Exploring an Integrated Theoretical Framework for Ontology-Based Job Matching Algorithms for Persons with Disabilities

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Introduction

Persons with disabilities are at a higher risk of long-term unemployment compared to individuals without disabilities (Burgess & Cimera, 2014; Kersten et al., 2023). The uncertainty and insecurity of their employment conditions therefore make them vulnerable workers (Boselie et al., 2021; Goud, 2014; Tompa, 2006). What causes disabled individuals to experience more vulnerability, compared to their non-disabled counterpart? According to disability studies literature, this question could be answered through an interactional perspective, which sees disability not simply as intrinsic impairments, but as the outcome of the interaction between those impairments and external societal or environmental factors (Shakespeare, 2012; Smart, 2004; Forstner, 2022; Masala et al., 2008; Altman, 2001; Whiteneck, 2006). According to this perspective, the mismatch between an individual and their work environment is a significant barrier to stable employment. When the environment fails to accommodate their needs, and when individuals are unable to meet rigidly defined job demands, this results in lower employment levels, wage disparities, job insecurity, and reduced job satisfaction among disabled workers (Schur et al., 2017; Yelln & Trupin, 2003). Therefore, effective job matching-a process that aligns individuals' work-related attributes with the characteristics of their work environment-is crucial for enhancing workplace inclusion and promoting sustainable employment for disabled individuals (Nützi et al., 2017).

With the rapid development of digital technologies, such as Artificial Intelligence (AI), human resource management (HRM) has received new tools and methods for decision-making (Malin et al., 2024; Nicolas-Agustín et al., 2022). While by focusing on job-related criteria, such as skills, AI has the potential to reduce biases (Rahman et al., 2025; Albaroudi et al., 2024; Delecraz et al., 2022), AI may also reinforce biases because it is not inherently neutral or objective. Its fairness depends on the quality of the data used to train these models. Current job matching algorithms, based on purely data-driven AI techniques (e.g., machine learning), for disabled people, are susceptible to biases when trained on incomplete, unrepresentative, or erroneous data, leading to discriminatory hiring decisions (Malin et al., 2024; Tilmes, 2022; Trewin, 2018). Furthermore, many AI models operate as "black boxes". Their lack of transparency undermines accountability and trust (Goodman & Flaxman, 2017; Shin, 2024), making it difficult to understand or explain how decisions are made, recognize whether bias exists, and determine whether the model appropriately represents the concepts that are relevant and meaningful in a given context.

Formal knowledge representation technologies, such as ontologies, are a different approach to AI, compared to data-driven approaches, which offer more transparency and explainability (Reyero Lobo et al., 2023; Martinez-Gil, 2020; Confalonieri & Guizzardi, 2023). Ontologies are formal and explicit specifications of a shared conceptualization (Gruber, 1993, 1995; Studer, 1998). They serve as abstract models of domain knowledge, identifying key concepts and the relationships between them (Gruber, 1993). The term "explicit" signifies that an ontology unambiguously defines these concepts and their constraints, making them interpretable by both humans and machines (Studer, 1998). Humans can understand an ontology because it reflects familiar common sense and domain knowledge (Confalonieri & Guizzardi, 2023), while machines can reason about the concepts using formal logic based on the ontology's defined semantics (Grabowski & Wang, 2023). Ontology-based algorithms differ from data-driven approaches in that they are rule-based rather than relying on statistical inference (Confalonieri & Guizzardi, 2023). Their inclusivity depends on the theoretical lens

used to define and structure domain concepts and their empirical meaningfulness to people. Therefore, establishing a robust theoretical framework is an essential foundation for ensuring that the ontology effectively represents diverse perspectives. This paper focuses on exploring a theoretical framework for designing a job-matching ontology tailored to disabled individuals, fostering a more inclusive labor market. The empirical aspect of validating and refining this framework could be addressed in future works.

Theoretical Framework

The framework we propose integrates multiple theoretical perspectives, with Person-Environment (P-E) Fit theory at its core. The concept of job matching is deeply rooted in P-E Fit theory (Nützi et al., 2017), which refers to the compatibility between an individual's characteristics and the attributes of their work environment (Kristof-Brown & Guay, 2011), offering a means to address mismatches between individuals and their work environments. P-E fit can be categorized into two types: supplementary and complementary (Muchinsky & Monahan, 1987). Supplementary fit occurs when individuals align with an environment because they share similar characteristics—such as values, goals, personality—with others in that environment (Chatman, 1989; Kristof-Brown, 1996). In contrast, complementary fit describes how an individual's characteristics serve to "make whole" or complement the needs of the environment (Muchinsky & Monahan, 1987, p. 271). Complementary fit has been further categorized into needs-supplies fit, where an organization provides resources that satisfy an individual's needs, desires, values, or preferences, and demands-abilities fit, where an individual's skills and abilities meet the organization's requirements (Kristof-Brown, 1996). A strong P-E fit fosters well-being, job satisfaction, good performance, and employee retention, whereas misfit or lack of fit leads to job dissatisfaction, stress, burnout, and turnover (Edwards et al., 1998; Caplan, 1987; French et al., 1974; Kristof-Brown & Guay, 2011).

