A Reference Ontology of Job Matching Based on Person–Environment Fit to Support Sustainable Employment

Luotong Cheng[1,*], Claudenir Morais Fonseca[1], Jeroen Meijerink[1], M. Birna van Riemsdijk[1] and Joschka A. Hüllmann[1]

[1]University of Twente, Drienerlolaan 5, 7522 NB Enschede, The Netherlands

Abstract

This work presents a reference ontology of job matching grounded in person–environment (P–E) fit theory. Fit is essential for sustainable employment, as it promotes job performance, satisfaction, and retention. P–E fit is a multidimensional and dynamic phenomenon, in which different types of fit jointly influence employment outcomes. Sustainable employment depends not only on initial fit, but also on the ongoing process of achieving and maintaining fit. However, these insights are rarely translated into computational job matching systems. Existing systems exhibit several limitations. 1) Fit is typically operationalized in a narrow manner, focusing primarily on skill–requirement matching, overlooking other dimensions of P–E fit. 2) Fit is treated as relatively static, with limited support for representing the work-adjustment processes through which fit is achieved and maintained over time. 3) Fit remains implicit, as matching outcomes are often expressed as opaque scores without explaining what it means to fit or why a fit holds. To address these limitations, we develop a reference ontology of job matching, which bridges P–E fit theory and computational systems. The ontology is developed through an ontological analysis grounded in the Unified Foundational Ontology (UFO) and is represented in OntoUML, enabling precise and unambiguous definitions of domain concepts. It is subsequently formalized in OWL to provide a machine-readable ontology supporting automated and explainable reasoning. The ontology is evaluated using competency questions and scenario-based instantiation. By reconceptualizing job matching as a multidimensional and dynamic process, this work contributes to the development of explainable job matching systems for sustainable employment and facilitates knowledge sharing and data integration across systems.

Keywords

Job matching, sustainable employment, person–environment fit, domain ontology, Unified Foundational Ontology

CEUR-WS.org/Vol-4342/paper2.pdf

1. Introduction

Job matching is a process of matching individuals' work-related attributes with the characteristics of their work environment [1]. Effective job matching supports sustainable employment, defined as workers' ability and willingness to remain employed over time [2], because a high degree of fit is associated with higher job performance, job satisfaction, and retention [3]. Research on person–environment (P–E) fit emphasizes that fit is a multidimensional phenomenon, involving alignment between multiple aspects of individuals and their work environment rather than a single criterion such as skills–requirements fit [4, 5]. P–E fit is also an ongoing process [6], indicating that sustainable employment depends not only on initial fit but also on maintaining and adapting fit as individuals and work environments change.

Job matching has traditionally relied on human experts who interpreted and integrated information about individuals and workplaces. Recent advances in AI (e.g., deep learning and natural language processing) have increasingly automated the extraction and alignment of such information [7]. Although effective for large-scale matching, these probabilistic AI approaches operate on latent statistical correlations and offer limited explanations of why a match holds [8]. Ontology-based approaches

Proceedings of FOIS 2026 Satellite events co-located with the 16th International Conference on Formal Ontology in Information Systems (FOIS 2026), September 21–25, 2026, Vitória, Brazil

*Corresponding author.

l.cheng@utwente.nl (L. Cheng); c.moraisfonseca@utwente.nl (C. M. Fonseca); j.g.meijerink@utwente.nl (J. Meijerink); m.b.vanriemsdijk@utwente.nl (M. B. van Riemsdijk); j.huellmann@utwente.nl (J. A. Hüllmann)

0009-0002-6567-8923 (L. Cheng); 0000-0003-2528-3118 (C. M. Fonseca); 0000-0002-0210-073X (J. Meijerink); 0000-0001-9089-5271 (M. B. van Riemsdijk); 0000-0001-5704-8644 (J. A. Hüllmann)

© 2026 Copyright for this paper by its authors. Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

CEUR Workshop Proceedings ceur-ws.org ISSN 1613-0073

published 2026-11-27

can complement probabilistic models by making underlying concepts and relations involved in job matching explicit, supporting traceable reasoning [9]. Job matching also relies on information from heterogeneous sources (e.g., curricula vitae, job and workplace-related information), and is applied across diverse application contexts (e.g., recruitment, reintegration, and workplace accommodation). Differences in how stakeholders interpret work-related concepts and how systems represent them often lead to semantic heterogeneity, hindering consistent interpretation and data integration across systems [10]. This heterogeneity highlights the need for a shared, explicit conceptual foundation for job matching. Ontologies can mitigate these issues by providing an explicit domain conceptualization, supporting consistent interpretation and integration of heterogeneous data [11].

However, existing ontologies for job matching do not yet provide a comprehensive, domain-level conceptual foundation. Although many ontologies have been developed for recruitment and job recommendation systems [12, 13], they are application-oriented and offer limited explanatory power. In these ontologies, the concept of fit is rarely explicitly defined and is instead treated as an operational predicate (e.g., [14, 15]). Many job matching systems, whether based on probabilistic AI or ontologies, tend to operationalize fit narrowly and statically, focusing mainly on workers' skills and job requirements [12, 16, 17]. By neglecting other relevant dimensions of fit identified in P-E fit literature (e.g., the match between workers' needs and workplace supplies and the congruence between workers' personal values and organizational values), these systems risk producing incomplete or inaccurate matches, as different fit dimensions influence work outcomes to varying degrees [5]. Most systems also focus on initial fit at hiring and do not account for the possibility that fit can be achieved, maintained, or restored afterward, limiting their support for long-term employment [17]. Thus, key theoretical insights from P–E fit research that are central to sustainable employment remain largely absent from computational job matching.

This paper presents a reference ontology of the job matching domain to address these challenges. It formalizes theoretical insights from P–E fit literature in an explicit conceptualization and is evaluated to assess its adequacy in representing the domain. The ontology is grounded in the Unified Foundational Ontology (UFO) [18], represented using the OntoUML modeling language [19], and translated into OWL [20]. The ontology is evaluated using competency questions and scenario-based instantiation. This paper contributes a theory-grounded, system-independent ontology of fit that provides a conceptual foundation for explainable reasoning, semantic interoperability, and knowledge reuse [21].

The remainder of this paper is structured as follows. Section 2 presents the theoretical background, including key concepts from P–E fit theory and the UFO. Section 3 presents the main result of this work, the job matching reference ontology, and describes its core modules and OntoUML representation. Section 4 evaluates the ontology through competency questions and scenario-based instantiation. Section 5 discusses related work. Section 6 concludes with implications, limitations, and directions for future research.

2. Domain and Ontological Foundations of Job Matching

In this section, we introduce the domain and ontological backgrounds of the proposed reference ontology. We first present key insights from P–E fit theory that ground the ontology and support its domain appropriateness [18]. We then introduce the UFO, which provides the ontological foundations for the ontological analysis of the domain [21].

2.1. Person-Environment Fit

Job matching is a process of aligning a suitable worker with a suitable job or workplace. This corresponds to P–E fit theory, which defines a match, or fit, as the compatibility between workers' work-related characteristics and those of the work environment [3]. The degree of compatibility is assessed through specific paired dimensions, such as workers' abilities and job demands or workers' needs and workplaces' supplies [22]. Because fit is well established in P–E fit research and supported by substantial empirical evidence [23, 24], this work adopts a theory-driven approach to capture domain knowledge.

