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Behavior at work: propositions for optimizing the human and organizational challenges of digital materials passports

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There is growing research on the implementation of Digital Materials Passports (DMPs) in different industries, yet there is lack of guidance for preparing the human and organizational components within this ecosystem of change. To help fill this void, in this position paper, we develop propositions for dealing with the people and organizational challenges of implementing DMP's within organizations and across supply chains. Applying a socio-technical systems approach, we highlight the interconnectedness between the human, organizational, and technical factors when designing and implementing DMPs. We also use the IGLOO framework which highlights that organizational support needs to occur at the individual, group, leader, organizational, and omnibus (interorganizational) levels. We draw on research from the literature on human behavior at work, covering areas such as social identity, trust, resilience in organizations, leadership, participatory job redesign, and training and learning as mechanisms to reduce socio-technical challenges and to reach important interorganizational goals. Understanding these mechanisms helps us to develop seven propositions that organizations and supply chains can put in place when implementing DMPs. These propositions can offer mutually reinforcing support for organizations when implemented, and can be adapted to consider both the long-term and the immediate implementation context. We also discuss the role of employee involvement in enhancing the benefit of the propositions for organizations and supply chains in moving towards Industry 5.0.

KEYWORDS

digital material passport, human behavior, socio-technical systems, IGLOO, trust, job characteristics, transformational leadership, industry 5.0

1 Introduction

A Digital Materials Passport (DMP) is a data set, which can be electronically accessed through a data carrier to electronically register, process and share product-related information amongst supply chain businesses, authorities and consumers (Götz et al., 2022). Put simply, DMPs bear similarity to an identity document, in which stakeholders of the value chain write information about the geographical, ecological, technical, and usage properties of materials during their lifespan (Panza et al., 2022). Manufacturing companies gain value from DMPs as it allows them to track changes in the composition of materials (Munaro and Tavares, 2021), which can improve materials' recyclability (Honic et al., 2019a) and can lead to improved product quality for consumers (Larsson and Lindfred,

2019). Other benefits of adopting DMPs include quicker procurement of appropriate materials (Panza et al., 2023) and increased transparency, traceability and consistency at all steps of the manufacturing process (Götz et al., 2022). Sharing the DMP data with other connected technologies (such as smart sensors for data collection or cloud computing for storing the data; Panza et al., 2023) can also help organizations within the supply chain to improve manufacturing and logistics processes, and increase the materials' usability (Demeter et al., 2021). Because these benefits are shared across organizations in the supply chain (Götz et al., 2022), it is also important that all relevant stakeholders in the manufacturing process (e.g., raw material providers, manufacturers and logistics, as well as material recycling companies) implement and use DMPs appropriately. Thus, implementing DMPs in multiple companies across the supply chain is an example of large-scale digital change, which can involve changes to companies' business models, organizational structure, and associated work processes (Verhoef et al., 2021). Overall, implementing DMPs (both as a technology and as an organizational digital change) can lead to adopting more sustainable business models (Panza et al., 2022) on the journey towards a circular economy (Jansen et al., 2022). Implementing DMPs can also prompt organizations to move towards Industry 5.0, which is characterized by the values of human centricity, resilience, and sustainability (Panza et al., 2023).

Thus, implementing DMPs entails making changes to human and organizational processes as well as implementing the DMP technology. Because of this, we adopt a broader view of DMPs and consider it an ecosystem of change similar to the concept of a digital product passport ecosystem (King et al., 2023). More specifically, [King et al. (2023), p.2] frame a digital product passport ecosystem as 'a network of organizations and technologies whose integration should be architected for legal, organization, semantic, and technical interoperability'. Digital Material Passports and Digital Product Passports differ as the latter aims to collect data on products as a whole, whereas DMPs are more detailed as they can contain data about the lifecycle and circularity of specific materials or parts of the product (Honic et al., 2024). However, the changes to human and organizational processes that accompany the implementation of these two technologies overlap. In the current position paper, we focus explicitly on discussing the human and organizational challenges that can impede the successful adoption of DMPs within and across organizations. More specifically, we develop propositions for reducing these challenges with the aim of helping the successful adoption of these technologies. As such, our work builds on the work of King et al. (2023) as it aims to prepare the human and organizational processes within and across organizations.

Although the nascent literature on DMPs has focused mostly on their technological implementation thus far (Götz et al., 2022; Jansen et al., 2022; Munaro and Tavares, 2021), there is a growing recognition that human and organizational challenges can hinder or enhance the successful implementation of DMPs (Berger et al., 2022; King et al., 2023; Larsson and Lindfred, 2019; van Capelleveen et al., 2023). To implement DMPs successfully, organizations in the supply chain need to interact and share data (King et al., 2023) because having an unimpeded data flow positively impacts all parts of the material circular economy (van Capelleveen et al., 2023). Internally, organizations may need to reimagine their own

workflows with the purpose of preserving the integrity of the shared data (King et al., 2023). Adhering to interorganizational standards for data sharing could be achieved by including role responsibilities for quality control or employing other digital technologies. Organizations may also need to create new jobs and change their mindset about sharing data (Timms and King, 2023). Setting up the DMP may require outside assistance from a DMP consultant (Honic et al., 2019b) and this assistance can introduce new ways of working for different stakeholders (King and Timms, 2023). To ensure that the use of DMPs is effective across all relevant stakeholders, employees may need to increase their knowledge of wider work processes rather than focus narrowly on technology specialization (Honic et al., 2019b) and acquire new skills and knowledge (Larsson and Lindfred, 2019). These challenges offer us an initial understanding of how to prepare the human and organizational processes within and across organizations when implementing DMPs.

However, studies with a technological lens either discuss these human and organizational challenges very briefly (Berger et al., 2022; Walden et al., 2021) or discuss them in relation to the impact of regulations on implementing technical solutions (King and Timms, 2023; King et al., 2023; Timms and King, 2023). To exemplify this, King et al. (2023) suggest that DMPs should be used only as an interface that enables work with other connected technologies. However, King et al. (2023) also call on future research to investigate under what conditions DMPs can be more effectively adopted, and how data sharing between organizations can be enabled. Thus, these literatures do not explicitly consider how socio-technical challenges from using the DMP can arise and nor do they develop propositions that can help to prepare the human and organizational processes for implementing DMPs. To fill this gap and heed the call of King et al. (2023), we aim to understand how human and organizational challenges arise by consulting different approaches to understanding human behavior at work from literatures on work psychology and organizational behavior. These approaches help us to develop theory-driven propositions that digital change practitioners can adopt to facilitate the successful implementation of DMPs. The propositions aim to enhance either cognitive processes (i.e., related to accumulating knowledge) or motivational processes (i.e., related to maintaining engagement and enthusiasm for digital change) to support achieving interorganizational goals. We draw on examples of key challenges from the nascent DMP literature and consider examples from other digital technology implementation contexts where relevant to guide the content of these propositions.

Therefore, rather than focus on the technological components of DMPs, we focus more explicitly on how to prepare human and organizational processes as part of the ecosystem of change. We focus on DMPs in particular because their implementation can create unique considerations (e.g., interorganizational integration, sharing data within and across organizations) that may not exist in other digital transformation contexts. However, because implementing DMPs can allow data sharing with other connected technologies (Panza et al., 2023), adopting the propositions can help to prepare the human and organizational processes for other large digital change initiatives. The developed propositions will also have

implications for technology design, as it is important that the DMP features are in line with human-centric ways of integrating technology at the workplace (Panza et al., 2023).

The rest of this article is structured as follows. First, we outline the socio-technical approach, which we use as our theoretical framework to highlight how social systems (stakeholders, culture, processes, goals and structures) can interact with the implementation of DMP technology to produce socio-technical challenges within and across organizations. To ensure that these socio-technical challenges are reduced, we also draw on the IGLOO framework (Nielsen et al., 2018), which emphasizes that support within and across organizations needs to be developed at the individual, group, leader, organizational, and omnibus (interorganizational) levels to facilitate change. We then provide evidence for how approaches to understanding human behavior at work (creating a shared social identity, building interpersonal and interorganizational trust, enhancing resilience throughout the digital change, adopting transformational leadership styles, expanding roles through work redesign and identifying training and learning needs) can help us to understand why socio-technical challenges occur. Having this understanding allows us to develop propositions that can promote positive practice at multiple IGLOO levels for preparing the workforce and organizational processes to implement and use DMPs. We then offer suggestions for implementing the propositions in different organizational contexts with appropriate timing. Finally, we discuss the role of involving different stakeholders - employees, certification bodies, higher education institutions, and industrial digital technology (IDT) providers - in enhancing the benefits of the propositions.

