facing?” Leaders were provided three text boxes to capture their responses. These data were collected prior to the leader attending any programs. Leaders in this study represented four different leadership development programs and thus represent leaders across distinct levels in most organizations (i.e., leaders of the organization, leaders of functions, leaders of managers, and leaders of direct reports).

The current models are based on a comprehensive sample of responses from 48,014 leaders working across more than 7,000 organizations over the course of twelve years (2010-2022). 12.61% of the overall sample were leaders of the organization, 12.02% were leaders of functions, 53.98% were leaders of managers, and 21.41% were leaders of others. Four different models were used to analyze the challenge data across the four different leader levels.

Along with leaders’ self-reported challenges, we also collected data regarding leaders’ gender, industry, and job function. Sixty-three percent of the overall sample were men, thirty-six percent were women, and the remaining one percent did not specify their gender.

**Topic Modeling**

In general, our text analysis follows these steps: data extraction, topic modeling, and naming of topics by subject matter experts (see Figure 1). The current models were developed using an AI topic modeling algorithm called Latent Dirichlet allocation (Blei, Ng, & Jordan, 2003) to detect the word and phrase patterns, and automatically cluster word groups and similar expressions. The algorithm uses an unsupervised probabilistic model that generates underlying topics from a collection of documents, where each topic reflects words from the statements with certain probabilities (see Figure 2).

**Topic Evaluation**

To evaluate the goodness-of-fit of the topic models, we calculated the coherence score for each topic, or latent challenge, identified based on the leader’s responses. Coherence scores, which range from 0 to 1, refer to the degree of semantic similarity between high-scoring words in each challenge. Topics, or challenges, with higher coherence scores, indicate that the most meaningful words found for a topic have a high rate of co-occurrence throughout a leaders’ responses. A high coherence score suggests a better fit.

Once we identified good-fitting models, subject matter experts (SMEs) with expertise in leadership development labeled the topic categories based on the grouping of leaders’ responses. For the current models, topics were categorized by at least two independent subject matter experts, who then came to an agreement on the category title in a consensus discussion. We held one final meeting with all participating SMEs to come to an agreement on the identified challenges.

**Results**

**Categorization of Leadership Challenges**

The current models yielded challenges relevant to leading across four levels (Table 1). These challenges can be categorized into three broader themes: personal growth, managing people and task demands, and working within a larger system. Consistent with the notion that challenges vary by context, the *specific* challenges within each of those themes varied by leadership level, with lower-level leaders generally reporting less need to deeply understand the larger system from a strategic perspective, and people and task demands differing depending on what people and tasks were being led.

**Changes Between Pre- and Post-Pandemic Periods**

To uncover insights about how leader’s challenges have changed in the wake of the pandemic, we compared the model’s results over time. Compared to pre-2020 data, several challenges have become more prevalent in recent years. We used Mann-Whitney test (Nachar, 2008) along with the *r* effect size (Cohen, 1988; 1992) to test the statistical and practical significance of these changes. Those responsible for leading the organization (Figure 3) reported a 3% increase in challenges related to their dynamic business environment and a 2% increase in creating organizational readiness amid uncertainty. Function leaders (Figure 4) reported a 6% increase in challenges related to the changing internal or external environment and a 3% increase in the limited market or sales growth. Those responsible for leading managers (Figure 5) reported a 2% increase in challenges related to personal limitations and a 1% increase in challenging business context. Finally, those responsible for leading direct reports (Figure 6) reported a slight (0.6%) increase in challenges related to frustrations with people and time.

**Discussion**

Leadership development is a “process by which one increases his or her ability to exercise influence in leadership situations that become increasingly more complex and varied” (Liu, Venkatesh, Murphy, & Riggio, 2021, p. 3). As such, it is important that leadership development programs align with the challenges leaders are facing. Unfortunately, achieving this type of alignment in an efficient, reliable, and valid manner is difficult. A primary contribution of our study is the application of a machine learning algorithm to leverage leaders’ self-reported challenge data for a more data-driven leadership development approach. Based on a sample of over 48,000 leaders, we found that we could reliably and meaningfully identify the types of challenges leaders are facing, and how those challenges have changed over time. Additionally, we were able to identify which challenges became more pressing in the wake of the pandemic for program participants across four levels of leadership. We see this method of data collection as a relevant tool for use in research and practice. For practitioners, the key challenges identified can serve as insights from the field that inform future leadership development solutions. For example, the key challenges resulting from this research are regularly used as the foundation for designing our custom leadership development programs.

From a research perspective, our approach coincides with a growing interest in applying text-based data analysis in I-O psychology (Mathieu, Wolfson, Park, Luciano, Bedwell-Torres, Ramsay, & Tannenbaum, 2022; Speer, 2021). As with these other applications, the models we employ here are able to discern meaning from a large corpus of qualitative data that would otherwise be too difficult to manage or analyze.

