

Systematic Review

Soft Skills, Attitudes, and Personality Traits: How Does the Human Factor Matter? A Systematic Review and Taxonomy Proposal through ProKnow-C Methodology

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Abstract: In the realms of operations management (OM) and supply chain management (SCM), the significance of the human factor (HF) is increasingly recognised as a pivotal determinant of corporate performance. This burgeoning interest aligns with the recognition that individual characteristics—spanning personality traits, attitudes, and soft skills—play a critical role in enhancing organisational outcomes. Despite growing scrutiny, the discourse is hampered by terminological ambiguity and the conflation of critical human-centric concepts within the OSCM context. Addressing this gap, our study embarks on a mission to dissect and delineate the nuanced distinctions among “soft skills”, “attitudes”, and “personality traits”. By proposing a clear and actionable taxonomy, this paper aims to facilitate the practical application and understanding of these terms within organisational settings. Leveraging the “Knowledge Development Process-Constructivist” (ProKnow-C), we conducted a systematic examination of the existing scientific literature to unearth and critically review pertinent bibliometric and content analyses. Our work not only illuminates the path for future research but also underscores the necessity of clarity and precision in the conceptualisation and application of human-factor considerations in OM and SCM.

Keywords: soft skills; attitudes; personality traits; human factor; taxonomy; behavioural operations management



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1. Introduction

Consideration of the human sphere within standard models of operations management and supply chain management only began to be considered in 2008, thanks to the work of Gino and Pisano [1]. The authors opened up a branch of the discipline that went by the name of Behavioural Operations Management (BeOps) and, albeit slowly, inexorably captured the interest of an ever-increasing number of researchers and inductees working in these fields. Over the last 15 years, BeOps researchers have studied various fields, dealing with human biases, perceptions, and decision making between individuals or groups [2]. Moreover, in the development of BeOps, research has addressed not only the technical properties of systems but also those related to the properties of individuals (soft skills, personality, attitudes, etc.). This new branch of study, focusing on human biases, perceptions, and decision making in individual and group contexts, has gradually garnered the attention of an increasing number of researchers and practitioners. Textbooks and literature often relegate such considerations to brief chapters or sections, failing to fully integrate them into broader operational and supply chain strategies [3]. Although methods for optimising and giving due weight to models for the optimal management of individuals are central to striving for operational excellence, they are still marginal [3].

Among the different topics in the BeOps domain, the analysis of practitioners' capabilities is one of the most relevant because it directly impacts operational excellence in industry [4]. In this regard, several works describe the relevance of the ability of individuals to influence the performance of an organisation [5,6]; these studies consider the characteristics that professionals have (skills, abilities, etc.) and how these qualities are put into practice to achieve business results. In their work, Stek and Schiele [7] show how several essential operations management (OM) and supply chain management (SCM) competences have been identified over the years; these competences are generally classified as hard or analytical and soft or personal.

Notably, existing studies often conflate distinct human characteristics, such as soft skills, attitudes, and personality traits, under broad, undefined categories. It is possible to observe three main aspects:

- Research highlights the critical impact of individual capabilities, such as skills and abilities, on organisational performance, emphasising the need for professionals to effectively apply these qualities for optimal business outcomes [5,6].
- A discrepancy is observed in the classification of OM and SCM competencies, with a predominant focus on technical (hard or analytical) skills over soft (personal) skills, despite the significant differences among soft skills, attitudes, and personality traits that necessitate distinct categorisation [7].
- The absence of a unified taxonomy for describing soft skills, personality traits, and attitudes in Behavioural Operations Management (BeOps) leads to confusion and misapplication of these terms, underscoring the need for a clear and shared framework to enhance clarity and accuracy in the field [7,8].

Therefore, this study aims to address these critical gaps by proposing a comprehensive and clear taxonomy that distinguishes among "personality traits", "soft skills", and "attitudes" within the BeOps context. By doing so, it seeks to advance the field's understanding of how these human dimensions contribute to organisational performance and operational success. Employing the ProKnow-C methodology, aligned with the PRISMA 2020 guidelines [9], this research meticulously selects a relevant bibliographic portfolio to conduct a detailed review of existing OM and SCM contributions. This approach not only highlights the need for a more nuanced recognition of behavioural factors in operational success but also sets the stage for future research to explore how these human aspects can be systematically integrated and leveraged in practice. The forthcoming sections begin with a detailed examination of the ProKnow-C methodology, highlighting its application in the identification and analysis of relevant scientific articles. Following this, we present the results of our bibliometric and content analysis derived from the selected bibliographic portfolio. Subsequently, we introduce the proposed taxonomy, providing a nuanced categorisation of the identified elements within each taxonomic cluster. Crucially, a dedicated section for discussion and implications elaborates on the broader relevance of our findings, addressing how they contribute to the understanding and integration of human factors in operations management (OM) and supply chain management (SCM). The conclusion not only reflects on the main contributions of this research but also emphasises its role in bridging the previously identified gaps. Additionally, it proposes directions for future research, particularly focusing on the exploration and implementation of the human factor in OM and SCM contexts.

2. The ProKnow-C Methodology

This primary purpose of this work is to clarify the connotations of three fundamental terms adopted for the description of individuals within organisations (i.e., “personality traits”, “soft skills”, and “attitudes”) and to allow for their proper usage in the Behavioural Operations Management field. To achieve this goal by proposing a comprehensive taxonomy, it is essential to first understand what has been developed in the current scientific literature and how these terms have been implemented. This would make it possible to understand their adoption and deduce the most common shared meanings of the terms.

An intervention tool with a constructivist philosophical basis, namely, the Knowledge Development Process-Constructivist, has been exploited to accomplish this task. This kind of approach is a guided procedure for performing a literature analysis, first proposed in the contribution of Tasca et al. [10] and further enhanced within the Laboratory of Multicriteria Decision Support Methodology-Constructivist (LabMCDA-C). A comprehensive literature analysis concerning the usage of the psychological terms in the BeOps field is performed and then adopted as the starting point for the taxonomy proposal. For a thorough description of the ProKnow-C methodology, the reader may refer to the contribution of Professor Jorge Eduardo Tasca et al. [10].