2 Theoretical framework

2.1 The socio-technical approach

The socio-technical approach aims to jointly optimize the social and technical work systems in organizations that are conducting digital and business process changes (Sarker et al., 2019). This approach recognizes six interconnected systems (stakeholders, culture, structure, processes, goals, and technology; Davis et al., 2014) and their optimization helps to create an organization where technology enables people to work effectively and achieve the desired levels of productivity whilst promoting their wellbeing (Clegg, 2000). Modern organizations and supply chains can be considered complex socio-technical systems within which technology-related changes have implications for the other (non-technical) components within the system (Bednar and Welch, 2020). King et al. (2023) also consider the digital product passport ecosystem as a socio-technical system that needs to be designed with human values in mind and which supports systemic change. For these reasons, we adopt the socio-technical approach in this work to understand how different systems interact within the DMP ecosystem and produce challenges. For example, introducing DMP technology not only impacts the technology subsystem but also the stakeholder, processes, structure, goals and culture subsystems as employees require extra training and learning to use DMPs effectively (Freitas et al., 2023), there may be new ways of working for employees (King and Timms, 2023), as well as new

jobs and necessary changes in organizational mindset and priorities (Timms and King, 2023). This interdependence between systems in the socio-technical network indicates that social and technological challenges need to be considered and optimized together when implementing DMPs.

Involving stakeholders when using the socio-technical approach is also important because stakeholders' intimate understanding of the interconnected social systems can provide insight to specific practical ways in which to optimize these systems (Scholl, 2004; Ullrich et al., 2023). In addition, receiving input from stakeholders within organizations can help to promote their engagement and secure their buy-in when using technology (Oreg, 2006) and can facilitate their feelings of control and autonomy over the new work processes (Vereycken et al., 2021). Due to these reasons, when developing the propositions we focus explicitly on how gaining input from stakeholders within organizations can help to adapt the propositions for implementation in specific organizations.

In the present paper, we identify important socio-technical challenges when implementing DMPs from previous literature on DMP and DPP technologies (Berger et al., 2022; Walden et al., 2021) and DPP regulations (King and Timms, 2023; King et al., 2023; Timms and King, 2023). Whilst the identified socio-technical challenges may not form an exhaustive list, the propositions aim to reduce their impact by preparing the workforce and organizational processes when implementing DMPs.

2.2 The IGLOO framework

Because the introduction of DMPs is likely to result in large-scale digital change (involving changes to goals, structures, processes, stakeholders, and culture), it is important to optimize the socio-technical systems by introducing resources and support across the entire organization and supply chain (Eberl and Drews, 2021). To help us conceptualize these resources, we employ the IGLOO framework (Nielsen et al., 2017) which highlights that support needs to be given at the individual, group, leader, organizational and omnibus (external) levels. Because the aim of using DMPs is to collect and share data across multiple organizations in a supply chain (King et al., 2023), it is important that the propositions extend beyond single organizations and consider how to create a multi-organizational environment which is conducive for implementing and using DMPs. The IGLOO framework also notes that supports at different levels can interact with each other (Nielsen et al., 2018) to promote an environment that is conducive for achieving organizational goals. As a result of this, we focus on how the propositions can influence support at multiple IGLOO levels.

2.3 Theoretical approaches towards understanding human behavior at work

We consult six theoretical approaches towards understanding human behavior at work as they help us to gain a better understanding of how socio-technical challenges arise and help us to develop propositions for reducing these challenges when implementing DMPs. These theoretical approaches are either

TABLE 1 Mapping propositions for reducing socio-technical challenges through approaches to understanding human behavior at work.

IGLOO levels	Challenges	Approaches	Proposition
Individual Omnibus	Resistance to sharing DMP data	Creating a shared social identity	*Proposition #1* creating conditions of common fate can foster a sense of shared social identity across the supply chain which helps to build interorganizational relationships and facilitate sharing of DMP data
		Building interpersonal trust	*Proposition #2* fostering interpersonal trust can promote intergroup/interorganizational trust and facilitate the sharing of DMP data within and across organizations
		Creating an intermediary body	*Proposition #3* creating an intermediary body designed on the basis of trust-building characteristics can facilitate sharing and use of DMP data
Organization Leadership Group Individual	Making changes to goals, structure and processes	Adopting healthy organizational resources and practices	*Proposition #4* Adopting healthy organizational resources and practices can promote positive psychological states and increase employees' psychological resources which motivates them to meet DMP-related goals
		Adopting transformational leadership styles	*Proposition #5* Adopting a transformational leadership style can help leaders to support employees through the implementation of DMPs by increasing their work engagement, motivation, and optimism about the digital change
Organization Group Individual	Broadening knowledge and roles	Ensuring appropriate work design	*Proposition #6* Embedding task and social characteristics in employees' roles can foster positive psychological states that promote integrated understanding and sharing of DMP data
Organization Group Individual	New training and learning needs	Conducting a training needs analysis	*Proposition #7* Organizations can offer training programs, as well as opportunities for self-directed and informal learning, to support the development of employees' skills in using the DMP and to help expand their roles.

closely linked to important socio-technical challenges identified within the DMP literature (e.g., building employee trust towards sharing data; Timms and King, 2023) or have been previously used to inform positive practice in other digital transformation contexts (e.g., providing training to foster open-mindedness towards technology; Ivaldi et al., 2022). Therefore, in the subsequent section we discuss each identified socio-technical challenge, present the appropriate theoretical approaches and cognitive or motivational psychological mechanisms to understand that challenge, and develop propositions to reduce the impact of that challenge on implementing DMPs within and across organizations (at different IGLOO levels). For brevity, we provide a condensed overview of each approach here, with the aim of explicitly linking them to the socio-technical challenges of DMPs. To present each proposition, we visually display how *organizational interventions* can influence a *psychological mechanism* that can lead to *positive employee or organizational outcomes* when implementing DMPs. We present an overview of the propositions in Table 1.

# 3 Socio-technical challenges and propositions

3.1 Resistance to sharing data

Previous literature has discussed resistance to sharing data as one of the most important socio-technical challenges in the implementation of DMPs within and across organizations (Berger et al., 2022; King and Timms, 2023). More specifically,

employees are likely to resist sharing data through the DMP if interorganizational trust has not been built (relating to the cultural system), if organizations work in silos (separate structural systems), and if sharing information can result in the loss of competitive advantage (impeding organizational goals) (King and Timms, 2023). To develop propositions for reducing these challenges, we draw on approaches to building a sense of shared social identity (Neville et al., 2022) and developing organizational trust (Mayer et al., 1995).

The social identity literature offers insights for building interorganizational relationships as it suggests that creating conditions of having a common fate (or common destiny and purpose) can help organizations to form a sense of a shared social identity (Neville et al., 2022). To create a shared social identity, organizations within the supply chain can introduce conditions that bind different employees together (Campbell, 1958), creating a sense of 'we are all in this together'. Specific methods to create this condition in a DMP setting could include developing shared interorganizational goals, opening communication channels between leadership and teams within and across organizations, offering training and learning opportunities for those using the DMP, and helping employees to understand how their work with the DMP impacts on others at different stages of the manufacturing process or supply chain.

These methods can help to introduce a shared social identity - referring to a sense of self that is activated when an individual thinks about themselves as a member of a mutually-binding group (Neville et al., 2022). To provide examples of shared social identities, individual employees might perceive themselves as a member of a department, organization, or entire supply chain. When a

FIGURE 1
Summary of proposition #1.
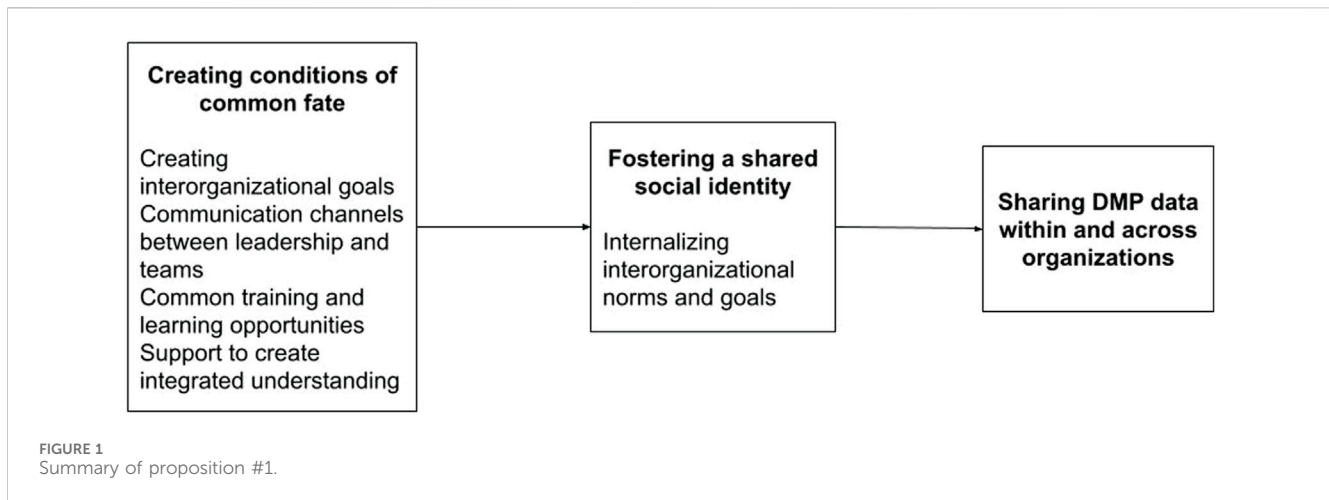
particular identity is activated, employees will exhibit the norms, behaviors, and attitudes of the group in question (Turner, 1991). Thus, in relation to the DMP, creating and fostering a sense of shared social identity across the supply chain as a whole is likely to help employees across the different organizations to feel connected to and affiliated to the higher level, interorganizational team and adhere to the shared organizational norms and goals (such as sharing data across departments and organizations). This sense of a shared social identity can help to break down organizational silos, facilitating changes to processes and structure at the cross-organizational (omnibus) level.