P-E fit studies consistently show that a high degree of fit leads to job satisfaction, high performance, and retention, while misfit results in job dissatisfaction, stress, burnout, and turnover [25, 3]. High fit helps individuals meet work demands, sustain high levels of energy, and develop enduring emotional attachment to their organization. Fit therefore contributes to sustainable employment, characterized by productive, healthy, and meaningful work [26, 2]. P–E fit therefore provides a conceptual framework for understanding the ontological nature of fit and identifying its core concepts and relations.

P–E fit is increasingly understood as a multidimensional phenomenon rather than a single-dimensional construct [4, 5, 25]. Because individuals interact with multiple aspects of their work environment, fit can be assessed at different environmental levels. The P–E fit literature commonly distinguishes four levels of fit: person–job, person–organization, person–team, and person–person fit [5, 4, 25]. These fit types influence work outcomes differently. Person–job fit is strongly related to task performance and job satisfaction, while person–organization fit is more associated with organizational commitment and turnover intentions. High fit across multiple levels is generally associated with more positive work outcomes [5, 25].

Across these environmental levels, P–E fit is classified into two primary forms: complementary fit and supplementary fit. Although both fall under the general notion of "fit", they rest on fundamentally different ontological assumptions. Complementary fit concerns the fulfillment of expectations between a worker and the work environment: fit occurs when characteristics of the worker and the environment satisfy each other's expectations. For example, workers may be expected to possess abilities that meet workplace demands (demands–abilities fit), while workplaces may be expected to provide resources that satisfy workers' needs (needs–supplies fit) [27]. Complementary fit thus arises when the characteristics of the worker and the work environment complement or "make whole" one another [27]. Although complementary fit is often discussed at the person–job level, its underlying logic is broader and may apply at different environmental levels wherever such expectations exist.

In contrast, supplementary fit is ontologically distinct in that it is based on assessments of similarity or "proximity" rather than fulfillment of expectations [22, 27]. It occurs when workers' characteristics are similar to those of the environment. Examples include proximity between workers' values and organizational or team values, or similarity in personality and work style between workers and supervisors or colleagues. Whereas complementary fit concerns expectation fulfillment, supplementary fit is evaluative and comparative, based on the similarity of specific fit dimensions (e.g., values, interests, work style, or personality traits) [27].

The distinction between complementary and supplementary fit is conceptually independent of the environmental level at which fit is assessed. Both forms of fit can occur at the job, organization, team, and person levels. Person–job fit is primarily complementary, reflecting the correspondence between workers' abilities, skills, and needs and employers' demands and supplies [28]. Person–organization and person–team fit concern alignment between workers' attributes and the collective characteristics of the organization or team [5]. An organization refers to the employing entity, whereas a team represents the immediate work group to which an employee belongs [29]. At both levels, fit may involve both complementary relationships (e.g., organizational practices satisfying workers' needs) and supplementary relationships (e.g., workers sharing values with the organization or team). Person–person fit concerns compatibility with specific workplace members (e.g., supervisors or colleagues) [5, 4], and may likewise involve complementary expectations or similarity in values, personality, and work style.

Fit is not static but a dynamic relationship between the person and the work environment [30, 23, 24]. As both characteristics of the worker and the work environment evolve over time, fit may increase or decline. Initial fit can become misfit, while initial misfit can be resolved when individuals and work environments adapt to one another [30]. Sustainable employment, therefore, depends not merely on initial match between pre-existing characteristics of the worker and the work environment, but on the ongoing capacity to achieve, maintain, and restore fit. The dynamic maintenance of complementary fit occurs through work adjustment [6]. Work adjustment is a process through which workers and work environments achieve and sustain satisfaction by fulfilling the expectations of both parties [6]. Work adjustment may occur actively, when individuals act upon the work environment to enhance correspondence, or reactively, when individuals modify their own characteristics to align with environmental

expectations [6]. Supplementary fit may also change over time, but it is primarily evaluative and is less adjustable than complementary fit through work adjustments. For example, similarity in values or personality traits may evolve through socialization, yet such attributes are rarely modified intentionally to achieve or restore fit.

2.2. Foundational Ontology and Ontological Analysis

To translate theoretical insights of P–E fit theory into an explicit conceptualization of the job matching, we use ontological analysis to make the implicit commitments of P–E fit concepts explicit, clarifying what entities exist and how they relate [31]. This analysis is guided by a foundational ontology that provides rigorous ontological distinctions and meta-properties [32, 33]. Grounding a domain ontology in a foundational ontology reduces conceptual ambiguity, improves internal consistency, clarifies the nature of fit, and supports interoperability and reuse [33]. For this study, we use a portion of the UFO [34]. Compared with many ontology modeling approaches that primarily distinguish between classes and instances, UFO provides taxonomies for both *universals* and *particulars* and supports a multi-level perspective in which domain types instantiate higher-order ontological categories [35]. This enables more precise definitions of domain concepts based on well-founded ontological distinctions. The resulting conceptual model is represented in OntoUML, an ontology-based modeling language grounded in UFO [19].

Entities can be classified as those that persist through time and those that occur in time. *Endurants* are entities that persist through time while maintaining their identity, whereas *perdurants* are entities that occur in time [34]. In OntoUML, perdurant universals are represented using the stereotype «event». OntoUML dichotomizes endurant universals into two main categories: *object* and *aspect*. Object universals include «kind» and «collective», providing a principle of identity to their instances and are *rigid*, defining essential characteristics of the entities they classify. Aspect universals are divided into *intrinsic* and *extrinsic* aspects. «quality» represents measurable intrinsic aspects grounded in quality structures. «mode» captures non-measurable aspects and may be intrinsic or extrinsic. «relator» represents extrinsic aspects that reify relationships and act as truthmakers for the relations they ground. «role» and «phase» are *anti-rigid universals* that classify individuals contingently over time. «category» represents *rigid non-sortal universals* that do not provide identity criteria and whose instances may belong to different *rigid* types, whereas «mixin» also does not provide identity but may classify instances that are either *rigid* or *anti-rigid*.

The resulting OntoUML-based model is subsequently transformed into OWL using gUFO [36], a lightweight implementation of UFO for the Semantic Web. The ontology is publicly available through the GitHub repository[1] under an open license, supporting its alignment with the FAIR principles[37].