As suggested by various disability employment studies (Vornholt et al., 2018; Suresh & Dyaram, 2023; Wu et al., 2023), job matching should be viewed as a dynamic process that allows for accommodation and adjustment, which is essential for fostering disability inclusion. P-E fit is grounded in an interactionist perspective that conceptualizes fit as a dynamic and reciprocal process. This perspective helps us move beyond static job-matching models. One of the most influential interactionist theories is Lewin's (1951) equation, B = f(P, E), emphasizing that behavior (B) is a function of both person (P) and environment (E), highlighting their mutual interdependence. This framework also draws from Bandura's (1978) theory of reciprocal determinism, which posits that behavior is not just an outcome but also an active force that shapes both the person and the environment. This perspective aligns closely with the theory of person-environment transactions (Stokols, 1978; Van Staden, 1984; Law et al., 1994). Transactions are reciprocal processes where individuals and environments continuously influence each other. These transactions can be either "reactive", focusing on how the environment affects an individual's behavior and well-being, or "active", where individuals take initiative to modify their environment to better align with their needs and goals (Stokols, 1978, p. 259).

Built upon this, the framework proposed in this paper is enriched by Magnusson and Stattin's (1996) holistic interactionism. This perspective moves beyond the traditional approach that isolates individual variables and analyzes their functions separately. Instead, holistic interactionism views both the individual and environment as a "person-environment system", which is an integrated whole, where the functioning of the system arises from the interactions between its elements, rather than from the influence of isolated parts on the whole (p. 405). Echoing the principles of holistic interactionism, there is a growing consensus on the multidimensional nature of P-E fit (Edwards & Billsberry, 2010; Wheeler et al., 2005; Jansen & Kristof-Brown, 2006; Chuang et al., 2016; Andela & van der Doef, 2019). Individuals are

"nested in multiple aspects" of their environment (Chuang et al., 2016, p. 68; Andela & van der Doef, 2019, p. 568), meaning that the experience of fit cannot be understood through a single dimension. Different dimensions of P-E fit have been shown to affect employee attitudes and behavior in distinct ways. Established studies distinguish four key types: person-job fit, person-organization fit, person-supervisor fit, and person-group fit (Chuang, 2016; Kristof-Brown et al., 2005; Kristof-Brown & Guay, 2011). These types of fit are further categorized by content dimensions, such as values, goals, personality, and interests.

These theoretical insights inform the design of ontology-based job-matching systems, which should: (1) Integrate multidimensional fit elements (e.g., different types of P-E fit and content dimensions), (2) Emphasize disability-inclusive dimensions (e.g., workplace accommodations, accessibility needs, assistive technologies), (3) Represent work adjustment possibilities (e.g., flexible job requirements, task redesign, tailored accommodations), and (4) Account for the dynamic nature of fit, ensuring responsiveness to changing individual and workplace conditions.

Evaluation of Existing Ontologies

Despite extensive developments of ontologies in general employment, human resources, and healthcare domains, ontologies focused on employment for disabled individuals remain scarce. Notable exceptions include the works of Spoladore et al. (2019, 2023, 2024), Shishehchi & Banihashem (2019), Rivas-Costa et al. (2014), and Paulino et al. (2022). However, Shishehchi & Banihashem and Rivas-Costa et al. (2014) focus solely on demand-ability fit, while Paulino et al. (2022) and Spoladore et al.'s works align with the International Classification of Functioning, Disability, and Health (ICF) to expand the framework to include aspects of need-supply fit. Despite these contributions, a comprehensive ontology that systematically analyzes P-E fit, covering various fit types and attributes, is still lacking. Moreover, they adopt a static approach to job matching, overlooking the dynamic interaction between individuals and their work environments. None account for how accommodations and adjustments can transform misfit into fit and how fit may change over time. Given these limitations, future research should focus on optimizing P-E fit by addressing these neglected dimensions and integrating more comprehensive and dynamic views of disability-inclusive employment.

Expected Contribution

The integrated theoretical framework we have outlined above adopts a dynamic, reciprocal, and holistic interactional perspective. Rather than treating job fit as a static match, it acknowledges that both disabled individuals and employers can actively shape and adjust their fit within work environments over time. Instead of being passively excluded due to misfit, it encourages seeing disabled individuals are empowered as active agents who continuously adapt to or change their work environments. We suggest that these insights have important implications for the design of ontology-driven job-matching systems for disabled individuals in the future, fostering long-term inclusion and sustainable employment.

In the workshop, we will present this integrated theoretical framework, including an analysis of both a general conceptualization of the person-environment system and the specification of key dimensions (e.g., ability, needs, and values) for each core concept (e.g., person and environment). Furthermore, we will discuss the implications of this framework, serving as design requirements for future ontology-driven job-matching systems.

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