For a practical example of this cognitive psychological mechanism, Bouncken et al. (2019) describe how different organizations in a supply chain were bonded by a mutual interest and benefit from using 3-D printing (i.e., having common goals prompted them to create a shared identity). Due to the urgency of using this digital technology, different organizations in a supply chain created interorganizational communication channels. Moreover, Davidson et al. (2022) demonstrated that creating conditions of common fate within multi-agency emergency services (i.e., creating contacts between different responders and sharing common difficult experiences) can increase the digital interoperability between different organizations. Together, these examples suggest that creating conditions of common fate when implementing DMPs can stimulate a shared social identity, which facilitates interorganizational relationships and interorganizational changes in structures, processes, and goals (such as sharing the DMP data).

Proposition #1 Creating conditions of common fate can foster a sense of shared social identity across the supply chain which helps to build interorganizational relationships and facilitate sharing of DMP data (see Figure 1).

To further promote data sharing both within and across organizations, interpersonal trust between employees within and across organizations is required. Principles from the integrated model of organizational trust (Mayer et al., 1995) imply that employees will be more willing to engage in behaviors they perceive as risky (i.e., sharing data within and across organizations) if they believe that the trusted party (e.g., other employees and organizational representatives) exhibit trustworthy characteristics (ability, benevolence, and integrity). *Ability* refers to the trustor perceiving

the trustee has a 'group of skills, competencies, and characteristics that enable them to have influence within some specific domain' (Mayer et al., 1995, p. 717). In DMP contexts, individual employees need to have confidence that other employees (as important stakeholders in the same and other organizations) can make sense of the DMP data (i.e., are able to use the technology) so that the manufacturing process benefits the entire supply chain (referring to interorganizational goals; King et al., 2023). *Benevolence* refers to the 'perception of a positive orientation of the trustee toward the trustor' (Mayer et al., 1995, p. 719) such that the trustee exhibits good will towards the trustor. Thus, if individual employees perceive that members of other organizations are acting in the best interests of the entire organization or supply chain (i.e., not just focusing on their own interests), then employees are more likely to be willing to share data through the DMP (Berger et al., 2022). Finally, *integrity* refers to the 'trustor's perception that the trustee adheres to a set of principles that the trustor finds acceptable' (Mayer et al., 1995, p. 720). Employees may be concerned that members of other teams or organizations will not provide accurate data (i.e., the data will not have high integrity), which can increase their own resistance to sharing information (strengthening a siloed mentality and culture; Gaggioli et al., 2019). To promote these trust-enabling characteristics, organizations in the supply chain can agree on the skills required to work with DMPs, data-sharing principles, and the types of information that will be beneficial to each organization. Thus, building intergroup and interorganizational trust by promoting interpersonal trust between key stakeholders (Zaheer et al., 1998) can be an important bottom-up strategy (intervening at the individual level across teams and organizations) for promoting DMP data sharing. Organizations can also involve individual employees (as relevant stakeholders) in creating and facilitating ways to practically promote interpersonal trust. For example, employees can be involved in helping organizations to develop communication channels, concurrent training and learning events, or team-building exercises (examples of changing structure and processes) which help to foster interpersonal trust-building between individual employees or teams within and across organizations.

Proposition #2 Fostering interpersonal trust can promote intergroup/interorganizational trust and facilitate the sharing of DMP data within and across organizations (see Figure 2).

Where establishing interorganizational trust is difficult (or where interorganizational trust needs to be supplemented), an

FIGURE 2
Summary of proposition #2.

FIGURE 3
Summary of proposition #3.
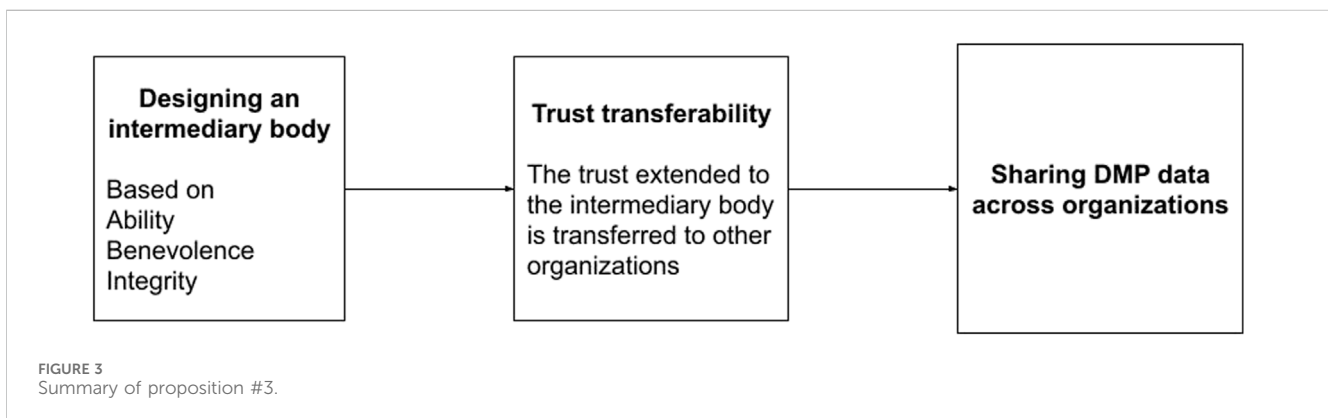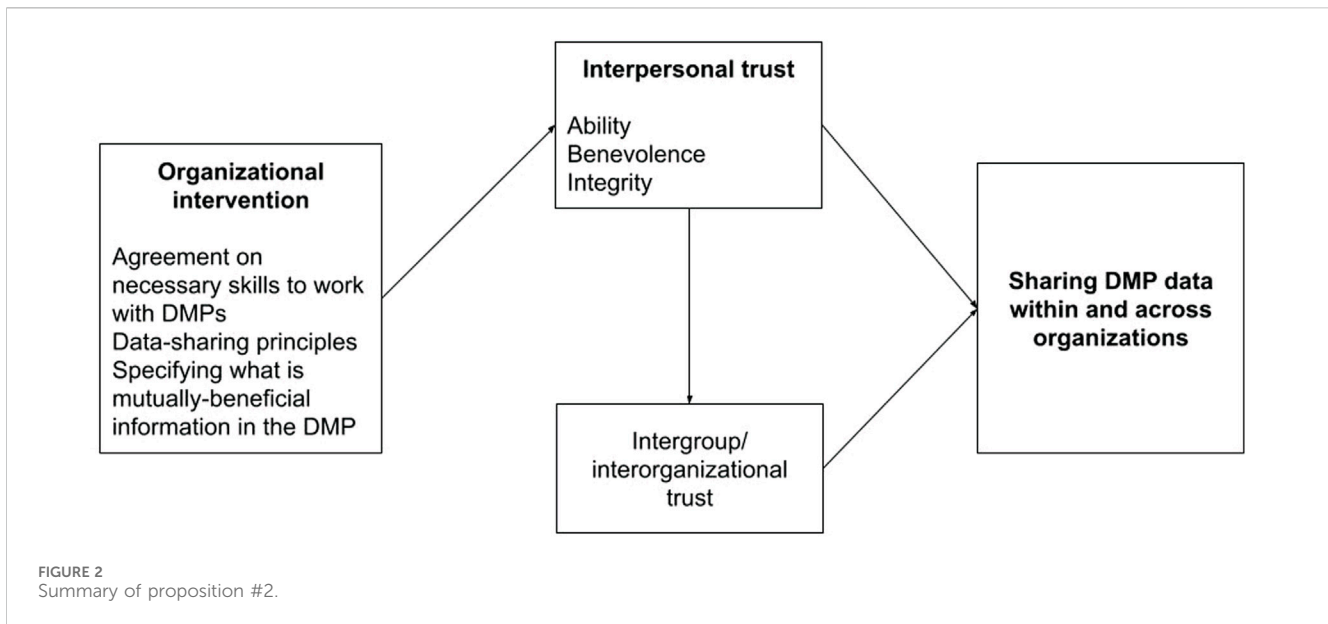
intermediary body could be created that controls the data and helps to share DMP data across organizations (as suggested by Bouwend Nederland, 2020). We build on this idea by proposing how this intermediary body should be designed from a human behavior perspective to enhance interpersonal trust. Ferrin et al. (2006) suggest that interpersonal trust can be promoted if both parties mutually trust a third party (i.e., the intermediary body) and this is known as trust transferability. Thus, this intermediary body should be designed with trust-enabling characteristics (ability, benevolence, and integrity) in mind to promote trust transferability.