Leading contributions to the taxonomic definition were collected through the ProKnow-C application within the bibliographic portfolio (PB), which collects the most scientifically relevant publications for this literature topic. The outcome of the PB analysis provides a map of the characteristics. It helps to map academic journals that have published in this field, thus deducing a comprehensive taxonomy and research agenda for this topic. Here is a summary of the steps followed:

1. Identify the connotations of “personality traits”, “soft skills”, and “attitudes” for their proper usage in Behavioural Operations Management.
2. Utilise the Knowledge Development Process-Constructivist (ProKnow-C) for a literature analysis to understand current scientific literature development and the implementation of these terms.
3. Perform a comprehensive literature analysis on the use of these psychological terms in the BeOps field as a foundation for the taxonomy proposal, referencing Tasca et al. [10] for a detailed description of the ProKnow-C methodology.
4. Collect leading contributions for the taxonomic definition through the ProKnow-C application, resulting in a bibliographic portfolio (PB) that maps out the most scientifically relevant publications on this topic.
5. Analyse the PB to provide a mapping of characteristics and academic journals, deducing a comprehensive taxonomy and research agenda.

2.1. Bibliographic Portfolio Selection

The ProKnow-C methodology specifies several steps for the definition of an appropriate bibliographic portfolio, which constitutes the starting point for the assessment of current knowledge in the desired domain under investigation.

The first stage in the procedure is carried out by selecting a raw bank of articles, presented in Figure 1. This stage comprises the following steps: establishing the keywords; describing the database; performing a query; and verifying the keywords [11]. To extrapolate scientific contributions for analysis, several scientific databases were investigated. Eventually, Web of Science (WoS) and Scopus were chosen for this study due to their wide use in academia and the breadth of contributions they contain. The two databases chosen to search for contributions are significant for two reasons. On the one hand, Scopus contains a very significant number of contributions, even including up to 70% of the literature of Web of Science; however, the latter has a higher citation rate in the field of engineering [12,13].

In order to define a taxonomy in BeOps, two axes have been designated to conduct the literature search. According to Table 1, the first axis encompasses keywords related to the field of psychology, such as soft skills, personality traits, and attitudes. Unlike the first, the second axis investigates words within the OSCM area: manufacturing, operations management, production, logistics, supply chain, maintenance, and transportation. The query submitted to extract the articles from the two databases can be described as follows: (“soft skills” OR “personality traits” OR “attitudes”) AND (“operations management” OR “manufacturing” OR “supply chain” OR “production” OR “logistics” OR “maintenance” OR “transportation”).

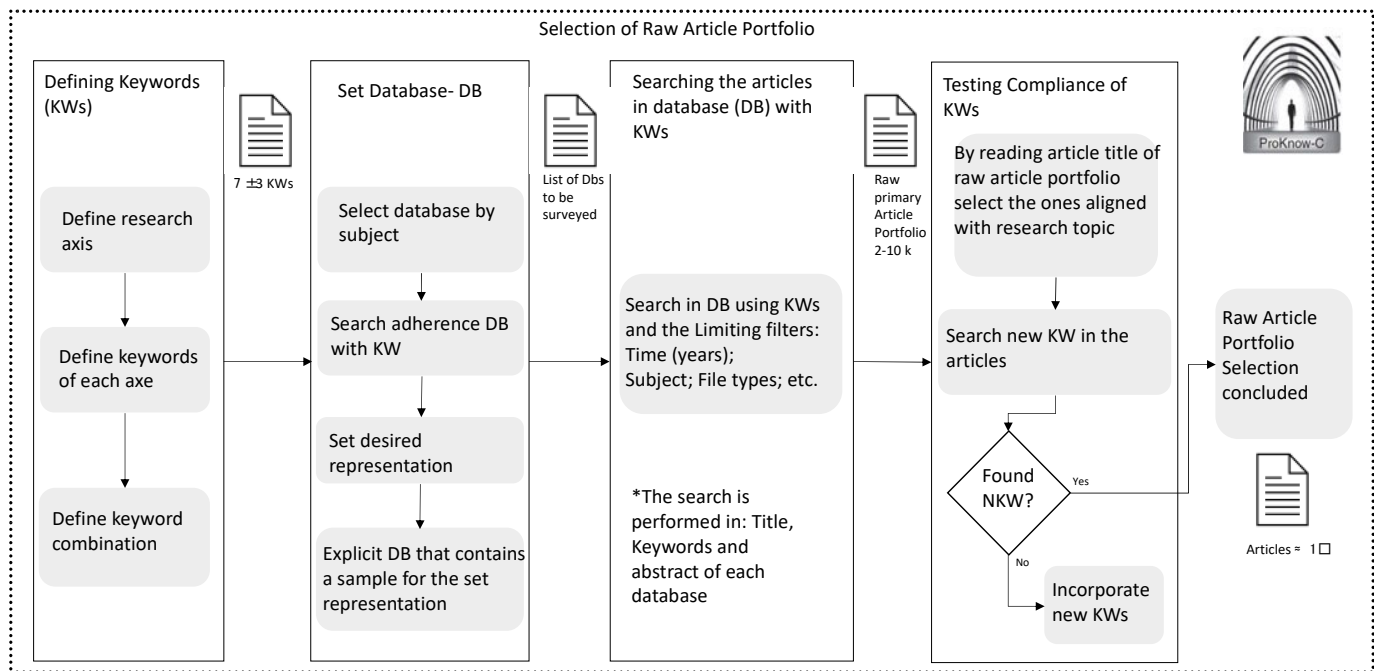


Figure 1. Selection of raw article portfolio. Adapted from Tasca et al. [10].

Table 1. Axes of keywords.