**Limitations**

Despite these contributions, there are important limitations to this study. First, we have assumed that the differences across time points are due only to contextual forces that emerged during the pandemic. Ultimately, however, our current research cannot pinpoint the direct factors leading to the change but instead focus on the corpus of changes co-occurring during the pandemic. For example, in future research, we can examine how the content of the leaders’ self-reported challenges varies based on their geography and the nature of the pandemic within those places (e.g., case counts, mortality rates). This would allow for a more direct connection between pandemic experiences and leadership challenges and rule out alternative explanations (Antonakis, Bendahan, Jacquart, & Lalive, 2010).

As well, the current models, which were developed prior to the pandemic, are limited by the broad topic categorizations identified by subject matter experts in 2019. Although the models provide information about which challenges have become increasingly relevant over time, a new study is required to uncover emergent topics. Our AI approach allows us to accomplish this quickly and accurately using a very similar method to the one described in the current study.

**Future Research Directions**

Going forward, we intend to further refine our machine learning algorithm to investigate emergent topics gleaned from a subset of data (n = 2500) collected following the onset of the pandemic. This includes creating respecified models to uncover text-based insights related to more specific challenges emerging in the pandemic’s wake. The new models will be based on an advanced topic modeling approach called BERTopic (Grootendorst, 2022). It is a topic modeling technique that leverages a pre-trained [transformer](https://en.wikipedia.org/wiki/Transformer_(machine_learning_model)#:~:text=A%20transformer%20is%20a%20deep,and%20computer%20vision%20(CV).) framework to embed all the input documents in a multi-dimensional space. Unlike LDA, which starts with a framework that is not initialized, BERTopic starts with a framework that is already trained on a large corpus of data (e.g., Wikipedia). This affords more accurate representations of words and sentences, making it a more effective method for gathering insights based on a smaller text-based datasets. We will evaluate the new models according to the same methods specified in the current study, involving a new group of subject matter experts to evaluate the emergent topics. We anticipate that our respecified models will yield topics emerging from specific challenges related to the pandemic and its aftermath, like those related to resilience, well-being, motivation, and stress.

**Conclusion**

Preparing today’s leaders for tomorrow’s challenges is a primary investment and executive imperative. Leadership development practitioners play a central role in equipping leaders at all levels with the right skills and perspectives for the disruptions and challenges of today and in the future. Although pandemics and other current upheavals are exceptional events, it is not expected that our post-pandemic future will be smooth sailing. Leaders at all levels will continue to face a future of unknown difficulties and challenges. Advances in data science algorithms have provided a way to identify leaders’ critical challenges utilizing large-scale data. Leadership development can be improved by seeking a data-driven answer to the following fundamental question: What leader pain points are we addressing through our leadership development strategies? Asking and answering this key question will increase the probability that key stakeholders will focus their efforts on what matters most and align on the leadership development initiatives that will enable their organizations to thrive in a post-pandemic world.

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Table 1: Themed Leader Challenges by Level of Leadership