An example of an intermediary body in practice is provided by Rijswijk et al. (2023) in their description of digitalisation in the Dutch flower sector. The traders (buyers and sellers) established a foundation (i.e., a new intermediary body) which collected key payment data from all organizations and third parties (thus its *ability* exceeded that of single organizations). The foundation also kept details of all members private (i.e., it had high *integrity*), and it was a not-for-profit organization that provided anonymized data to allow traders to make informed decisions (is *benevolent* towards traders by protecting their competitive advantage). Rijswijk et al. (2023)'s case study therefore offers a potential model for how to create an intermediary body at the omnibus level that controls the

DMP data (as an interorganizational goal) based on trust-building characteristics.

Proposition #3 Creating an intermediary body designed on the basis of trust-building characteristics can facilitate sharing and use of DMP data (see Figure 3).

3.2 Making changes to goals, structure and processes

Introducing DMPs is likely to prompt changes to the company's business model (or structures) as well as goals and processes (such as specifying new key performance indicators or creating new jobs; Timms and King, 2023). These changes can introduce pressures to deliver results through using the DMP, which can be difficult to meet if different processes are not integrated (van Capelleveen et al., 2023) and if employees (as key stakeholders) cannot use the data due to lack of skills (Honic et al., 2019b). Employees may also be concerned about losing their jobs if they do not understand how using DMPs assists their work (Larsson and Lindfred, 2019). Because these changes are psychologically aversive for employees and teams (Kayaalp et al., 2024) and may curb their enthusiasm for the

FIGURE 4
Summary of proposition #4.
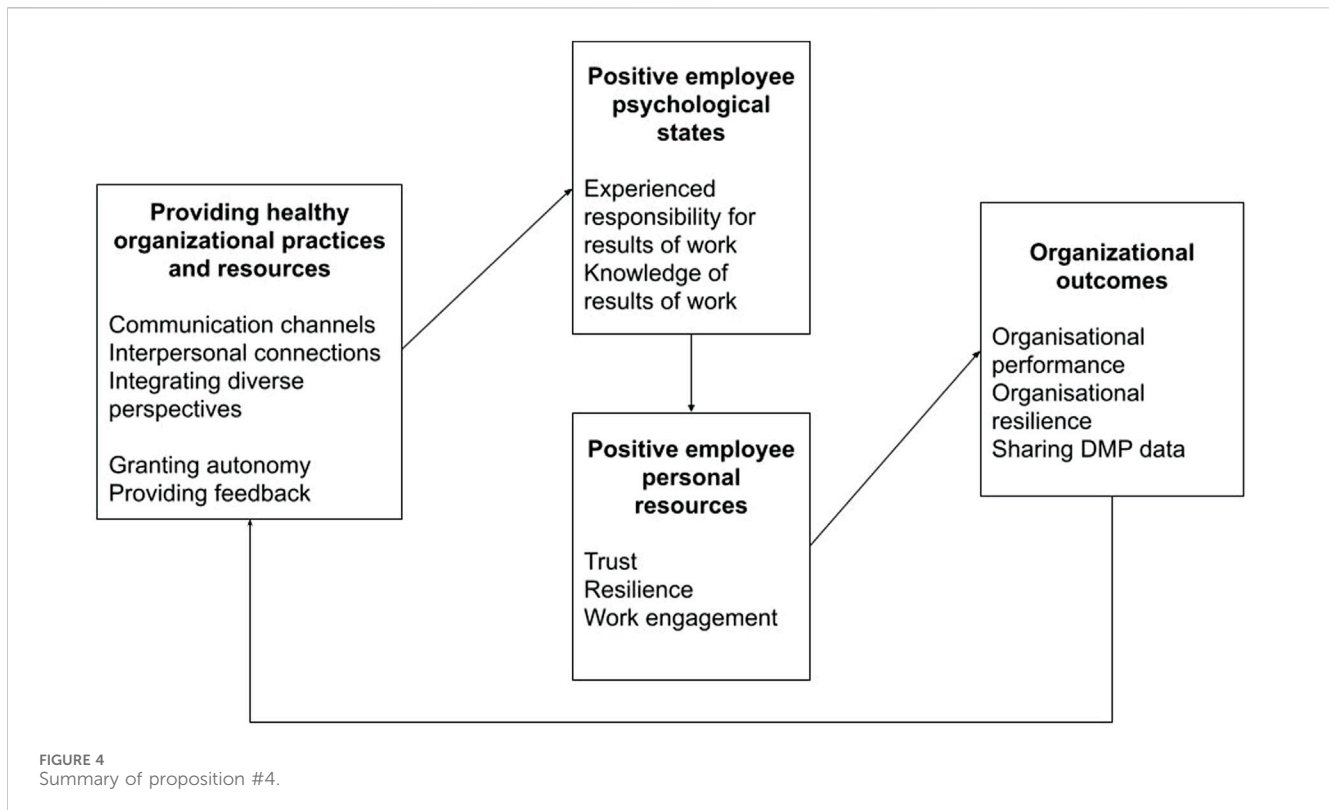
digital change (Kane, 2015), organizations could reduce these socio-technical challenges by drawing on the HERO model for building resilient organizations (Salanova et al., 2012) and adopting transformational leadership styles (Bass and Riggio, 2006).

As organizations are likely to make changes to their structures and processes when implementing DMPs, it is important that efforts are made to prepare the workforce for these changes. In support of this idea, the HERO model (Salanova et al., 2012) argues that organizations who provide healthy organizational resources and practices promote positive psychological resources (such as trust and work engagement) amongst employees which in turn facilitates the achievement of organizational outcomes (such as meeting new goals when introducing DMPs). Healthy organizational resources and practices are changes in the organization that are systematic, planned, and proactive (Salanova et al., 2012). When these changes are perceived as positive, they can motivate employees to remain highly engaged at work which increases their commitment to, and performance at, work (Halbesleben, 2010).

To explain how healthy organizational resources promote work engagement, the HERO model draws on the concept of job resources which [Demerouti et al. (2001), p.3] define as 'physical, psychological, social, or organizational aspects of the job that are functional in achieving work goals or stimulate personal growth and development'. Organizations that provide employees and teams with job resources related to their tasks (e.g., autonomy and feedback) and the social environment (e.g., teamwork, coordination, and supportive leadership) can help employees and teams to accrue important positive psychological resources (such as work engagement, work-related trust, and resilience). Employees who are given healthy organizational practices and resources can enter positive psychological states (experiencing responsibility for work, and knowledge of the results of work; Hackman and Oldham,

1976) that can facilitate them in accruing positive personal resources. To explain how accruing positive personal resources results in healthy organizational outcomes, Halbesleben (2010) suggests that engaged employees are motivated to invest their resources in achieving goals at work to obtain further resources (i.e., positive feedback, more autonomy). Thus, to facilitate the implementation of DMPs within and across organizations, organizations can provide important work resources and practices (intervening at the organizational level) that help employees to gain positive psychological resources and harness these resources to meet organizational goals.

Examples of healthy organizational practices that may be relevant for working with DMPs include demonstrating positive environmental impact, creating channels for communication and feedback, and promoting interpersonal connections (Salanova et al., 2012). These practices can also reduce siloed mentalities (which is important for the organization's culture) and can help to integrate processes so that DMP data can be more easily shared throughout the organization and supply chain. In previous digital transformation contexts, organizations who have provided their employees with combinations of healthy organizational resources and practices (such as information sharing, interdependent operations between employees, and integrating diverse perspectives) have achieved increased employee satisfaction, improved organizational performance (Felício et al., 2022) and organizational resilience (Lengnick-Hall and Beck, 2016). Providing these and other relevant healthy organizational resources and practices when implementing DMPs may therefore be important for enhancing employees' engagement, trust, and resilience so they are better able to meet DMP goals.