Axis 1: People’s Dimensions	Axis 2: OM and SCM Field
Soft skills	Operations management
Personality traits	Manufacturing
Attitudes	Supply chain
	Production
	Logistics
	Maintenance
	Transportation

By applying a time filter, considering only papers published since 2009, the total number of extracted articles was 5184, respectively: 2026 from Scopus and 3158 from WoS. By applying those filters, a raw primary article portfolio consisting of 1022 contributions was created at this point.

In the next stage of applying the method, a filter is made of the articles obtained, as reported in Figure 2. Duplicate articles are eliminated, and the titles of the papers are analysed to assess their alignment with the subject of the investigation. This identified 94 duplicates, making a total of 928 articles. Following a detailed analysis of the titles and keywords chosen by the authors of the articles, 885 contributions were excluded because they were not in line with the theme of the study. Most of the rejected contributions discussed considerations of environmentally friendly transport and urban mobility behaviour. After these steps of ProKnow-C application, the resulting specimen dimension amounted

to 65 articles. In the following phase, the abstracts of the articles were analysed; in this phase, 11 articles were excluded, and the sample was reduced to 54 articles. Finally, in the last filtering phase, the remaining articles were studied to define those that provided valuable insights into the research topic, obtaining an ultimate sample size of 33 articles (see Table A1 in Appendix A). Furthermore, in addition to the considered bibliographic portfolio, in order to represent the current usage of taxonomies concerning skills, attitudes, and personality traits the present work integrates the PB analysis with contributions from European documents and standards (e.g., European Qualification Framework, EQF), detailed as in Table A2 in Appendix A.

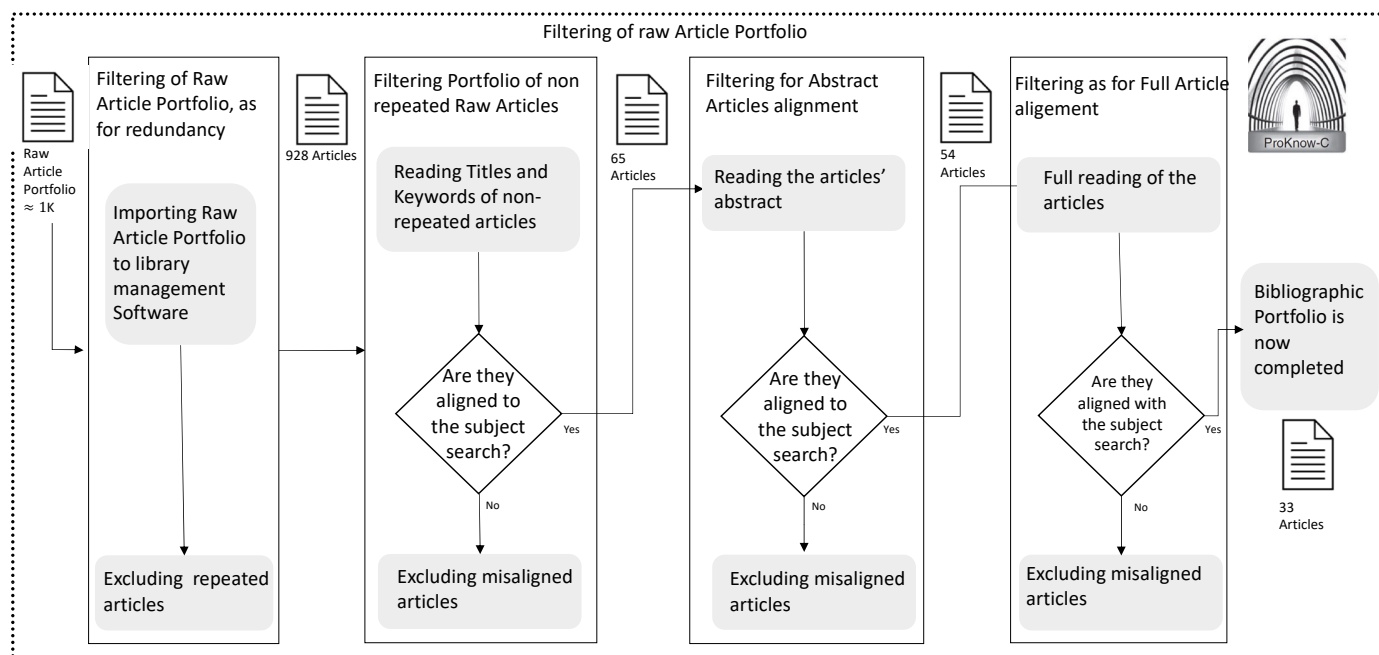


Figure 2. Filtering of raw article portfolio. Adapted from Tasca et al. [10].

2.2. Bibliometric Analysis

Once the PB screening phase has been completed, the bibliometric analysis phase is carried out. For a group of articles, bibliometric analysis is conducted to provide quantitative data and manage and schematise the scientific contribution to a given topic. In conducting bibliometric analysis, we can understand the positioning of the investigated contributors (i.e., authors, journals) with respect to the specific research area. This activity is usually performed by counting and analysing articles [10] and related metrics.

As shown in Figure 3, the trend of publications on this topic over the last 12 years is rising: 17 of the 33 reviewed articles have been published since 2017, providing further evidence of the growing interest in this area and the entire field of BeOps in general. Despite the increasing interest in this research area, surprisingly, during 2019, no contributions on this specific topic were found.