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Theme** | **Leading the Organization** | **Leading the Function** | **Leading Managers** | **Leading Direct Reports** |
| **Personal Growth**  The challenges of personal shortcomings and aspirations for a better self | **Interpersonal Rigidity**  The challenge of changing the way you interact with others to be more interpersonally effective. This includes changing how you communicate, manage, or influence. It also includes adapting your style for different people and finding the right balance in your leadership approach. | **Limited Self-Awareness**  The challenge of becoming more self-aware and understanding how others perceive you. This includes others’ perceptions of your confidence, approachability, and the style in which you deliver difficult messages.  **Credibility Gaps**  The challenge of building credibility as an organizational leader. This includes gaining the trust of senior managers and other stakeholders, as well as enhancing your visibility in the organization. | **Personal Limitations**  The challenge of overcoming a leadership inadequacy related to who you are as a person. These internal struggles are experienced as needing to work in ways that “go against your grain,” to overcome your own doubts or those of others about your ability or readiness to lead, to better manage personal conflicts or dilemmas, or to have the courage to do the right thing.  **Ineffective Interpersonal Style**  The challenge of modifying your interpersonal style to be more effective in leadership relationships. This includes being less dominant in interactions, being less directive and actively seeking input from others, being more open and approachable, managing your emotions, and being more assertive and self-confident. | **Personal Improvement**  The challenge of learning to be more like your “ideal self.” This includes developing confidence, being a better listener, improving flexibility, dealing more effectively with conflict, and being less reactive.  **Frustrations with People and Time**  The challenge of feeling frustrated with others and overwhelmed with inefficiencies. This includes providing considerable guidance to direct reports, overcoming resistant attitudes, and adjusting communication and feedback styles to work with different people more effectively. |
| **People and Task Demands**  The challenge of managing people and getting work done | **Strategic Responsibilities**  The challenge of developing strategy for an organization. This includes aligning priorities and initiatives across groups, as well as developing a team to support strategic efforts.  **Lack of Cooperation**  The challenge of influencing others to gain their cooperation. This challenge is experienced when new to a role, when managing former peers or more experienced colleagues, when working with a new boss, when introducing significant change in your unit, when departments operate in silos, or when employees are in conflict or lack accountability.  **Organizational Talent Issues**  Challenges related to hiring, retaining, compensating, motivating, or reducing staff in the organization. These talent management issues are particularly challenging when the organization is facing financial challenges or an uncertain future. | **Transition into a New Role**  The challenge of transitioning to a new role due to a promotion, a new position in a reorganization, a functional shift, or a geographic move. Challenges stem from changes in responsibilities, managing new people or former peers, or geographical separation from colleagues.  **Talent Pipeline Issues**  The challenge of creating strategies and structures that facilitate hiring, development, and succession — both for divisions and for the organization as a whole. This includes transferring knowledge, simultaneously hiring younger employees and motivating senior employees, encouraging senior employees to train their replacements, developing career pathways for staff, creating developmental experiences, resource constraints on employee development, and remote workforce planning. | **New or Ambiguous Responsibilities**  Challenges related to the difficulties of your specific managerial role. These can stem from a recent promotion or reorganization that brings new or broader job responsibilities, or from occupying a role that is not clearly defined or has limited direct authority.  **Accountability for Others’ Work**  Challenges related to transitioning from doing the work to creating the context in which work gets accomplished by others. Creating the context involves providing direction, plans, and prioritization — and then letting others do their jobs. This includes trusting others yet being available to them, having a process to monitor the work, and holding people accountable. Creating this context can be particularly challenging when there is unclear direction above you and a lack of talent or teamwork below you.  **Competing People and Project Priorities**  Challenges stemming from being responsible for both the motivation of individual employees and the completion of project-based work. Motivating people requires extra attention when they vary in personality, abilities, demographics, location, experience, or performance. Managing numerous projects that compete for importance and resources also demands attention. Balancing these competing priorities is difficult and often creates workload issues.  **Development Gaps: Yours and Others**  The challenge of expanding your own capabilities and developing direct reports to enhance the group’s overall success. Developing others involves motivating them to improve, identifying stretch opportunities, and coaching and mentoring them. For your own professional growth, an emphasis is placed on communication skills, strategic thinking, and executive presence.  **Staffing Issues**  The challenge of attracting, hiring, training, motivating, and retaining a talented staff. These staffing issues are particularly challenging in startup, high growth, and turnaround situations; in tight labor markets; and when facing resource constraints or external pressures for change. | **First Time Managing People**  The challenge of managing people for the first time or in a new way. This may include managing employees older than you, former peers, or a large group. It requires learning how to juggle day-to-day and management responsibilities, filling the big shoes of a predecessor, and gaining respect as a new person in the role.  **New to Positional Authority**  The challenge of moving into a position of authority rather than influencing from the position of peer. This includes establishing credibility, communicating across levels, motivating direct reports, supporting problem-solving, managing push-back, connecting with others from a new position of authority, taking initiative on behalf of others, and managing up.  **Peers as Team Members**  The challenge of managing teammates who are peers. Issues include balancing friendship with authority, balancing assertiveness with responsiveness, communicating effectively, managing relationships, creating a cohesive team, and delegating without micromanaging.  **Limited Influence**  The challenge of leading and influencing other people, often without authority. The issues include the need to make sense of different views and have your own understood by others; boundary spanning; working across functions, teams, and regions; working with people who are difficult or have different priorities; and leading others with different training/ experience.  **Team Performance**  The challenge of building and developing an effective team. It includes learning how to provide effective direction, giving feedback, coaching for performance, and dealing with resistance from direct reports.  **Employee Engagement**  The challenge of keeping employees engaged and motivated by their work. This includes strengthening employee morale and commitment, encouraging innovation, motivating through difficult circumstances, supporting those who feel overworked, and retaining older employees who are looking to retire.  **Competing Priorities**  The challenge of accomplishing work while leading at the same time. This includes juggling multiple priorities, dealing with lack of consistent direction from higher-ups, having responsibility without authority, managing in a matrix, and coaching others to prioritize while managing own workload. |
| **Working within a Larger System**  The challenge of managing dynamics across the organizational and environmental systems | **Dynamic Business Environment**  The challenge of leading an organization or business unit that must adapt to ever-changing circumstances. These changes may be brought about by new regulations, market and economic conditions, competition, and business growth. It requires developing and retaining the talent needed to support change, as well as revising business models and systems.  **Organizational Readiness Amid Uncertainty**  The challenge of being ready for an uncertain future. This challenge is experienced when there is a shifting organizational mission, significant resource constraints, changing technologies, or new ways of working. | **Process Improvement across Groups**  The challenge of influencing the organization to improve and accept new processes. This requires strategic thinking, boundary spanning, developing a systemic view, and influencing others.  **Tense and Complex Situations**  The challenge of managing others during tense and complex situations. This includes developing trust among stakeholders, managing internal politics, dealing with different personalities, and effectively following up with others.  **Problems with Upper Management**  Challenges related to managing your bosses and other senior executives in the organizational hierarchy. These include lack of empowerment by upper management, lack of expertise on the part of decision-makers, inconsistent direction from senior management, shifting priorities, and limited ability to influence upward.  **Limited Market/Sales Growth**  The challenge of making strategic shifts to maximize market growth and sales. This may include expanding beyond core products, extending market reach, shifting to a market/customer orientation, and better alignment of sales.  **Changing Internal/External Environment**  The challenge of leading in the context of organizational, market, societal, political, and environmental changes. It may include changes in goals, expectations, organizational culture, or structure.  It requires influencing, strategic thinking, driving innovation, and creating and modifying systems.  **Resource Constraints and Financial Instability**  The challenge of doing more with less. This includes engaging employees when promotion isn’t an option, attracting and retaining employees while working within budget and compensation constraints, managing organizational performance despite personnel reductions or inadequate facilities, and leading with agility. | **Cross-Functional Influence**  The challenge of influencing without formal authority in order to coordinate efforts or advance an initiative beyond your own group. This includes building presence and credibility as a leader, developing a cross-organizational network, partnering with others, and bridging functional boundaries.  **Adverse Work Environment**  The challenge of creating a more positive and efficient work environment. This includes both enhancing business processes and fostering healthy cultures where people adapt and thrive. The impetus for change may come from corporate initiatives, business system changes, changes in the external environment, or the desire for a more positive group climate.  **Challenging Business Context**  The challenge of delivering business results while operating in a difficult or changing business context. This includes improving business models and processes, keeping staff focused and motivated, and using limited resources effectively. | **Deficient Operational Processes**  The challenge of needing stronger operational processes to address a business problem. This includes process auditing, process improvement and development, managing interdependencies, and planning.  **Change and Instability**  The challenge of managing when conditions are changing and unstable. Issues include leading with incomplete information, managing ambiguity, developing agility in staff to adapt to changing conditions, and engaging employees with different generational attitudes toward change. |