Proposition #4 Adopting healthy organizational resources and practices can promote positive psychological states and increase

employees' psychological resources which motivates them to meet DMP-related goals (see Figure 4).

Having leaders with a transformational leadership style (Bass and Riggio, 2006) is likely to be helpful to support employees when creating structural, process and goal-oriented changes (such as introducing new key performance indicators based on enhanced business models or integrating operational processes). Transformational leadership is a behavioral approach through which leaders influence and transform follower attitudes and behaviors, aligning employee and leader's values and ideals so that work is performed beyond self-interest for the improvement of the organization (Yukl, 1999). Thus, adopting a transformational leadership style can help leaders to motivate their employees to retain a high level of motivation throughout the implementation of DMPs and associated structural changes.

Judge and Piccolo (2004) outline four different dimensions of transformational leadership - idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration - all of which can increase employee motivation. [Judge and Piccolo (2004), p.755] describe idealized influence as the 'degree to which the leader behaves in admirable ways that cause followers to identify with the leader', and inspirational motivation as the 'degree to which the leader articulates a vision that is appealing and inspiring to followers'. [Judge and Piccolo (2004), p.755] also describe intellectual stimulation as the 'degree to which the leader challenges assumptions, takes risks, and solicits followers' ideas', and individualized consideration as the 'degree to which the leader attends to each follower's needs, acts as a mentor or coach to the follower, and listens to the follower's concerns and needs'. Decuypere and Schaufeli (2021) suggest that leaders who provide transformational leadership through these dimensions can increase the meaningfulness of work for employees, satisfy their psychological needs, and provide employees and teams with appropriate job, social and personal resources to promote their work engagement and motivation. Due to this reason, adopting transformational leadership styles is likely to help keep employees and teams motivated and engaged during and after the implementation of DMPs.

Theoretical and empirical research concerning digital transformation provide evidence for this assertion. For example, Philip (2021) proposes that leaders who exhibit idealized influence and intellectual stimulation (e.g., through encouraging new and creative ideas from employees) foster motivation and engagement in employees and thus prepare them for structural changes stemming from digitalization. Additionally, Philip (2021) proposes that leaders who exhibit inspirational motivation and individualized consideration (e.g., through providing a supportive climate) also foster motivation and optimism in employees which prepares them for the digital change and for collaboration with other employees in the organization or supply chain. This could reduce interorganizational silos in DMP implementation contexts. In a large-scale examination of small and medium German organizations from different industries, Bunjak et al. (2022) found that employees whose leaders exhibit transformational leadership behaviors showed an increased desire to adopt digital technologies because this leadership style increased employees' motivation to engage with these technologies. Adopting transformational leadership styles can help managers to provide important resources to employees (e.g., autonomy, security, learning), which can also be useful to facilitate their active

involvement in implementing organizational change (Richardson and Vandenberg, 2005). Thus, adopting a transformational leadership style (an intervention at the leadership level) can provide a supportive environment that is beneficial for keeping employees and teams motivated and engaged while making structural changes associated with the implementation of DMPs.

Proposition #5 Adopting a transformational leadership style can help leaders to support employees through the implementation of DMPs by increasing their work engagement, motivation, and optimism about the digital change (see Figure 5).

3.3 Broadening knowledge and roles

Reducing intra-organizational silos and enhancing data sharing are important conditions to reap the benefits of the DMP (Timms and King, 2023). To achieve these goals, employees may need to gain a larger process orientation (rather than focusing on their own narrow specialization) so that they understand the implications of their actions and how the data from their work can impact on other processes (Honic et al., 2019b). To support this idea, van Capelleveen et al. (2023) suggest that the current value of DMPs for organizations and supply chains relates to learning from the data to enhance operational processes. One way of enhancing the value of learning from the DMP data is to increase employees' integrated understanding of processes - that is, how the data from their work enhances other connected operational processes (e.g., processes related to the design, production and assembly of materials; van Capelleveen et al., 2023). We draw on approaches to work design (Hackman and Oldham, 1976; Humphrey et al., 2007; Morgeson and Humphrey, 2008) to propose ways of redesigning roles that promote integrated understanding and facilitate data sharing within and across organizations. This approach is appropriate because Morgeson and Humphrey (2008) argue that work design can promote learning and the achievement of performance goals within organizations.

Interventions at the organizational level to expand employees' roles and include wider responsibilities can facilitate the development of integrated understandings of organizational processes. Work design theories (Hackman and Oldham, 1976; Humphrey et al., 2007; Morgeson and Humphrey, 2008) indicate that organizations can change the characteristics of employees' roles so that they enter positive psychological states (so they experience increased meaningfulness of work, knowledge of results of work, experienced responsibility) that lead to increased work motivation and high quality work performance. Most importantly for DMPs, work design theories propose that three adaptable task characteristics - skill variety (the extent to which employees use different skills in their role), task identity (whether employees complete a whole piece of work or just parts of it), and task significance (whether the work has impact on the lives of others) - can help employees to experience greater meaningfulness from their work. When working with DMPs, jobs should therefore be designed to enhance meaningfulness such as by incorporating tasks requiring new data skills (which enhances skill variety) ensuring task identity (with identifiable complete tasks undertaken where employees can gain a sense of accomplishment) and task significance (such as making employees aware of the environmental impact of their work). In support of this example, Almatrodi et al. (2023) found that digital change implementers
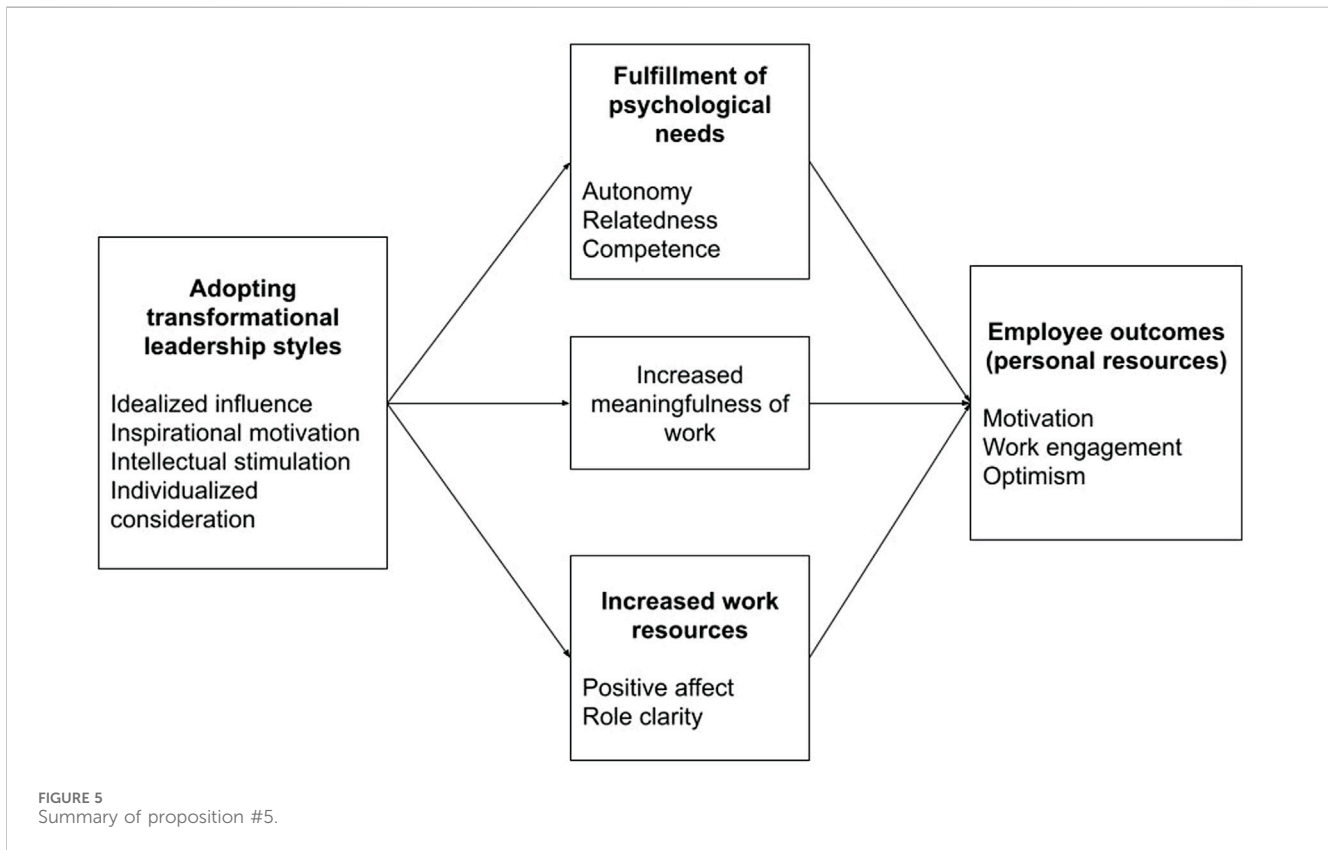
realigned employees' role responsibilities to increase skill variety amongst them which helped to prepare them for the digital change. Nadeem et al. (2024) found that individual employees who were given enhanced autonomy and feedback within advanced digital change initiatives experienced increased meaningfulness of their work and role responsibility which increased their job engagement. When redesigning roles however, it is also important that employees have confidence to perform the different tasks within those roles (also known as role breadth self-efficacy; Parker, 1998). The work design literature suggests that organizations can foster role breadth self-efficacy in employees by providing relevant training, enabling employees to have an influence over work-based decisions and autonomy over their work tasks (Axtell and Parker, 2003). Thus, positive work design characteristics can help to enhance employee roles through increasing the meaningfulness and felt responsibility of work as well as giving them the necessary confidence to successfully complete their new responsibilities.