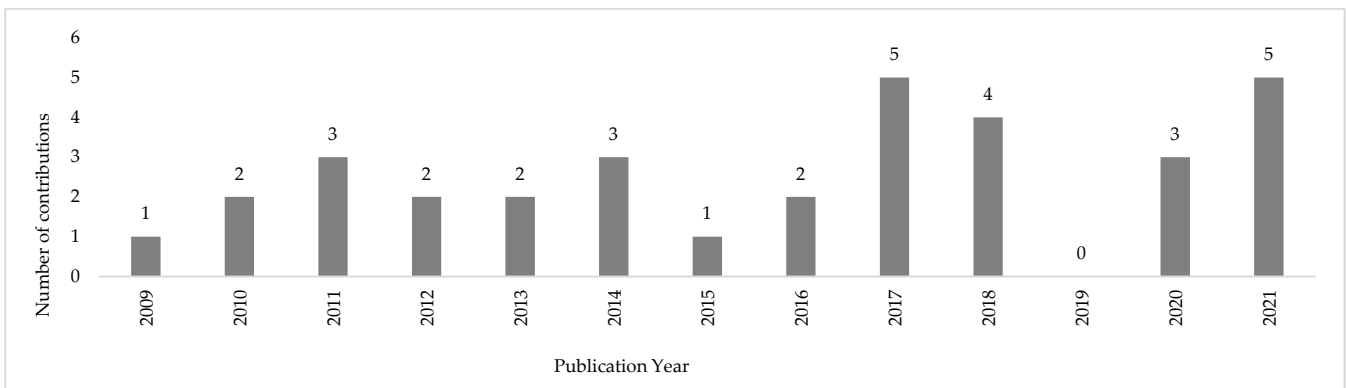


Figure 3. Publication years of papers included within the bibliographic portfolio.

Furthermore, the analysis of the leading journals in terms of published contributions reported as in Figure 4 shows that six of the twenty-five journals account for fourteen of the total thirty-three articles, i.e., roughly one in two articles in the PB. In particular, *International Journal of Operations and Production Management* and *The International Journal of Human Resource Management* constitute the representative sample in terms of the pool formed by the journals in which the articles can be found. The research areas in which the reviewed articles were published are typically operations management and human resource management. The last consideration allows us to underline how the journals of high relevance in the OM and SCM field are giving more and more space to topics such as the one examined (e.g., *Procedia Manufacturing, Journal of Operations Management*).

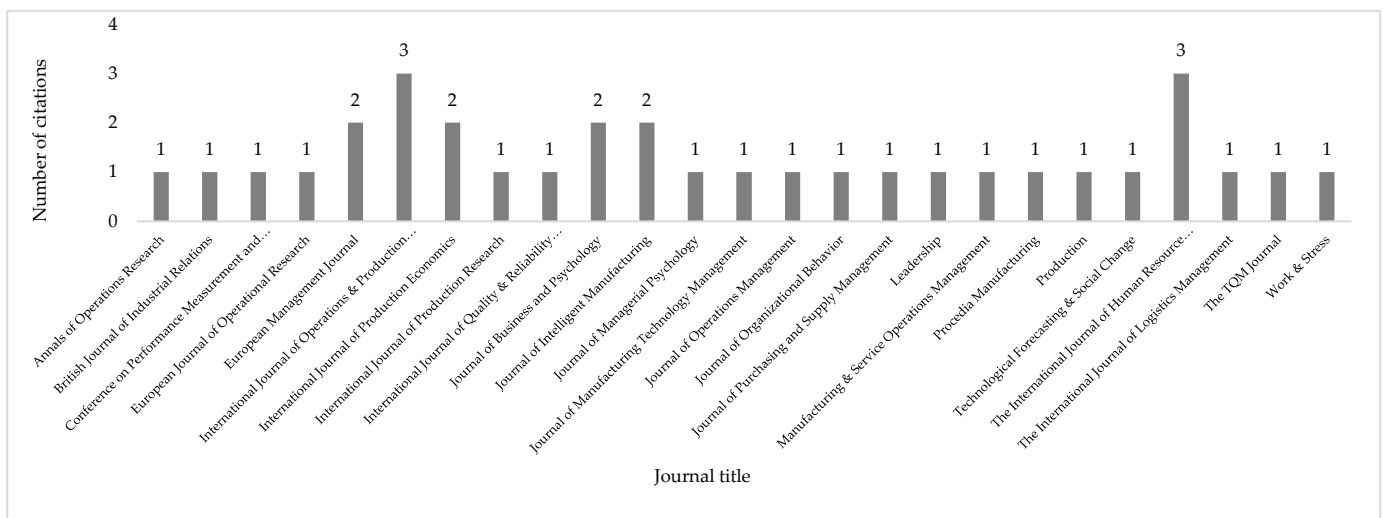


Figure 4. Distribution of journals in terms of publications.

Furthermore, the recurrence distribution, i.e., the frequency with which the topics of the different works, including the words under consideration, were addressed, is not uniform. As shown in Figure 5, the attitudes within the portfolio are the ones that count a more significant number of recurrences, followed by soft skills and, last, topics related to personality traits. This discrepancy of accounts underlines the frequency with which specific issues are addressed but could also be a driver for defining areas of interest to be further explored.