3. A Reference Ontology of Job Matching

The proposed ontology was built following the systematic approach to building ontologies (SABiO) [38], beginning with defining its purpose, scope, and requirements. Its purpose is to support sustainable employment, while its scope covers the types and dimensions of P-E fit and the work-adjustment processes through which fit can be created, maintained, or restored. The ontology provides a conceptual foundation for more complete and accurate matching but does not model the entire matching process or its rules. The requirements are formulated as competency questions (CQs) [39]. The main CQs include: *What types of fit exist between a worker and a work environment? Does a work adjustment result in a change in the fulfillment degree of an expectation?* During the ontology capture phase of SABiO, these CQs are addressed through ontological analysis of the relevant domain knowledge, resulting in a domain conceptualization [38]. Drawing on P–E fit literature, the ontology includes concepts such as complementary fit, supplementary fit, work adjustment, organization, team, worker, employer, and

[1]All supplementary materials, including the competency questions, OWL version, and evaluation materials are available here: https://github.com/LuotongCheng/ROJM-ontology/tree/main

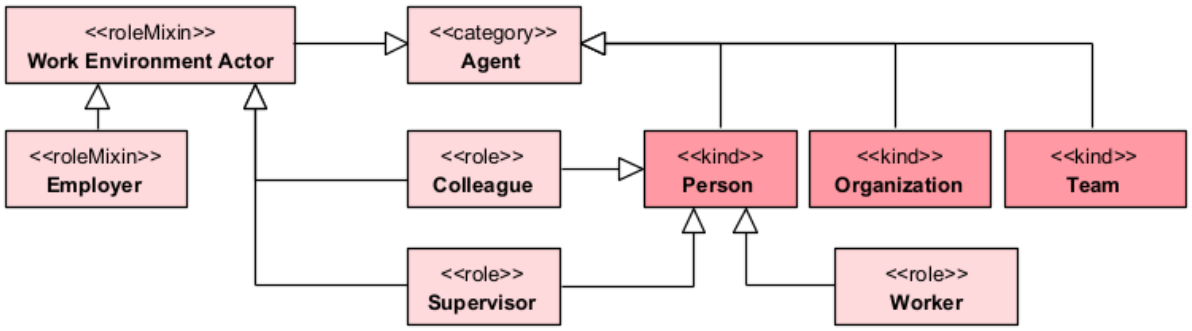

Figure 1: Agent taxonomy

supervisor. The ontology is modularized into three loosely coupled modules [40]: complementary fit, the supplementary fit, and the work adjustment module. They reflect the distinct ontological natures of fit as expectation fulfillment, fit as similarity assessment, and the dynamic processes through which complementary fit can be actively created and sustained.

3.1. Ontology Modules

Figure 1 presents the agents represented in the ontology. In line with P–E fit theory, the work environment may be Persons, Teams, and Organizations. These entities are modeled as specializations of Agent, an entity capable of holding intentions and acting toward goals, in alignment with UFO-C [41]. Person is a physical agent, whereas Team and Organization are institutional social agents [41]. Person, Team, and Organization are modeled as «kind», and therefore as *functional complexes*, because they provide identity criteria for their instances and are composed of parts that make differentiated contributions to the functioning of the whole. Worker is a «role» assumed by a Person whose fit with the work environment is analyzed. Since entities of different ontological types may participate in the work environment, the ontology introduces the «roleMixin» Work Environment Actor. This contingent role can be assumed by Persons, Teams, or Organizations. Supervisor and Colleague are person-specific specializations of this role. Employer is also a «roleMixin» that can be assumed by either a Person or an Organization. It represents the agent whose expectations concerning job requirements constitute the job side of person–job fit.

3.1.1. Complementary Fit Module

Figure 2 presents the Complementary Fit module. Complementary Fit (C-F) is conceptualized as a relationship between a Worker and a Work Environment Actor. To make explicit the ontological nature of this relationship, Complementary Fit is reified as a «relator», which serves as the truthmaker for the claim that a Worker is in complementary fit with a Work Environment Actor. The relator mediates the C-F Worker and C-F Environment Actor, specializations of the Complementary Fit Actor, assumed by the Worker and the Work Environment Actor, respectively. The introduction of Complementary Fit Actor makes explicit that actors participate in complementary fit only within a complementary-fit situation. It is modeled as a «roleMixin» because these roles can be assumed by entities of different ontological types (e.g., persons, teams, or organizations).

The Complementary Fit relator is constituted by one Expectation inhering in a Complementary Fit Actor and one Fulfillment Capacity inhering in the other Complementary Fit Actor. In gUFO, both modes are modeled as aspect proper parts of the relator. Expectation is modeled as a general «category» of «mode» that represents an agent's normative or anticipatory stance toward a state of affairs (e.g., a worker expecting flexible working hours). Expectations vary in Expectation Priority (e.g., necessary, mandatory, or optional), which determines their interpretation as needs, demands, or other forms of expectation. Fulfillment Capacity is likewise modeled as a «category» of «mode», specifically a disposition representing the potential of an actor to satisfy an expectation (e.g., an employer's ability

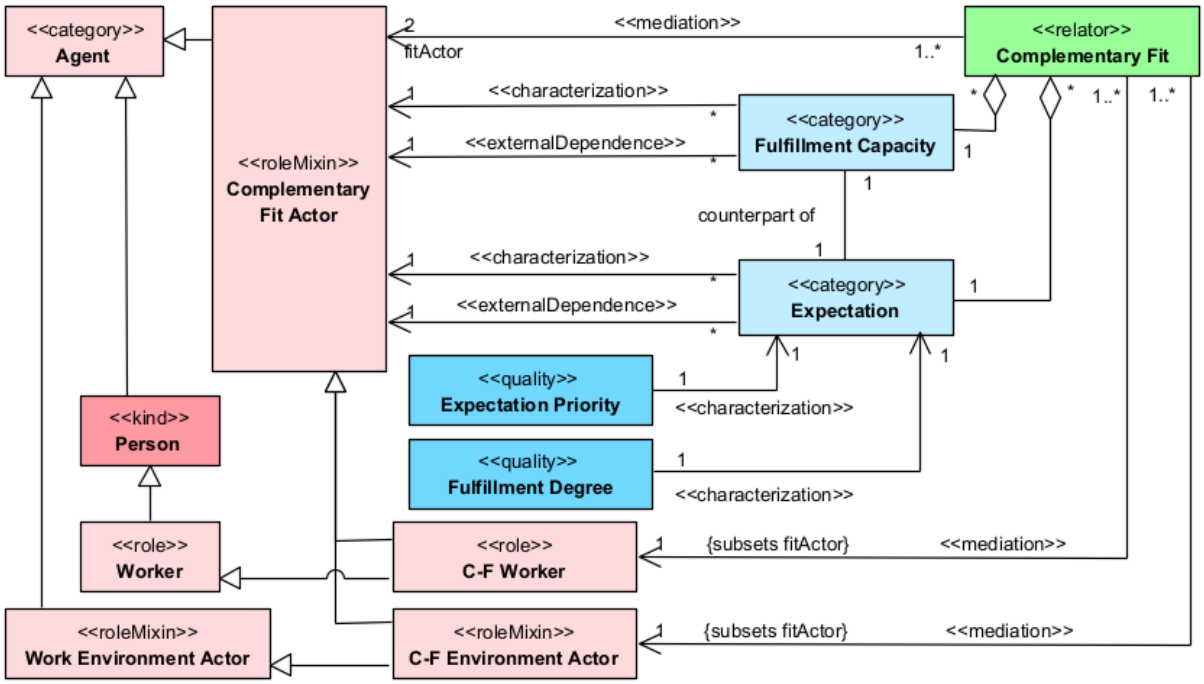

Figure 2: Complementary fit module

to provide flexible scheduling). Expectation and Fulfillment Capacity are modeled as extrinsic modes in this ontology, since they depend not only on their bearer but also on their counterpart actor. An Expectation is externally dependent on the actor whose characteristics may satisfy the expectation, whereas a Fulfillment Capacity is externally dependent on the actor who holds the corresponding expectation. Complementary fit is classified as an external descriptive relationship [42], grounded in descriptive aspects, namely Expectations and Fulfillment Capacities, which inhere in its relata and whose existence depends on entities external to those relata.