However, working with DMPs may also entail collaborative work as part of an interdisciplinary team, for example, data specialists may need to work with strategy specialists to ensure alignment between the organizational strategy and data management practices. In such instances, modern approaches to work design (Humphrey et al., 2007; Morgeson and Humphrey, 2008) suggest that embedding social characteristics - social support, interdependence (creating tasks that require input from multiple team members) and feedback from others - within roles can help promote team level psychological states (i.e., team trust, team cohesion, and team motivation; Gagné et al., 2022; as well as

team belonging; Knight et al., 2022). These team psychological states could facilitate organizational or interorganizational goal achievement (e.g., learning about processes, extracting value from DMP data). Thus, intervening at the group level, and ensuring that team designs include a focus on social characteristics can promote integrated understanding within teams and increase performance within DMP implementation contexts.

Proposition #6 Embedding task and social characteristics in employees' roles can foster positive psychological states that promote integrated understanding and sharing of DMP data (see Figure 6).

3.4 New training and learning needs

While digital and organizational transformation (such as implementing DMPs) is likely to offer numerous technical opportunities, Vey et al. (2017) note that organizations may not be ready to capitalize on these opportunities if their workforce does not possess the necessary skills. Sony and Mekoth (2022) emphasize that the workforce, as key stakeholders in digital transformation, must develop both technological expertise and interdisciplinary soft skills (e.g., communication, teamwork, and adaptability) to effectively engage with new digital tools that facilitate the DMP. This is particularly important when embedding new role responsibilities as organizations must ensure that employees' skills are continuously updated through internal or external training programs (Larsson and Lindfred, 2019). Since DMP-required skills can range from basic data input to cross-

FIGURE 6
Summary of proposition #6.
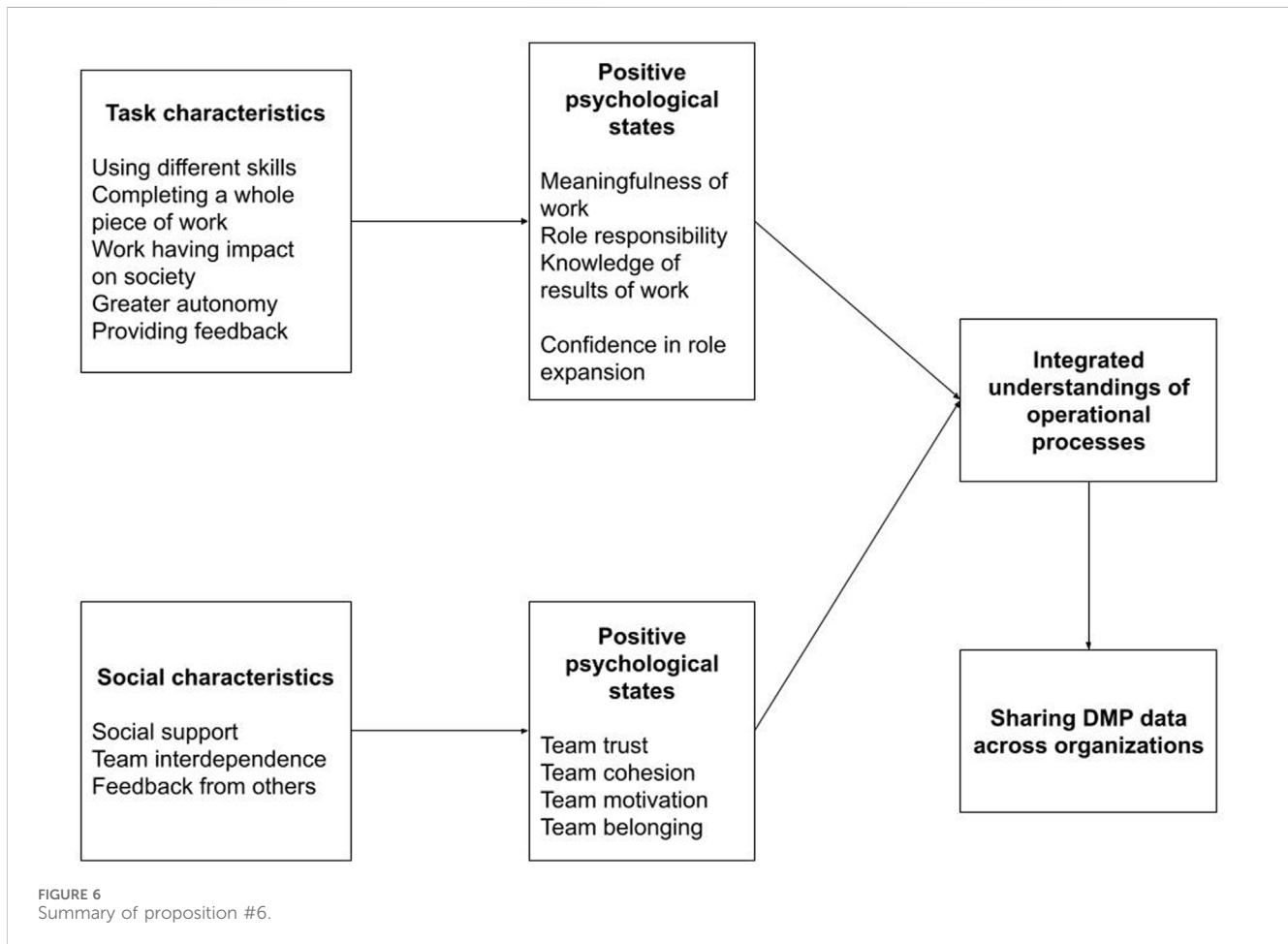
functional collaboration in extracting value from data, organizations need to assess which skills will be needed as roles expand, and offer employees growth opportunities through internal or external training, informal learning, and networking events (Vey et al., 2017). To enhance this socio-technical opportunity, we draw on approaches to performing training needs analysis (Goldstein, 1993; Salas and Cannon-Bowers, 2001) and on recommendations for undertaking self-directed (Garrison, 1997) or informal (Tannenbaum et al., 2009) learning. Providing training and learning opportunities in digital transformation settings (and thus investing in a learning-oriented organizational culture) not only increases employees' confidence in their digital skills (Chen and Zhou, 2022) but also encourages open-mindedness toward adopting new technologies (Ivaldi et al., 2022).

The training needs analysis literature suggests that organizations should take a holistic view, identifying areas where employees need upskilling, analyzing specific operational processes and the corresponding skill requirements, and assessing individual employees' specific development needs (Salas and Cannon-Bowers, 2001). By performing these different analyses simultaneously, organizations can identify and target skills that employees should develop (Goldstein, 1993). However, modern organizations that value human-centricity should also consider how employees' characteristics (i.e., their learning strategies, attitudes, motivations, personality and their perceptions of the learning climate) can influence the effectiveness of their skills

development (Bell et al., 2017). Because of this reason, fostering employees' motivation to engage in the training can be another key factor that positively affects their learning (Tannenbaum and Yukl, 1992). To understand which DMP-related skills employees need to develop and to facilitate employees' motivation for training and learning, organizations should involve employees in the identification of these skills (Gallie and Zhou, 2020). Involving employees in this process not only helps pinpoint the necessary skills but also increases their motivation to participate in training (Colquitt et al., 2000). Altogether, performing a training needs analysis through employee involvement can help organizations to identify the necessary DMP-related skills employees need to develop and encourage their active participation in skill development.