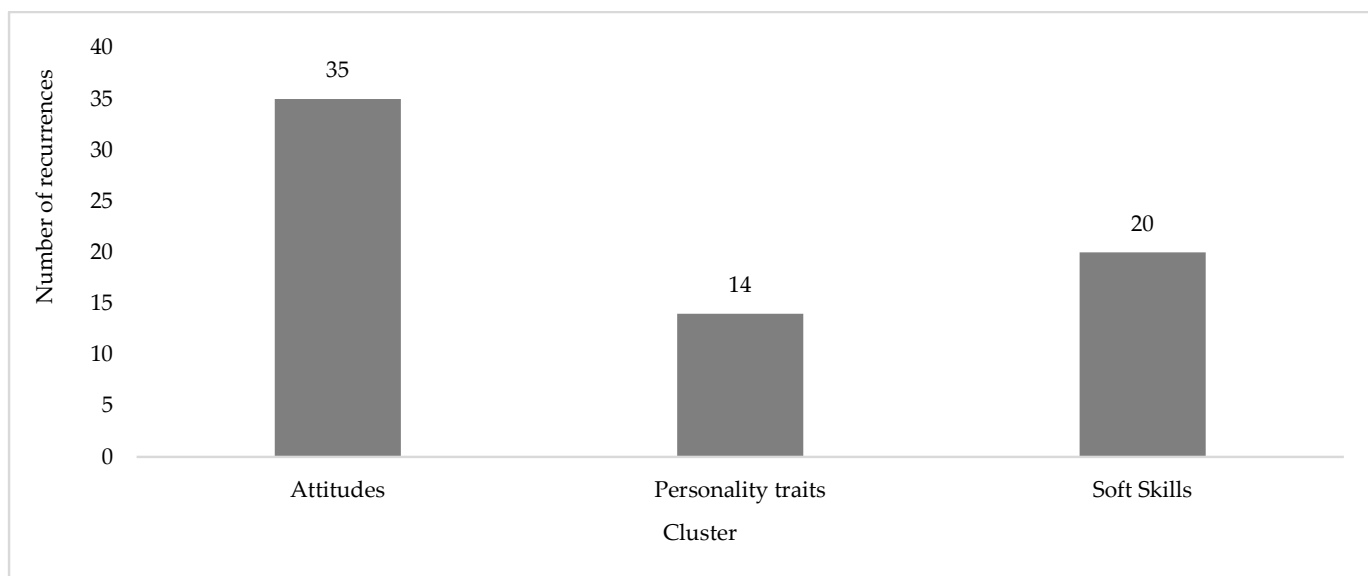


Figure 5. Number of recurrences in PB.

3. Content Analysis

In contrast to bibliometric analysis, a content analysis of the selected articles is carried out at this stage, thus making it possible how the contributors addressed the topics of interest to provide a taxonomy based on the most significant contributions to the scientific literature.

The dynamics of individuals in the OM and SCM context were examined in the PB using the terminology under evaluation and related diverse meanings. Moreover, as expected, the adoption of the language was not perfectly balanced among the different papers. The terms “attitude” and “soft skills” were presented in a more significant number of papers than “personality traits”.

In the following subsections, an analysis of the main contributions and meanings concerning a specific term (i.e., personality traits, attitudes, soft skills) is reported. Moreover, Table 2 shows some major contents of the literature.

Table 2. Main PB contents.

Reference	Content	Journal	Year
[14]	The research investigates aspects of personality and how they are related to the workplace. In particular, a meta-analysis is provided concerning the relationship with the phenomenon of burnout.	<i>Work and Stress</i>	2009
[15]	The article emphasises how attitudes are an indicator for measuring kaizen interventions, linking attitudes to elements such as enthusiasm and willingness.	<i>International Journal of Operations and Production Management</i>	2018
[16]	The paper investigates employees’ perceptions of the introduction of innovative practices. In particular, it emphasises the role played by a perceived positive attitude toward employees, which translates into behaviours that add value to company activities.	<i>The International Journal of Human Resource Management</i>	2017

Table 2. Cont.

Reference	Content	Journal	Year
[17]	The work, which focuses its attention on the impact of industrial competencies in the United Kingdom, points out how soft skills improve the ability of individuals to interact with each other and have a substantial effect on the career progression of individuals.	<i>Technological Forecasting and Social Change</i>	2017
[18]	The paper emphasises the personal dimension of evaluating work processes. It is pointed out that soft skills, personality traits, and attitudes represent enabling factors in exercising individuals' competences in the workplace.	<i>Journal of Intelligent Manufacturing</i>	2011
[19]	The article investigates aspects of performance measurement, integrating the dimension of individual performance. In particular, it emphasises how corporate practices aimed at trust and fairness translate into higher individual performance and positive employee attitudes.	<i>Conference on Performance Measurement and Management Control</i>	2014
[20]	The research analyses HR practices in the humanitarian field, particularly the importance of "soft" factors and how they impact HR practices for developing staff potential.	<i>Annals of Operations Research</i>	2021
[21]	The paper deals with the resilience of organisations by considering topology, learning capacity, and the attitude of the workforce. In particular, attention is paid to how the same working condition can result in two different views depending on the positive or negative attitude of the workforce involved.	<i>International Journal of Production Research</i>	2018
[22]	The work evaluates how the implementation of TQM practices affects employees' positive or negative attitudes toward the workplace and how this translates into job satisfaction, emotional engagement, job commitment, and team member turnover.	<i>The TQM Journal</i>	2021
[23]	The research analyses the factors that guide managers in their choice of in-house production, emphasising that aspects of perceived behavioural control (PBC) were among the critical elements.	<i>Journal of Purchasing and Supply Management</i>	2021
[24]	The paper, through an analysis of the literature, underlines how there is a powerful link between skills and business performance, highlighting how difficulty is assessing the "soft" aspects of individuals and the need for greater clarity on these aspects.	<i>British Journal of Industrial Relations</i>	2011
[5]	The research relates corporate performance to HR practices. In particular, employee attitudes, skills, and behaviours are considered measurement elements.	<i>European Management Journal</i>	2010
[25]	The article emphasises the importance of the human and aptitude factors in the matching process between companies and employees.	<i>The International Journal of Human Resource Management</i>	2013
[6]	The paper examines the human factor and how HR practices are linked to performance. In particular, it assesses how best practices are linked with employee output in terms of relationships, behaviours and attitudes.	<i>European Management Journal</i>	2016
[26]	The work, through a case study, investigate how the utilisations of learning factories can enhance both the soft and hard capabilities to work successfully within Industry 4.0.	<i>Procedia Manufacturing</i>	2020

Table 2. Cont.