Expectations are characterized by Fulfillment Degree, a «quality» inhering in an Expectation that captures the extent to which it is satisfied (e.g., the degree to which a worker's expectation for flexible hours is supported by the employer). This allows the ontology to represent complementary fit not only as a binary condition (fulfilled or unfulfilled) but also as varying levels of expectation satisfaction.

3.1.2. Supplementary Fit Module

Figure 3 presents the Supplementary Fit module. Unlike complementary fit, which is grounded in expectations and fulfillment capacities, Supplementary Fit (S-F) captures the similarity between a Worker and a Work Environment Actor with respect to certain relevant characteristics, such as values, personality traits, or interests. To make its ontological nature explicit, Supplementary Fit is reified as a «relator» that serves as the truthmaker for the claim that a Worker is in supplementary fit with a Work Environment Actor. The relator mediates the S-F Worker and S-F Environment Actor. Both specialize Supplementary Fit Actor, a «roleMixin» that captures an agent's contingent participation in a particular supplementary-fit assessment.

Supplementary fit is constituted by Supplementary Fit Modes inhering in the Supplementary Fit Actors. These modes capture the relevant characteristics of the Worker and the Work Environment Actor that are subject to comparison. To distinguish the modes belonging to each party, the ontology introduces S-F Worker Mode and S-F Environment Actor Mode, both modeled as «roleMixin» assumed by instances of the same type of Supplementary Fit Mode. Each Supplementary Fit Mode is associated with an S-F Mode Type, which specifies the dimension along which similarity is assessed. Examples of such types include Value System, Personality Profile, and Interest Profile. These modes represent

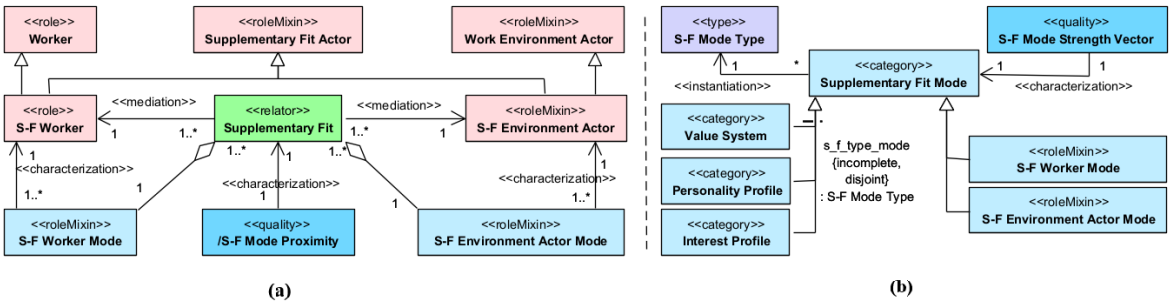

Figure 3: Supplementary fit module

complex configurations rather than single attributes, consisting of multiple individual modes of the same type (e.g., individual values, interests, or personality traits) together with their relative priorities or intensities. In this ontology, such configurations are abstracted as a single «mode» for comparison.

The relative priorities or intensities of the complex modes are captured by the S-F Mode Strength Vector, a «quality» inhering in a Supplementary Fit Mode that represents a measurable property grounded in a quality structure. For example, in the case of value congruence, it represents the configuration of value priorities; in personality fit, the configuration of personality trait levels; and in interest fit, the configuration of interest intensities. Inspired by the conceptual space framework [43, 44], such vectors can be interpreted as positions in a multidimensional conceptual space, where each dimension corresponds to an individual mode composing the complex mode. For instance, in value congruence, both a worker and a work environment actor may be characterized by value profiles consisting of multiple work-related values (e.g., achievement, autonomy, and flexibility). Each value corresponds to a dimension in the conceptual space, and the relative priority assigned to each value determines the coordinate along that dimension. The resulting configuration of priorities forms a value strength vector for each actor.

S-F Mode Proximity is modeled as a derived «quality» representing the measurable closeness between the Worker's and Work Environment Actor's corresponding S-F Mode Strength Vectors in the conceptual space. The Supplementary Fit relation is derived from S-F Mode Proximity, holding when this proximity is sufficiently high. Supplementary fit can therefore be understood as an internal descriptive relationship [42], because it is grounded in descriptive aspects, namely the Supplementary Fit Modes inhering in each relatum, and is derived from the measurable closeness between these modes.

3.1.3. Work Adjustment Module

Figure 4 presents the Work Adjustment module. As discussed previously, work adjustment concerns complementary fit, as it involves actions aimed at fulfilling expectations. Changes in supplementary fit are outside the scope of the current ontology. Work Adjustment is modeled as an «event» through which Complementary Fit Actors (i.e., a Worker and/or a Work Environment Actor) address unfulfilled expectations by changing relevant aspects of the worker or the work environment. Additional agents beyond Complementary Fit Actors may also participate in the event. A Work Adjustment manifests the Fulfillment Capacities and Expectations that ground a Complementary Fit. A Work Adjustment may have attributes (e.g., cost), and requires resources (e.g., tools), represented as specializations of Thing.

The objective of Work Adjustment is to transform an Unfulfilled Expectation into a Fulfilled Expectation. Fulfilled Expectation and Unfulfilled Expectation are modeled as «phase» of Expectation. An Unfulfilled Expectation corresponds to the phase in which the expected state of affairs does not obtain, whereas a Fulfilled Expectation corresponds to the phase in which it does (e.g., a worker expecting flexible working hours when the work environment does not support flexible scheduling versus when such scheduling is provided). Modeling expectations using «phase» enables the representation of how satisfaction conditions may change over time.