When there are large differences between individual employees in terms of their training needs, then offering tailored in-house training for each person is unlikely to be feasible. In this case, organizations might suggest appropriate external courses for skill development (Morris, 2019). Vey et al. (2017) suggest that learning and development leaders in digital transformation settings should identify the learning needs of individual employees, and suggest appropriate courses of action for their development. To upskill individual employees effectively, organizations can offer formal opportunities for more self-directed learning where employees reflect on their own skills and develop personalized development plans (Garrison, 1997). To that end, organizations might offer career counseling or mentoring as well as opportunities for individual
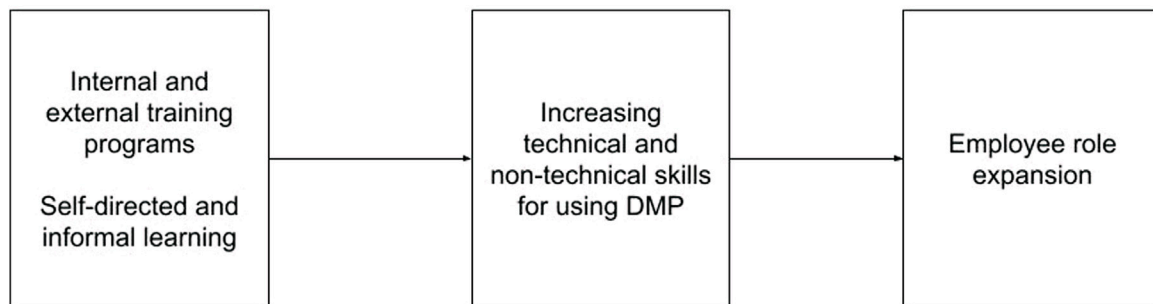
FIGURE 7
Summary of proposition #7.

employees to attend external training programmes (Konovalova, 2017). Employees may also benefit from less formalized experiential learning (Tannenbaum et al., 2009) as Cerasoli et al. (2018) have found that engaging in informal learning can increase knowledge and skill acquisition. Leaders can also establish a knowledge-sharing climate which can promote interpersonal trust (Park and Kim, 2018) as well as increase soft and technical skills and a desire to innovate during digital transformation (Ivaldi et al., 2022). In sum, organizations can offer employees formal training opportunities (intervening at the individual level) so that employees develop the necessary soft and technical skills to work effectively with DMPs. Where this is not possible, organizations could offer opportunities for employees to engage in self-directed training or informal learning opportunities that enhance employees' motivation for working with the DMP.

Proposition #7 Organizations can offer training programs, as well as opportunities for self-directed and informal learning, to support the development of employees' skills in using the DMP and to help expand their roles (see Figure 7).

4 Discussion

The aim of this position paper is to demonstrate how approaches towards understanding the mechanisms of human behavior at work can explain the emergence of socio-technical challenges and inform propositions for preparing the human and organizational processes when implementing DMPs. We draw on six approaches from work and organizational psychology (creating a shared social identity, building trust and resilient organizations, transformational leadership, work design and identifying training and learning needs) to develop seven different propositions that support interventions at multiple IGLOO levels (see Table 1). In the next sections, we first discuss the theoretical contributions of the present work to the nascent literature on DMPs. Then, we discuss practical implications for how the propositions can be used in DMP implementation contexts. We also discuss how the involvement of different stakeholders (employees, third parties, and IDT providers) can benefit the implementation of the propositions. These considerations are likely to be important in DMP implementation contexts as they can help practitioners to augment employees' work and to design new organizational processes.

4.1 Theoretical contributions

We contribute to the nascent DMP literature by discussing the key socio-technical challenges that can arise from implementing DMPs within and across organizations. More specifically, we develop theory-driven propositions that can enable organizations to make changes with the aim of achieving DMP-related organizational goals (such as focusing on sharing data, supporting employees through structural changes, gaining broader knowledge of processes and identifying training and learning needs). Therefore, we extend previous work that discusses the importance of stakeholders in successfully implementing DMPs (King et al., 2023; van Capelleveen et al., 2023) by suggesting propositions that affect multiple IGLOO levels within and across organizations and proposing distinct cognitive and motivational psychological mechanisms to support different stakeholders during this digital change. The propositions also add to previous literature that has focused on supporting organizations and stakeholders in moving towards Industry 5.0.

First, we extend previous theoretical work that discusses the importance of different stakeholders in facilitating a DMP ecosystem of change (King et al., 2023; van Capelleveen et al., 2023). Due to concerns around data sharing in DMPs and DPPs (van Capelleveen et al., 2023), the first three propositions we develop provide possible solutions for stakeholders across organizations who are apprehensive about adopting DMPs. These propositions aim to enhance interorganizational trust between stakeholders so that they can achieve interorganizational goals and reduce organizational silos. Additionally, King et al. (2023) note that stakeholders (employees, managers) can use DMPs to improve operational efficiencies. To augment this assertion and support stakeholders' work with DMPs, we suggest ways of optimizing interorganizational processes and structures (propositions #4 and #5), goals (propositions #6) and cultures (propositions #7). Thus, our first theoretical contribution is to extend previous DMP literature that highlights the importance of stakeholders in facilitating the successful implementation of DMPs within organizations and across the supply chain.

Second, we extend previous organizational behavior literature (e.g., Salanova et al., 2012) that typically focuses on examining support within organizations by considering interorganizational processes, structures, goals, and culture. The DMP literature

(Berger et al., 2022; King et al., 2023; van Capelleveen et al., 2023) suggests that introducing DMPs has important implications for multiple different organizations in the supply chain. Thus, the propositions we developed specifically address creating support within and across organizations for data sharing and interorganizational collaborations (propositions #1, #2, and #3), changing goals, processes, and structure (propositions #4 and #5) as well as employee role expansion and upskilling (propositions #6 and #7). This is particularly important when undertaking large-scale digital change (such as introducing DMPs across organizations) as the benefits from this change offer advantages for the entire supply chain (Götz et al., 2022). Thus, by broadening the focus to consider interorganizational goals, the propositions developed in this paper offer initial guidance for supporting stakeholders both within and across organizations as digital change continues to expand beyond single organizations, such as in the case of DMP implementation.

Third, we highlight different psychological mechanisms related to cognitive processes (e.g., learning and knowledge acquisition, proposition #7) and motivational processes (e.g., increased work engagement and resilience, proposition #4). Specifically, propositions driven by cognitive mechanisms aim to support stakeholders by establishing the necessary knowledge to drive the adoption and implementation of DMPs, whereas propositions driven by motivational mechanisms aim to support employees by enhancing the meaningfulness of their work and building their resilience. By drawing on these mechanisms, the propositions are designed to augment the work of stakeholders and facilitate changes to organizational processes, structures, culture, and goals. This is important because previous work has been limited to considering the implementation of DMPs from a financial (van Capelleveen et al., 2023), technological (King et al., 2023) or regulatory (Timms and King, 2023) perspective. However, given that the success of digital change initiatives is dependent on human involvement and acceptance (Kane, 2015), we build on these perspectives by developing propositions that draw on cognitive and motivational approaches to understanding human behavior at work. To achieve the goals of digital change, we argue that both propositions driven by cognitive mechanisms (e.g., upskilling employees, proposition #7) as well as propositions driven by motivational mechanisms (e.g., adopting healthy organizational practices; proposition #4) are important to support stakeholders when working with DMPs. Thus, we extend previous work by highlighting the importance of considering the psychological (cognitive and motivational) mechanisms that underpin the sociotechnical challenges associated with implementing DMPs.

Finally, although the primary focus of developing the propositions is on promoting the implementation of DMPs, the propositions can supplement the drive to wider changes such as moving towards Industry 5.0. Current debates in the Industry 5.0 literature highlight the necessity for employees to achieve complex psychological needs through their work (such as self-actualization and high self-esteem; Aheleroff et al., 2022) and to acquire additional technical and soft skills (Acerbi et al., 2022). Implicit in these debates, however, is the role that organizations and supply chains can play in moving towards Industry 5.0. With regard to the current work, if organizations implement DMPs by ensuring that both employee and organizational goals are met, then the implementation of DMPs can support the drive towards Industry 5.0. Thus, the current propositions also build on previous work on Industry 5.0 by suggesting how

organizations can utilize the highlighted psychological mechanisms to stimulate positive, human-centered changes to the structure, processes, goals, stakeholders, and culture socio-technical systems within and across organizations.