Reference	Content	Journal	Year
[27]	The research examines the elements necessary to achieve operational excellence, considering aspects related to university training, learning factories, and research. Particularly relevant are parts of the human factor relating to attitudes, soft/hard skills, competences, and knowledge.	<i>Journal of Intelligent Manufacturing</i>	2011
[28]	The paper examines several aspects related to the impact of leadership on performance within the Chinese migrant workers' environment.	<i>Leadership</i>	2012
[29]	The article analyses how nervousness and aggression play a role in predicting work behaviour and self-defeat. In particular, it examines the output related to elements such as aspects of personality traits and how they manifest themselves in workers' attitudes and behaviour.	<i>Journal of Business and Psychology</i>	2012
[30]	The research evaluates the impact of introducing a project-based teaching approach in production in Brazil. In this context, the effect is emphasised in improving complex knowledge and soft knowledge to provide the training to operate efficiently in the work environment.	<i>Production</i>	2017
[3]	The paper examines 45 empirical studies and assesses how introducing new practices and technologies impacts company productivity. In addition, the factors considered include aspects linked to the communication, attitudes, and cooperation of workers.	<i>International Journal of Operations and Production Management</i>	2010
[31]	The work analyses the role of corporate social responsibility by assessing the behaviours they implement, taking into account how these also impact the behaviour of employees and their attitudes towards the workplace.	<i>International Journal of Production Economics</i>	2021
[32]	The research, set in the hospital sector, investigates how different HR practices can impact aspects of attitude, such as work satisfaction, environmental engagement, and turnover.	<i>The International Journal of Human Resource Management</i>	2016
[33]	The article explores how certain aspects of individual workers, such as self-efficacy, can directly impact their attitudes, such as job satisfaction, turnover, and performance in achieving set goals.	<i>Manufacturing and Service Operations Management</i>	2017
[34]	The paper shows how integrating field trips into students' training programmes in logistics can increase their capabilities in terms of attitudes and learning skills.	<i>The International Journal of Logistics Management</i>	2018
[35]	The research examines the links connecting stressors at work in Tunisia, perceived stress, and the possibility of burnout with factors related to personality traits and work context. Possible solutions are proposed to involve adopting systems that include improved social skills.	<i>Journal of Managerial Psychology</i>	2015

Table 2. Cont.

Reference	Content	Journal	Year
[36]	The paper examines connections within employees' honesty and work behaviour/attitudes based on a sample of 588 employees. The results show that specific characteristics related to employee authenticity directly influence positive attitudes and behaviours while inhibiting negative ones.	<i>Journal of Business and Psychology</i>	2020
[7]	The article analyses the skills needed to work in the procurement sector in the Supply Chain environment. The work proposes a classification based on a survey of 366 professionals in the industry to give a direction for university and professional training.	<i>European Journal of Operational Research</i>	2021
[37]	The research studies how human traits (intelligence, knowledge, personality, and interests) affect performance during a task of inventory management that is structurally simple but dynamically complex.	<i>International Journal of Production Economics</i>	2013
[38]	The paper investigates how various dimensions of human resource management (HRM) can affect organisational outcomes. Among the highlighted aspects of relevance are those related to attitudes such as corporate commitment, turnover, and job satisfaction.	<i>Journal of Organizational Behavior</i>	2014
[2]	The article elaborates an agent–system co-development (ASC) framework for behavioural investigation in SCM area. Furthermore, the ASC model is designed to explain the agent–system dynamic relation in supply chains in which the two properties influence the actions of individuals.	<i>Journal of Operations Management</i>	2014
[39]	The paper, following a review based on 107 articles, aims to understand aspects of behavioural leadership and how these develop in the context of change. The examined elements are related, among others, to developing the soft elements of leaders as elements for the best manifestation of employees' capabilities.	<i>Journal of Manufacturing Technology Management</i>	2020
[40]	The work provides a review of the characteristics that characterise Six Sigma projects. The authors provide a list of essential elements for achieving the defined objectives, including factors related to soft skills, personality traits, and attitudes.	<i>International Journal of Quality and Reliability Management</i>	2018
[41]	The research examines attitudes towards SCM integration in the Chinese and US environments. In particular, it examines managers' attitudes (positive/negative) and the collaborationist or non-collaborationist context of the organisational culture in which they are employed.	<i>International Journal of Operations and Production Management</i>	2017

The above content analysis is supplemented with contributions from different standards to have a more comprehensive representation of the current scientific background. Therefore, Table 3 below shows the most significant contributions in this respect.

Table 3. Main contents from the European standards.

Reference	Content	Journal/Publisher	Year
[42]	Within the EQF, competences are characterised as cognitive (implying the utilisation of logical, intuitive, and creative abilities) or more practical (implying hand dexterity and use of methods, tools, materials, and equipment).	<i>Official Journal of the European Union</i>	2017
[43]	Behaviours or attitudes come under the cross-cutting aspects of EN 16234-1 (e-CF) that in turn are linked to competences and skills. While attitudes reflect the way in which ICT professionals integrate aspects of competences and knowledge and apply them in a contextually adequate way, skills encompass behavioural aspects, that are used to successfully cope with workplace scenarios. Character skills can concern the quality of performance, the quality of social interaction or emotions. These include areas such as motivation, empathy, paying careful attention to detail, and having integrity.	CEN-CENELEC Management Centre	2021
[44]	This contribution provides clear definitions for the elements analysed, namely, “Skills”, defined as the capacity to perform either managerial or technical assignments, and can be either cognitive or hands-on; “Attitude”, which constitutes the people component of an e-competence and describes the way in which an ICT practitioner incorporates knowledge and skills and applies them within a contextually appropriate way; and “Behavioural Skills”, defined as the interactive abilities used to deal successfully with workplace circumstances, which can relate to quality of work, social interaction or emotion (examples include communication, empathy, attention to detail, reliability, and integrity).	CEN-CENELEC Management Centre	2021
[45]	Behaviour and attitudes constitute significant factors that make the successful implementation of knowledge and skills easier. In each competence, embedded attitudes are represented in behaviour and facilitate the integration of knowledge and skills successfully. Nevertheless, attitude is incorporated in all 3 aspects and even in the cross-cutting aspects. Attitudes constitute the individual aspect of an electronic competence. These reflect the way in which an ICT worker combines knowledge and skills and applies them in an appropriate way to the situation.	CEN-CENELEC Management Centre	2018

3.1. Personality Traits

Personality traits are among the dimensions by which people can be differentiated. The “Five-Factor Model” is mainly mentioned in the PB analysed [37]. Alarcon [14], in his work on assessing how personality factors relate to burnout, he points out that: “*Much of the recent research on personality has been based on the Five-Factor Model, which organises personality traits under five broad dimensions: emotional stability, extraversion, conscientiousness, agreeableness, and openness*”. Personality traits represent the different authors of the distinctive characteristics of PB of individuals that, in most cases, are assessed as challenging to change or influence [40]. This type of evaluation is linked to the difficulty of appreciably modifying distinctive character traits of individuals.