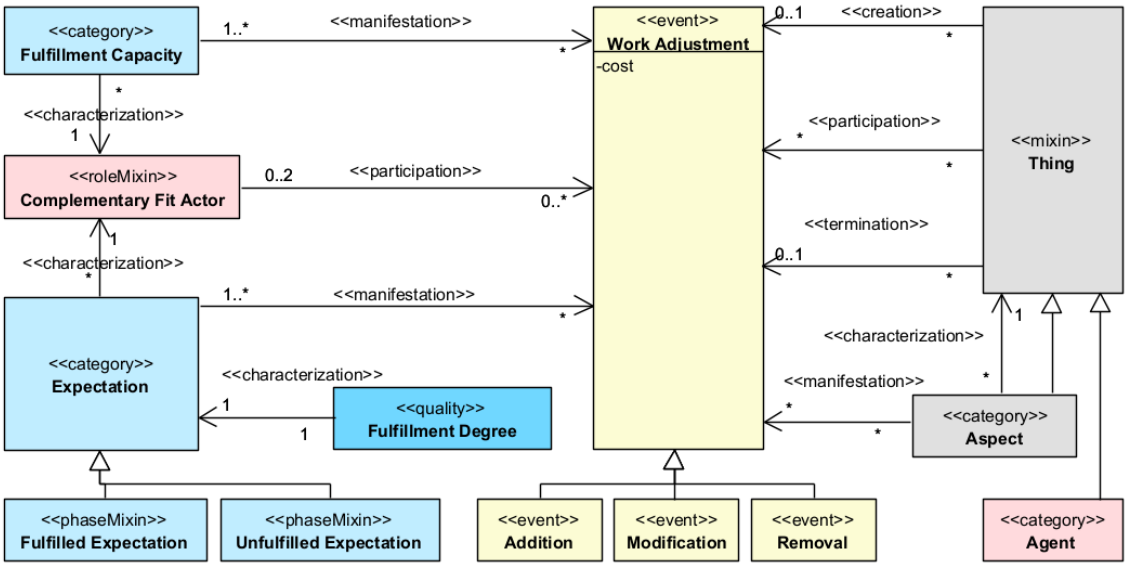

Figure 4: Work adjustment module

Work Adjustments are classified into three types according to the kind of change they bring about. The entities affected by these adjustments may be objects or aspects inhering in objects. Both are modeled as specializations of Thing, a «mixin» that generalizes entities of different ontological natures without providing a common identity principle and can classify instances belonging to both *rigid* and *anti-rigid* types. An Addition corresponds to a Work Adjustment event that creates a new entity through the creation relation. The created entity may be an object (e.g., equipment, tools, or a new task) or an aspect inhering in an object (e.g., a skill as an aspect of a worker, or a feature of the work environment). A Removal corresponds to a Work Adjustment event that terminates an existing entity through the termination relation. The terminated entity may likewise be either an object (e.g., removing a task or a piece of equipment) or an aspect (e.g., eliminating a responsibility or task). A Modification corresponds to a Work Adjustment event in which an existing object (either an agent or a non-agentive object) participates in the event through a participation relation, while the event manifests a change in one of its Aspects through the manifestation relation. In this case, the entity itself continues to exist, but one of its aspects or the quality associated with that aspect is altered (e.g., adjusting a work schedule or improving a worker's skill level). Although the three types are distinct, a single Work Adjustment may combine several types.

4. Ontology Evaluation

For evaluation, we include verification, assessing whether the ontology adequately answers its CQs, and validation, examining its potential use through real-world scenarios. To verify the proposed ontology, each CQ is mapped to the corresponding ontology concepts and relationships, resulting in a table[2], following the approach of [45]. SPARQL queries are conducted to operationalize the CQs and demonstrate how the ontology answers them. For example, the CQ "Does a work adjustment result in a change in the fulfillment degree of an expectation?" is addressed by querying an expectation and its fulfillment degree before and after a work adjustment (see query below). Comparing these values illustrates how work adjustment can improve the fulfillment degree of an expectation and thereby achieve Complementary Fit.

```
PREFIX rojm: <https://w3id.org/rojm#>
```

[2]https://github.com/LuotongCheng/ROJM-ontology/tree/main/ontology%20evaluation

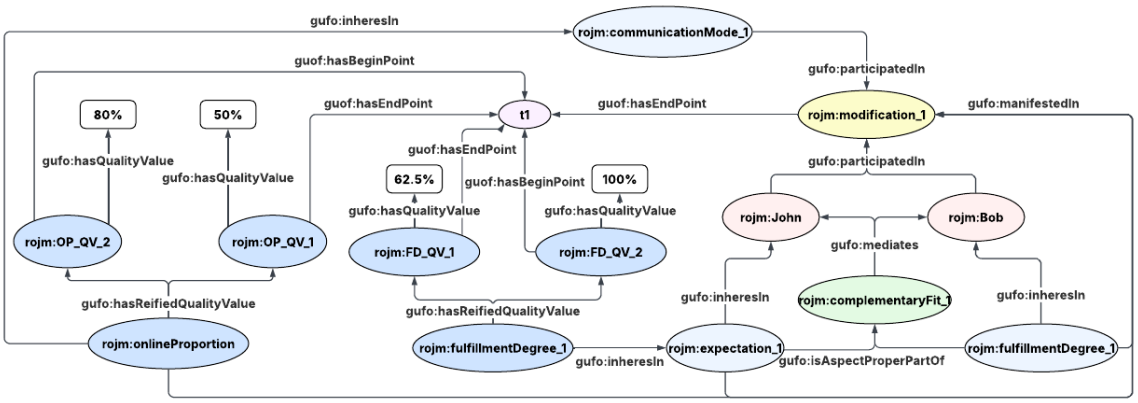

Figure 5: Instantiation example

```
PREFIX gufo: <http://purl.org/nemo/gufo#>
SELECT DISTINCT ?expectation ?adjustment ?fulfillmentDegree ?beforeValue ?afterValue
WHERE {
  ?expectation rdf:type rojm:Expectation ;
               gufo:manifestedIn ?adjustment .
  ?fulfillmentDegree gufo:inheresIn ?expectation ;
                     gufo:hasReifiedQualityValue ?qvBefore, ?qvAfter .
  ?qvBefore rojm:hasFulfillmentDegreeValue ?beforeValue ;
            gufo:hasEndPoint ?changedTime .
  ?qvAfter rojm:hasFulfillmentDegreeValue ?afterValue ;
           gufo:hasBeginPoint ?changedTime .
}
```

For validation, we instantiate each ontology class in OWL, covering scenarios of complementary fit, supplementary fit at the person, team, and organization levels, and the three types of work adjustment (addition, removal, and modification). The paper presents one illustrative scenario (see Figure 5), while the complete instantiation table and the full OWL instantiation are available in the repository. In this scenario, John (Worker) and Bob (Supervisor) are involved in a complementary fit grounded in John's expectation and Bob's fulfillment capacity. John expects 80% of his meetings with Bob to occur online. Initially, the communication mode between John and Bob has an online proportion of 50% (OP-QV1), resulting in a fulfillment degree of 62.5% (FD-QV1). A modification event occurs between t0 and t1. After the modification, the online proportion increases to 80% (OP-QV2), and the fulfillment degree reaches 100% (FD-QV2). This example demonstrates the ontology's explanatory capability. Rather than merely providing a fit score, it explains that John's expectation became fully fulfilled because the modification increased the proportion of online meetings. By explicitly linking the actors, expectation, fulfillment degree, and adjustment event, the ontology makes the basis of the fit assessment traceable.

5. Related Works

Several well-founded reference ontologies have been developed in domains related to job matching. Core-O [46] provides a UFO-grounded competence reference ontology to support professional and learning ecosystems. It defines how knowledge, skills, and attitudes (KSA) contribute to the formation of competences and accounts for competence manifestation through tasks, as well as competence evolution over time by modeling proficiency levels and developmental phases. A related effort, Creon [45], introduces a UFO-grounded capability reference ontology that focuses on the conceptualization of capabilities and supports the analysis of their manifestation, interaction, and emergence. Earlier work by [47] and [48] focuses on competence and capability modeling in enterprise architecture, clarifying the semantics of human competences and organizational capabilities. In addition, OccO [49] offers a

BFO-grounded ontology for occupations, focusing on occupation holders and their associated skills and abilities.

Despite these contributions, reference ontologies of job matching remain limited. A closely related effort is [50], who propose a UFO-grounded ontology for career-related data on professional social media platforms. Their model represents person–job fit through competence–requirement relations, linking Competence Types to Position Types via a "requires" relationship. It accounts for the dynamic nature of fit by treating competences as dispositional properties that evolve through experience and learning, and by modeling time-specific relations (e.g., Employment, Former Employment, Graduation). Beyond reference ontologies, job matching has been widely addressed in application ontologies, particularly in recruitment and career recommendation systems. These ontologies are primarily used to resolve semantic heterogeneity in representing jobs, skills, competences, and personal data [12, 13]. Some approaches employ a single integrated ontology to model both candidate and job information (e.g., [51, 14, 15]), whereas others treat job matching as an ontology alignment task that aligns concepts across separate ontologies (e.g., [52, 53]).