Figure 1. *Text Analysis Process Flow Chart*

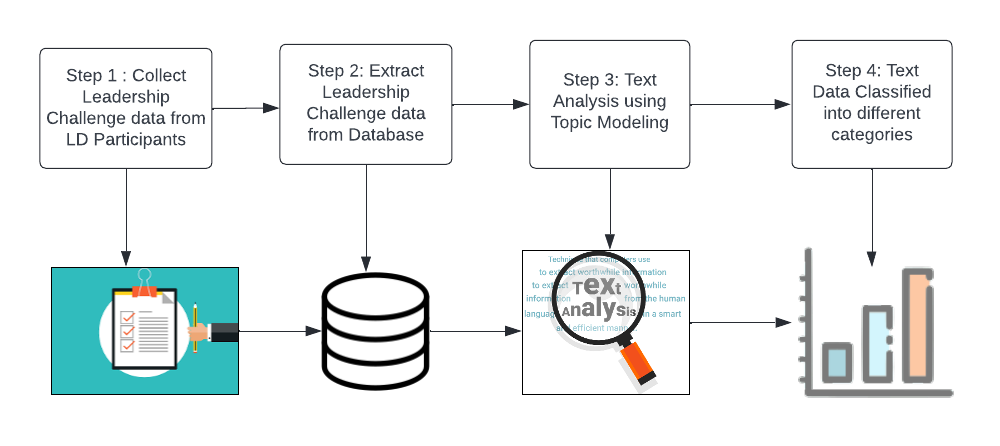


Figure 2. *Topic Modeling*Graphical user interface

Description automatically generated

Figure 3.  *Leadership Challenges Pre Vs Post-Pandemic for Leaders of the Organization*

Graphical user interface, application

Description automatically generated

Figure 4. *Leadership Challenges Pre Vs Post-Pandemic for Leaders of a Function*

Graphical user interface

Description automatically generated

*Figure 5.* *Leadership Challenges Pre Vs Post-Pandemic for Leaders of Managers*

A picture containing graphical user interface

Description automatically generated

*Figure 6.* *Leadership Challenges Pre Vs Post-Pandemic for Leaders of Direct Reports*

A picture containing application

Description automatically generated