Furthermore, several works have found that individuals’ behaviour and performance are linked to personality characteristics: for example, the inclination to be anxious can be negatively or positively associated with stress management [5,14,35]. Finally, understanding the different traits of each person can not only influence their performance as workers but also improve the work of human resources (HR), which would then be able to suggest tools and methods tailored to the expected response of each worker [6].

3.2. Soft Skills

A great deal of attention has been paid to the terminology of soft skills over the past decade. The division arose to distinguish purely technical or hard skills from those skills manifested by individuals and not attributable to technical competencies, which were then referred to as soft skills. As pointed out by the work of Grugulis and Stoyanova [24], there was a period until just before 2010 in which the skills demanded by employers were purely hard. On the contrary, subsequently, the demand for soft skills started to grow on the part of employers, thus generating a greater focus on soft skills. Several works support these considerations. Hence, Witt and Baker [40] provide the five main characteristics of a certified Six Sigma black belt: good leadership, a change agent, an effective communicator, a team builder, and results-driven—and all these are soft skills. The same arguments can be found in the recent work by Stek and Schiele [7], which analyses the main features of supply and purchasing managers and the evidence that soft skills are “essential antecedents to hard skills” [7]. This kind of representation of soft skills is aligned with the work of the European Committee for Standardisation [45]. Indeed, the provided definition of soft skills overlaps with ‘behavioural skills’, which are the skills required to effectively interact with others at work. Finally, in several other works [17,18,30], soft skills are essential attributes for enhancing business performance.

3.3. Attitudes

The term “attitude” generally has rather vague connotations among researchers, practitioners, and businesses. However, the analysis of this term within the PB reveals a convergence of different authors on a shared meaning. For instance, in 2013, Mavrikios et al. [27] described the term as follows: “‘Attitude’ is a hypothetical construct that represents the degree of an individual’s likes or dislikes of an item”. Several years later, Yang et al. [41] expressed a similar perspective regarding its usage: “An attitude is an individual’s evaluative judgment of a psychological object that represents a tendency toward general favorableness of an object’s overall favorableness (e.g., good vs. bad, beneficial vs. harmful)”. These considerations are also in line with what is defined by the e-CF standard [45]. However, we also note how attitude is linked to competence: “Competence is defined as a demonstrated ability to apply knowledge, skills and attitudes for achieving observable results”. Therefore, also in line with the standard definition, the authors adequately represent this word’s use within the PB, finding, albeit with some slight differences, a convergence of thought in this regard, thus providing a valuable contribution for review for the taxonomic proposal presented in the next section. This type of representation is also identified in more recent works and, in general, in the various pieces that have touched on this subject in the PB [15,21,22]. The use of the term “attitude(s)” is sometimes combined with the word “work”: the use of “work attitude” is used for describing the behaviour of employees in the workplace. This type of term is often used to measure the impact of human resources or management policies. Measuring the positive or negative attitude of employees gives an overall indication of the perceived quality of the workplace [5]. Finally, several aspects that can serve as stimuli for the assessment of the attitudes of employees are work contentment, engagement, and turnover intentions.

4. Taxonomical Proposal

A taxonomy proposal is provided, in this section, as in Table 4, on the basis of the bibliographic portfolio review presented thus far. In addition, a classificatory idea of the main characteristics that can be included in the defined clusters is also provided. Although performing a comprehensive classification of all the soft skills, attitudes, and personality traits presented in the scientific research is not the target of the present work, it certainly allows to give a contribution to be further expanded in future research, defining, in any case, a direction to follow.

Table 4. Proposed taxonomy.

Term	Proposed Taxonomy
Personality traits	The intrinsic characteristics that effectively distinguish individuals, which cannot be changed in the short run regardless of place or context.
Soft skills	The set of characteristics of individuals that enable them to translate their technical knowledge effectively and efficiently into the work context, which may naturally be present or may be learnt over time.
Attitudes	The set of characteristics that depend on individuals' environment and influence the way people manifest their personality traits and hard or soft skills.

Personality traits are the 'backbone' of an individual; they define who the person is and how he or she relates to the outside world, i.e., they are essential elements of that person's character that clearly distinguish him or her from any other individual. Examples are shyness, anxiety, extroversion, introversion, etc. This set of connotations is independent of the context in which individuals are placed, whether at work or not. This set of connotations is independent of the context in which individuals are identified, whether at work or not, and is unlikely to change radically over time. Measuring these characteristics adequately could help allocate human resources effectively in different work contexts. Thus, for instance, those who by nature are not very extroverted will find it more challenging to communicate effectively in public.

Soft skills are the enabling characteristics of individuals that allow them to express their technical (or hard) knowledge (skills) efficiently. Possessing strong technical knowledge, but not being able to communicate constructively with others or build a team reduces the impact an individual can provide to the company in which they are located. Typically, the characteristics of team building, change management, and problem solving can be learned or improved through experience and practice, albeit at a slower pace than learning more in-depth knowledge. For example, an operations manager who knows how to analyse efficiency losses in a production line accurately but cannot persuade operators to improve due to a lack of communication skills may find it difficult to improve overall production performance.

Finally, attitudes constitute a third dimension that depends on where individuals are placed. Although a person may be characterised by different requirements in terms of personality traits and hard and soft skills to fill a particular job position adequately, they may underperform because they have a negative attitude towards specific dimensions of the workplace. For example, an individual who has all the characteristics to be a demand planner may not perform well when placed in a work context that reflects his ambitions and may perform inadequately. Moreover, although attitudes can take on a variety of nuances, they are sometimes concisely defined with the adjectives "positive/negative".