Across these approaches, fit is typically treated as an operational outcome of matching procedures rather than as an explicit ontological construct. While such ontologies support automated matching and semantic interoperability, they do not formally represent the meaning of person–job fit, limiting their explanatory power beyond numerical matching scores. Moreover, most ontologies focus primarily on recruitment-stage and emphasize skill–requirement alignment, while providing limited support for other dimensions of fit, such as needs–supplies fit, value congruence, and fit at organizational, team, and interpersonal levels, as well as for explicitly representing work adjustment.

Overall, prior work includes reference ontologies that provide well-founded conceptual foundations for modeling domains relevant to job matching (e.g., [50, 46, 48]) as well as application ontologies that effectively support operational job matching in recruitment systems. However, most approaches treat fit primarily as a task, rather than as a domain concept to be ontologically analyzed and represented explicitly. Consequently, this work addresses the need for a reference ontology that explicitly conceptualizes fit and provides a theoretically grounded basis for explanation and potential reuse in future applications.

6. Conclusion

In this paper, we presented a UFO-grounded reference ontology for the job matching domain, also available in OWL. The ontology is organized into three core modules that clarify the notion of fit, its classification, and how fit can be achieved and maintained over time, drawing on P–E fit theory. The ontology was evaluated against its competency questions and through instantiation in job-matching scenarios, indicating that it adequately represents the intended domain.

The proposed ontology contributes to the conceptual clarification of the job matching domain by making the concept of fit explicit as a first-class domain concept, rather than reducing it to the outcome of a computational operation. It explains what it means for a person and a workplace to fit. In particular, the ontology clarifies different forms of fit (i.e., complementary fit and supplementary fit), as well as why such fit holds. Thereby, it improves the comprehensibility appropriateness [18] of the job matching representations. By grounding job matching in P–E fit theory, the ontology encourages job matching systems to move beyond simple skill–requirement alignment and consider multiple types of fit across different levels. By conceptualizing job matching as a dynamic and ongoing process, the ontology supports modeling fit not only as an initial condition but also as something that can be achieved, maintained, and restored over time through work adjustment. This perspective can inform the design of ontology-based matching systems that aim to support long-term career development.

As a reference ontology, the proposed model is intended to serve as a conceptual foundation rather than to provide concrete implementation or decision-making mechanisms for job matching systems. Operational matching rules and algorithms are beyond the scope of this work and belong to the implementation and application levels. The ontology focuses on capturing the core conceptual structure

of P–E fit and therefore does not exhaustively represent all possible aspects of workers (e.g., capabilities, values, personality traits) or work environments (e.g., job characteristics, workplace resources) that may be relevant for assessing fit. Although it represents multiple dimensions of fit, it does not explicitly represent how different fit dimensions influence work-related outcomes. Instead, it focuses on clarifying the nature of the two main types of fit and the multiple environmental actors involved in fit relationships. Applications built on top of the ontology may then selectively focus on particular types of fit depending on the work-related outcomes of interest. A further limitation is that the CQs are theory-derived and have not been validated with intended users. The ontology has been evaluated only through illustrative scenarios, without assessment by domain experts or application to real-world use cases.

As future work, we plan to extend the ontology with domain-specific modules capturing concrete aspects of workers and work environments, such as job characteristics, employment conditions, and workplace resources. These extensions may align with established occupational and skill standards and databases, such as ESCO [54] and O*NET [55], thereby facilitating semantic interoperability with existing job-related data infrastructures. We also plan to align or reuse related reference ontologies in relevant domains (e.g., Core-O[46]) that capture specific domain aspects such as competencies. In addition, we plan to integrate the ontology with job matching systems, including the consideration of contextual factors and matching rules at the implementation level. Finally, we plan to validate the CQs and evaluate the ontology's completeness, relevance, and usefulness through real-world use cases with domain experts and intended users, including employees, recruiters, and intermediaries.

Declaration on Generative AI

During the preparation of this work, the authors used ChatGPT and Grammarly for grammar and spelling correction, paraphrasing, and rewording. All generated content was reviewed and revised by the authors, who take full responsibility for the final content of the publication.

References

[1] M. Nütz, B. Trezzini, L. Medici, U. Schwegler, Job matching: An interdisciplinary scoping study with implications for vocational rehabilitation counseling, Rehabilitation Psychology 62 (2017) 45–68. doi:10.1037/rep0000119.

[2] K. Van Dam, T. Van Vuuren, S. Kemps, Sustainable employment: The importance of intrinsically valuable work and an age-supportive climate, The International Journal of Human Resource Management 28 (2017) 2449–2472. doi:10.1080/09585192.2015.1137607.

[3] A. Kristof-Brown, R. P. Guay, Person–environment fit, in: S. Zedeck (Ed.), APA Handbook of Industrial and Organizational Psychology, Volume 3: Maintaining, Expanding, and Contracting the Organization, American Psychological Association, Washington, DC, 2011, pp. 3–50. doi:10.1037/12171-001.

[4] K. J. Jansen, A. Kristof-Brown, Toward a multidimensional theory of person–environment fit, Journal of Management Issues 18 (2006) 193–212. URL: http://www.jstor.org/stable/40604534.

[5] A. Chuang, C.-T. Shen, T. A. Judge, Development of a multidimensional instrument of person–environment fit: The perceived person–environment fit scale (PPEFS), Applied Psychology 65 (2016) 66–98. doi:10.1111/apps.12036.

[6] R. V. Dawis, L. H. Lofquist, A Psychological Theory of Work Adjustment, University of Minnesota Press, Minneapolis, MN, 1984.

[7] S. Rojas-Galeano, J. Posada, E. Ordoñez, A bibliometric perspective on AI research for job-resume matching, The Scientific World Journal 2022 (2022) 1–15. doi:10.1155/2022/8002363.

[8] B. Goodman, S. Flaxman, European Union regulations on algorithmic decision making and a "right to explanation", AI Magazine 38 (2017) 50–57. doi:10.1609/aimag.v38i3.2741.

[9] R. Confalonieri, G. Guizzardi, On the multiple roles of ontologies in explanations for neuro-symbolic AI, Neurosymbolic Artificial Intelligence (2024) 1–15. doi:10.3233/NAI-240754.