4.2 Practical implications

To ensure that the propositions are beneficial for implementing DMPs (as a large-scale digital change), it is important that they are implemented early on in the change process to achieve interorganizational goals (i.e., sharing data and integration of processes). For larger-scale digital change projects (where the introduction of DMP changes the goals, structures, processes, stakeholders, and culture of multiple organizations), it is crucial to implement actions towards fostering interorganizational trust early on in the process, as preparing employees and organizations for this change takes time. Other important actions are to identify and update learning needs (proposition #7) as these may be a prerequisite for employees to build their knowledge of wider organizational processes (proposition #6), which can promote interorganizational and interpersonal trust (propositions #1 and #2) in the long term. Where organizations opt to undertake smaller-scale digital change to test whether the implementation of DMPs provides value within pilot projects, certain propositions can still be implemented immediately (such as offering training and learning opportunities, proposition #7; or involving employees in discussing how roles can be enhanced, proposition #6).

Some of the propositions may also need to be repeated or updated over time. For instance, identifying learning needs can be useful for enhancing DMP-related skills (proposition #7), but the skills that employees develop may need to be updated if employees' task or social work design characteristics change (proposition #6) as a result of new technological developments or regulatory requirements. Establishing interorganizational trust (proposition #1) will also facilitate the flow of data between organizations (King et al., 2023) and reduce the need for an intermediary body (proposition #3). Due to these reasons, organizations can build on and implement the propositions more than once where necessary, but it is important to implement actions as soon as possible to facilitate the successful implementation of DMPs.

In line with Nielsen et al. (2018)'s IGLOO model, the propositions can help to promote positive practice at multiple different levels (i.e., at the individual employee, group, leader, organizational, and omnibus levels). For example, providing healthy organizational resources and practices (proposition #4) can entail providing work resources for individuals and groups of employees, the adoption of supportive leadership styles, and providing open communication channels throughout the whole organization. Similarly, different propositions can support the implementation of other propositions. For example, research by Dirks and De Jong (2022) suggests that adopting transformational leadership styles (proposition #5) can help to promote interpersonal trust (proposition #2). To break down organizational silos at the omnibus level (King and Timms, 2023), creating an intermediary body (proposition #3) need not preclude the development of a shared social identity (proposition #1) as organizations can continue developing new communication channels between teams from different organizations. Due to these interconnections, we recommend that digital change practitioners

should keep in mind the synergies between propositions when implementing DMPs.

The propositions are applicable (and adaptable) to organizations and supply chains which vary in structure, processes, and size. For instance, some organizations who control multiple steps of the production process may implement DMPs more easily because processes at these different steps are already better integrated (including but not limited to communication, knowledge management, and competitive advantage protection; Kedir et al., 2021). If multiple steps are within one organization (who already share the same identity), this might also help to enhance trust between stakeholders at different steps of the process (propositions #1, #2 and #3) which can facilitate the implementation of DMPs. Implementing the propositions may also differ if organizations implement changes to their processes at a different pace. For example, Honic et al. (2019b) suggest that organizations who would like to make slower changes to their processes (i.e., due to lacking broader knowledge of processes) could initially rely on external services to create the DMP as well as to maintain and share DMP data. These types of organizations can define the task and social characteristics of their own employees (proposition #6) and analyze their training needs (proposition #7) in the interim. The scale of change may also be different in different sized organizations. For instance, small and medium enterprises may have to implement DMPs throughout all of their existing processes whereas larger organizations might be able to implement DMPs in one area of manufacturing and then scale its implementation to other units or processes (Demeter et al., 2021). Employees in these organizations may resist the digital change if it takes place only in certain units or if it challenges current job positions (Fernandez and Rainey, 2017), which can make adopting transformational leadership practices (proposition #5) and identifying learning needs (proposition #7) crucial for supporting these employees. Altogether, digital change practitioners should consider how the structure, processes, and size of organizations that are implementing DMPs can influence how the propositions can be adapted and implemented.

4.3 Stakeholder involvement

To ensure that the propositions benefit both employees and organizational goals, the propositions have been developed with participatory stakeholder involvement (Ullrich et al., 2023) in mind. Involving relevant stakeholders such as employees, certification bodies, higher education institutions, customers, and IDT providers in adapting the propositions to the specific DMP implementation context can unearth organizational strengths for researchers to build on when testing the propositions. Involving stakeholders in designing practical ways to implement the propositions may also help to reduce siloed mentalities within and across organizations. In turn, this can enable the development of interpersonal and interorganizational trust (proposition #2). Therefore, organizations can involve different stakeholders to suggest practical ways in which the propositions can be adapted so that they suit interorganizational and employee needs.

In support of this idea, Nielsen and Christensen (2021) argue that participating actively in the process of designing organizational change can promote employees' understanding of why the change is happening and fosters their buy-in and ownership of the change. For

example, individual employees can provide input to which skills they need to develop to work effectively with DMPs (proposition #7). Therefore, organizations who enable employee involvement in the change process can benefit from understanding practical ways in which to augment the propositions and prepare the human and organizational processes for successful DMP implementation.

Organizations can also benefit from consulting with other relevant stakeholders (e.g., certification bodies, higher education institutions, customers, and IDT providers) during the DMP implementation process (King et al., 2023). Consultations between certification bodies and organizational representatives can allow all organizations to agree on the types of data that should be collected within the DMP so that interorganizational trust can be promoted (propositions #1 and #2) within the supply chain. Specifically, organizations may agree to collect data that facilitates trust such as by sharing information that has high integrity (e.g., that is collected at source and cannot be changed after collection) and that is useful to other organizations (benevolence) without giving away information that could jeopardize their competitive advantage. Additionally, IDT providers should consult with organizational stakeholders so that the DMP technology can be designed in a way that allows organizations to securely share information that is beneficial to others in the DMP ecosystem, without them being able to access commercially sensitive information. Furthermore, as Industry 5.0 is led by humanistic values, it is important that IDT providers consider the currently developed propositions when designing DMP technology so that organizational stakeholders can work with it more effectively. For example, Parker and Grote (2022) suggest that IDT providers can embed important task and social characteristics (e.g., task significance, social support) within the technology interface (in line with proposition #6; broadening roles and responsibilities). The current propositions may also prompt IDT providers to design DMPs so that they can collect social responsibility data associated with sustainable work practices (e.g., collecting data on the working conditions for employees extracting raw materials; Panza et al., 2023). Designing DMP technology in such human-centric ways can help to facilitate employee acceptance and use (thereby reducing the rates of unsuccessful digital change activities; Oludapo et al., 2024) and promote its broader societal value. Higher or further education institutions might also be able to provide input on the types of training and learning that could be provided for leaders and employees (proposition #7). Customers may need to learn new ways of reusing and recycling materials, and thus employee roles can be designed and created within organizations (proposition #6) to facilitate this purpose. For the reasons outlined, identifying and involving relevant stakeholders (employees, certification bodies, IDT providers, higher education institutions, and customers) in the DMP ecosystem (King et al., 2023) can be important for adapting the propositions in DMP implementation settings.

4.4 Limitations and considerations for future research

Whilst the propositions are based on previous related literature, they need to be tested within DMP implementation contexts. Future research might also identify additional interorganizational goals that may be important when implementing DMPs or goals aligned with

the values of Industry 5.0 (e.g., sustainability, employee wellbeing), identify other socio-technical challenges that have not yet been considered by the DMP literature, and discuss practical methods of adapting the current propositions in more depth. As additional considerations, fitting the propositions to the implementation context (e.g., using existing interorganizational communication channels to disseminate information) and involving different stakeholders is crucial to meet DMP-related goals.

4.5 Conclusion

In this position paper, we outlined key socio-technical challenges by consulting the academic literature on DMPs. We drew on the literature on human behavior at work to develop seven propositions for preparing the human and organizational processes within and across organizations when implementing DMPs. The propositions build on previous work to extend literature on DMP implementation and within-organizational support systems. The propositions offer distinct cognitive (e.g., acquiring knowledge to support the implementation of DMPs) and motivational (e.g., enhancing the meaningfulness of employees' work) pathways for supporting different organizational stakeholders in meeting interorganizational goals. Organizations can also benefit from implementing changes in the organizational processes, structure, goals and culture with these psychological mechanisms in mind to align their practices with the values of Industry 5.0. The propositions are applicable and adaptable to digital change in different organizational and interorganizational contexts, and they can influence long-term organizational goals through immediately implementable actions. Adapting these actions through involving relevant stakeholders (employees, certification bodies, higher education institutions, customers, and IDT providers) can also help to ensure that the implementation of DMPs supports both interorganizational and employee needs. Due to these reasons, testing the propositions can be an important step towards preparing the human and organizational processes across organizations that are implementing DMPs. In doing so, testing the propositions can enhance the value of DMPs for employees, organizations, and supply chains.

Author contributions

VG: Conceptualization, Investigation, Writing–original draft, Writing–review and editing. CA: Conceptualization, Funding acquisition, Writing–review and editing. HZ: Conceptualization, Investigation, Writing–review and editing. KN: Conceptualization, Funding acquisition, Writing–review and editing.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The author(s) declare that no Generative AI was used in the creation of this manuscript.

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