[10] T. Bittner, M. Donnelly, S. Winter, Ontology and semantic interoperability, in: S. Zlatanova, D. Prosperi (Eds.), Large-Scale 3D Data Integration, CRC Press, Boca Raton, FL, 2005, pp. 139–161.
[11] H. Rahman, M. I. Hussain, A comprehensive survey on semantic interoperability for internet of things: State-of-the-art and research challenges, Transactions on Emerging Telecommunications Technologies 31 (2020) e3902. doi:10.1002/ett.3902.
[12] F. M. Hassan, I. Ghani, M. Faheem, A. A. Hajji, Ontology matching approaches for erecruitment, International Journal of Computer Applications 51 (2012) 39–45. doi:10.5120/8018-0917.
[13] A. C. Tuan, M. T. Dang, H. N. Do, V. K. Solanki, J. Torres, R. Gonzalez Crespo, T. N. A. Nguyen, Ontology and its applications in skills matching in job recruitment, Applied Ontology 19 (2024) 287–306. doi:10.3233/AO-240019.
[14] D. Ntioudis, P. Masa, A. Karakostas, G. Meditskos, S. Vrochidis, I. Kompatsiaris, Ontology-based personalized job recommendation framework for migrants and refugees, Big Data and Cognitive Computing 6 (2022) 120. doi:10.3390/bdcc6040120.
[15] S. Shishehchi, S. Y. Banihashem, JRDP: A job recommender system based on ontology for disabled people, International Journal of Technology and Human Interaction 15 (2019) 85–99. doi:10.4018/IJTHI.2019010106.
[16] M. N. Freire, L. N. de Castro, e-recruitment recommender systems: A systematic review, Knowledge and Information Systems 63 (2021) 1–20. doi:10.1007/s10115-020-01522-8.
[17] C. de Ruijt, S. Bhulai, Job recommender systems: A review, 2021. URL: https://arxiv.org/abs/2111.13576. arXiv:2111.13576.
[18] G. Guizzardi, Ontological foundations for structural conceptual models, Doctoral Dissertation, University of Twente, Enschede, Netherlands, 2005.
[19] G. Guizzardi, C. M. Fonseca, A. B. Benevides, J. P. A. Almeida, D. Porello, T. P. Sales, Endurant types in ontology-driven conceptual modeling: Towards OntoUML 2.0, in: Conceptual Modeling, volume 11157 of *Lecture Notes in Computer Science*, Springer, Cham, Switzerland, 2018, pp. 136–150. doi:10.1007/978-3-030-00847-5_12.
[20] B. Motik, P. F. Patel-Schneider, B. Parsia, C. Bock, A. Fokoue, P. Haase, R. Hoekstra, I. Horrocks, A. Ruttenberg, U. Sattler, M. Smith, OWL 2 web ontology language: Structural specification and functional-style syntax, W3C Recommendation, 2009. URL: https://www.w3.org/TR/owl2-syntax/.
[21] G. Guizzardi, On ontology, ontologies, conceptualizations, modeling languages, and (meta)models, in: O. Vasilecas, J. Eder, A. Caplinskas (Eds.), Databases and Information Systems IV, Frontiers in Artificial Intelligence and Applications, IOS Press, Amsterdam, The Netherlands, 2007, pp. 18–39.
[22] J. R. Edwards, Person–environment fit in organizations: An assessment of theoretical progress, Academy of Management Annals 2 (2008) 167–230.
[23] A. E. M. Van Vianen, Person–environment fit: A review of its basic tenets, Annual Review of Organizational Psychology and Organizational Behavior 5 (2018) 75–101. doi:10.1146/annurev-orgpsych-032117-104702.
[24] R. Su, C. Murdock, J. Rounds, Person-environment fit, in: P. J. Hartung, M. L. Savickas, W. B. Walsh (Eds.), APA Handbook of Career Intervention, volume 1, American Psychological Association, Washington, DC, 2015, pp. 81–98. doi:10.1037/14438-005.
[25] M. Andela, M. van der Doef, A comprehensive assessment of the person–environment fit dimensions and their relationships with work-related outcomes, Journal of Career Development 46 (2019) 567–582. doi:10.1177/0894845318789512.
[26] R. S. Rauvola, C. W. Rudolph, L. K. Ebbert, H. Zacher, Person–environment fit and work satisfaction: Exploring the conditional effects of age, Work, Aging and Retirement 6 (2020) 101–117. doi:10.1093/workar/waz011.
[27] P. M. Muchinsky, C. J. Monahan, What is person–environment congruence? supplementary versus complementary models of fit, Journal of Vocational Behavior 31 (1987) 268–277. doi:10.1016/0001-8791(87)90043-1.
[28] J. R. Edwards, Person-job fit: A conceptual integration, literature review, and methodological critique, in: C. L. Cooper, I. T. Robertson (Eds.), International Review of Industrial and Organizational Psychology, volume 6, John Wiley & Sons, Chichester, UK, 1991, pp. 283–357.

[29] R. M. Vogel, D. C. Feldman, Integrating the levels of person–environment fit: The roles of vocational fit and group fit, Journal of Vocational Behavior 75 (2009) 68–81. doi:10.1016/j.jvb.2009.03.007.

[30] W. Vleugels, R. De Cooman, M. Verbruggen, O. Solinger, Understanding dynamic change in perceptions of person–environment fit: An exploration of competing theoretical perspectives, Journal of Organizational Behavior 39 (2018) 1066–1080. doi:10.1002/job.2294.

[31] G. Guizzardi, A. Bernasconi, O. Pastor, V. C. Storey, Ontological unpacking as explanation: The case of the viral conceptual model, in: A. Ghose, J. Horkoff, V. E. Silva Souza, J. Parsons, J. Evermann (Eds.), Conceptual Modeling, volume 13011 of *Lecture Notes in Computer Science*, Springer, Cham, Switzerland, 2021, pp. 356–366. doi:10.1007/978-3-030-89022-3_28.

[32] S. Borgo, R. Ferrario, A. Gangemi, N. Guarino, C. Masolo, D. Porello, E. M. Sanfilippo, L. Vieu, DOLCE: A descriptive ontology for linguistic and cognitive engineering, Applied Ontology 17 (2022) 45–69. doi:10.3233/AO-210259.

[33] G. Guizzardi, The role of foundational ontologies for conceptual modeling and domain ontology representation, in: 2006 7th International Baltic Conference on Databases and Information Systems, IEEE, Vilnius, Lithuania, 2006, pp. 17–25. doi:10.1109/DBIS.2006.1678468.

[34] G. Guizzardi, A. Botti Benevides, C. M. Fonseca, D. Porello, J. P. A. Almeida, T. Prince Sales, UFO: Unified foundational ontology, Applied Ontology 17 (2022) 167–210. doi:10.3233/AO-210256.

[35] V. A. Carvalho, J. P. A. Almeida, C. M. Fonseca, G. Guizzardi, Extending the foundations of ontology-based conceptual modeling with a multi-level theory, in: P. Johannesson, M. L. Lee, S. W. Liddle, A. L. Opdahl, Ó. Pastor López (Eds.), Conceptual Modeling, volume 9381 of *Lecture Notes in Computer Science*, Springer, Cham, Switzerland, 2015, pp. 119–133. doi:10.1007/978-3-319-25264-3_9.

[36] J. P. A. Almeida, G. Guizzardi, T. P. Sales, R. d. A. Falbo, gufo: A lightweight implementation of the unified foundational ontology (ufo), 2020. URL: https://nemo-ufes.github.io/gufo/, accessed June 10, 2026.

[37] M. D. Wilkinson, M. Dumontier, I. J. Aalbersberg, G. Appleton, M. Axton, A. Baak, N. Blomberg, J.-W. Boiten, L. B. da Silva Santos, P. E. Bourne, J. Bouwman, A. J. Brookes, T. Clark, M. Crosas, I. Dillo, O. Dumon, S. Edmunds, C. T. Evelo, R. Finkers, A. Gonzalez-Beltran, A. J. G. Gray, P. Groth, C. Goble, J. S. Grethe, J. Heringa, P. A. C. 't Hoen, R. Hooft, T. Kuhn, R. Kok, J. Kok, S. J. Lusher, M. E. Martone, A. Mons, A. L. Packer, B. Persson, P. Rocca-Serra, M. Roos, R. van Schaik, S.-A. Sansone, E. Schultes, T. Sengstag, T. Slater, G. Strawn, M. A. Swertz, M. Thompson, J. van der Lei, E. van Mulligen, J. Velterop, A. Waagmeester, P. Wittenburg, K. Wolstencroft, J. Zhao, B. Mons, The FAIR guiding principles for scientific data management and stewardship, Scientific Data 3 (2016) 160018. URL: https://doi.org/10.1038/sdata.2016.18. doi:10.1038/sdata.2016.18.

[38] R. d. A. Falbo, SABiO: Systematic approach for building ontologies, in: OntoCOM/DISe 2014: Proceedings of the Joint Workshops on Ontologies in Conceptual Modeling and Information Systems Engineering, CEUR Workshop Proceedings, Aachen, Germany, 2014, pp. 22–31. URL: https://ceur-ws.org/Vol-1301/ontocomodise2014_2.pdf.

[39] M. Grüninger, M. S. Fox, The role of competency questions in enterprise engineering, in: A. Rolstadås (Ed.), Benchmarking — Theory and Practice, IFIP Advances in Information and Communication Technology, Springer, Boston, MA, 1995, pp. 22–31. doi:10.1007/978-0-387-34847-6_3.

[40] M. d'Aquin, A. Schlicht, H. Stuckenschmidt, M. Sabou, Criteria and evaluation for ontology modularization techniques, in: H. Stuckenschmidt, C. Parent, S. Spaccapietra (Eds.), Modular Ontologies, volume 5445 of *Lecture Notes in Computer Science*, Springer, Berlin, Heidelberg, 2009, pp. 67–89. doi:10.1007/978-3-642-01907-4_4.

[41] R. S. S. Guizzardi, G. Guizzardi, A. Perini, J. Mylopoulos, Towards an ontological account of agent-oriented goals, in: Software Engineering for Multi-Agent Systems V, volume 4408 of *Lecture Notes in Computer Science*, Springer, Berlin, Heidelberg, 2007, pp. 148–164. doi:10.1007/978-3-540-73131-3_9.

[42] C. M. Fonseca, D. Porello, G. Guizzardi, J. P. A. Almeida, N. Guarino, Relations in ontology-driven conceptual modeling, in: A. H. F. Laender, B. Pernici, E.-P. Lim, J. P. M. de Oliveira (Eds.), Conceptual Modeling, volume 11788 of *Lecture Notes in Computer Science*, Springer, Cham, Switzerland, 2019,

pp. 28–42. doi:10.1007/978-3-030-33223-5_4.
[43] A. Albuquerque, G. Guizzardi, An ontological foundation for conceptual modeling datatypes based on semantic reference spaces, in: IEEE 7th International Conference on Research Challenges in Information Science (RCIS), IEEE, Paris, France, 2013, pp. 1–12. doi:10.1109/RCIS.2013.6577693.
[44] P. Gärdenfors, Emulators as sources of hidden cognitive variables, Behavioral and Brain Sciences 27 (2004) 403–403. doi:10.1017/S0140525X04280098.
[45] R. F. Calhau, J. P. A. Almeida, R. Hoffmann, G. Guizzardi, Creon: A capability reference ontology for the analysis and design of systems capabilities, in: D. Bork, R. Lukyanenko, S. Sadiq, L. Bellatreche, O. Pastor (Eds.), Conceptual Modeling, volume 16189 of *Lecture Notes in Computer Science*, Springer, Cham, Switzerland, 2026, pp. 85–105. doi:10.1007/978-3-032-08623-5_5.
[46] R. F. Calhau, J. P. A. Almeida, T. P. Sales, P. P. F. Barcelos, G. Guizzardi, Core-O: A competence reference ontology for professional and learning ecosystems, in: C. Trojahn, D. Porello, P. P. F. Barcelos (Eds.), Frontiers in Artificial Intelligence and Applications, volume 394, IOS Press, 2024, pp. 16–30. doi:10.3233/FAIA241289.
[47] R. F. Calhau, C. L. B. Azevedo, J. P. A. Almeida, Towards ontology-based competence modeling in enterprise architecture, in: 2021 IEEE 25th International Enterprise Distributed Object Computing Conference (EDOC), IEEE, Gold Coast, Australia, 2021, pp. 71–81. doi:10.1109/EDOC52215.2021.00018.
[48] C. L. Azevedo, M.-E. Iacob, J. P. A. Almeida, M. van Sinderen, L. F. Pires, G. Guizzardi, Modeling resources and capabilities in enterprise architecture: A well-founded ontology-based proposal for ArchiMate, Information Systems 54 (2015) 235–262. doi:10.1016/j.is.2015.04.008.
[49] J. Beverley, S. Smith, M. A. Diller, W. D. Duncan, J. Zheng, W. Judkins, W. R. Hogan, R. McGill, D. Dooley, Y. He, The occupation ontology (OccO): Building a bridge between global occupational standards, in: Joint Ontology Workshops 2023 Episode IX: The Quebec Summer of Ontology, CEUR Workshop Proceedings, Aachen, Germany, 2023, pp. 1–12. URL: https://ceur-ws.org/Vol-3637/paper13.pdf.
[50] B. Aktaş, L. F. Pires, R. Calhau, A. Akbıyık, Ontology-driven modelling of personal data for professional social media platforms (PSMPs), in: Proceedings of the FOIS 2025 Satellite Events co-located with the 15th International Conference on Formal Ontology in Information Systems (FOIS 2025), CEUR Workshop Proceedings, Aachen, Germany, 2025, pp. 1–14. URL: https://ceur-ws.org/Vol-4111/SC_Paper_4.pdf.
[51] F. García-Sánchez, R. Martínez-Béjar, L. Contreras, J. T. Fernández-Breis, D. Castellanos-Nieves, An ontology-based intelligent system for recruitment, Expert Systems with Applications 31 (2006) 248–263. doi:10.1016/j.eswa.2005.09.023.
[52] T. T. Phan, V. Q. Pham, H. D. Nguyen, A. T. Huynh, D. A. Tran, V. T. Pham, Ontology-based resume searching system for job applicants in information technology, in: H. Fujita, A. Selamat, J. C.-W. Lin, M. Ali (Eds.), Advances and Trends in Artificial Intelligence: Artificial Intelligence Practices, volume 12798 of *Lecture Notes in Computer Science*, Springer, Cham, Switzerland, 2021, pp. 261–273. doi:10.1007/978-3-030-79457-6_23.
[53] A. Shakya, S. Paudel, Job-candidate matching using ESCO ontology, Journal of the Institute of Engineering 15 (2019) 1–13. doi:10.3126/jie.v15i1.27699.
[54] European Commission, Directorate-General for Employment, Social Affairs and Inclusion, European Skills, Competences, Qualifications and Occupations: ESCO Annual Report 2019, Technical Report, Publications Office of the European Union, 2020. doi:10.2767/740371.
[55] National Center for O*NET Development, O*NET OnLine, 2026. URL: https://www.onetonline.org/, accessed June 10, 2026.