In conclusion, the proposed taxonomy allows for a proper adoption and usage of this terminology in Behavioural Operations Management, significantly contributing to laying the foundations for developing this research field. Moreover, the described terms allow for building the foundation for the areas concerning the measurement of individuals and for developments in this direction.

Categorization Finding and Suggested Classification

Valid for the analysis proposed in this section is the study of the categorisations offered in the examined bibliographic portfolio. In summary, the following analysis aims at providing a direction to evaluate which characteristics most commonly fall within the presented clusters, defined as: "personality traits", "attitudes", and "soft skills". Indeed, it is necessary to underline that this research work is not primarily focused on the proposal of a categorisation, but on the proposal of a taxonomy in the field of SCM and OM. Nevertheless, the most significant contributions in terms of categorisation these contributions are reported in Table 5. In particular, the work of Stek and Schiele [7] on the classification of soft skills and traits deserves special mention, useful for future work on classifications in the field of reference.

Table 5. Summary of the main categorisations in the PB.

Reference	Findings
[14]	Personality traits: Emotional stability, extraversion, conscientiousness, agreeableness, and openness
[15]	<u>Attitudes:</u> Enthusiasm, willingness
[16]	<u>Attitudes:</u> Dimension of the human aspect describing how an individual relates positively or negatively with a specific context
[17]	<u>Soft skills:</u> Interpersonal communication, ethical behaviour, problem-solving, decision making, ability to prioritise, creativity, and critical thinking
[18]	<u>Soft skills:</u> Collaboration, creativity, and communication
[20]	<u>Soft Skills:</u> Relationship building, coordination, and leadership
[21]	<u>Soft skills:</u> Collaboration, communication, cooperation, and leadership
[22]	<u>Attitudes:</u> Dimension of the human aspect describing how an individual relates positively or negatively with a specific context
[23]	<u>Attitudes:</u> Dimension of the human aspect describing how an individual relates positively or negatively with a specific context
[5]	Motivation, commitment, and satisfaction <u>Soft skills:</u> Cooperation with management and cooperation among employees
[6]	<u>Attitudes:</u> Dimension of the human aspect describing how an individual relates positively or negatively with a specific context or job satisfaction
[26]	<u>Soft skills:</u> Creativity
[27]	<u>Attitudes:</u> Dimension of the human aspect describing how an individual relates positively or negatively with a specific context
[28]	<u>Attitudes:</u> Organisational commitment and turnover
[29]	<u>Attitudes:</u> Organisational commitment and job satisfaction; dimension of the human aspect describing how an individual relates positively or negatively with a specific context
[30]	<u>Personality traits:</u> Openness, conscientiousness, extraversion, agreeableness, and neuroticism <u>Soft skills:</u> Communication, teamwork, and leadership
[3]	<u>Attitudes:</u> Boredom and satisfaction <u>Soft skills:</u> Communication and cooperation
[32]	<u>Attitudes:</u> Job satisfaction, job motivation, and organisational commitment
[33]	<u>Attitudes:</u> Job satisfaction and turnover intentions; dimension of the human aspect describing how an individual relates positively or negatively with a specific context
[34]	<u>Attitudes:</u> Positive or negative.

Table 5. Cont.

Reference	Findings
[36]	<u>Attitudes:</u> Job satisfaction, citizenship, task performance, and turnover intention; dimension of the human aspect describing how an individual relates positively or negatively with a specific context
[7]	<u>Soft skills:</u> Curiosity, critical thinking, dealing with ambiguity, resilience, self-confidence, communication, relationship management, proactivity, and leadership <u>Personality traits:</u> Humility, openness, open-minded, passion, and self-reflection
[37]	<u>Personality traits:</u> Openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism
[38]	<u>Attitudes:</u> Organisational commitment
[40]	<u>Personality Traits:</u> Emotional stability, extraversion, conscientiousness, agreeableness, and openness
[41]	<u>Attitudes:</u> Dimension of the human aspect describing how an individual relates positively or negatively with a specific context

Similar to how the analysis was carried out for the taxonomy proposed in the PB, Table 6 shows the classification offered. The suggested classification, most of which, as we can note, reflects most of the categories proposed in the different works, summarises the different classification intentions in the other works analysed. However, it is worth noting a relationship factor between these terms. In fact, we can see how the dimensions of personality traits are factors that can better predict who might be a good manager or a good employee, depending on the context. For example, someone who is open to new experiences might be an employee with greater adaptability to change, perhaps having a predominantly positive attitude in the workplace. Therefore, these three dimensions are intertwined with each other, making it possible to define workers in the OM and SCM sectors from a personal point of view. Moreover, this type of research can potentially be transferred to other industrial sectors or scientific research.

Table 6. Suggested classification.

Term	Proposed Categorisation
Personality traits	Openness, conscientiousness, extraversion, agreeableness, neuroticism
Soft skills	Curiosity, problem solving, interpersonal communication, leadership
Attitudes	Organisational commitment, job satisfaction, turnover intention, motivation, dimension of the human aspect that reflects how positively or negatively an individual relates to a specific context

5. Discussion and Implications

The research confirms that the BeOps field is still relatively new and that its structure and topics are still entirely in development. Several possible research directions could contribute to expanding this content-based analysis of the PB [7,37,40]:

- First, the characteristics that fall under each of the three described macro-dimensions in this paper could be better clarified by also specifying their application areas.

Indeed, it is undoubtedly of interest to identify the main characteristics commonly used to describe the non-technical sphere of individuals. This type of classification will help scholars conquer this research area by systematising it [24]. Until around 2008, most types of classification focused on the technical side; however, as proposed in Gino and Pisano's [1] work on BeOps, investigating and appropriately classifying the individual sphere is necessary to lead companies toward a new operational dimension.

- Second, starting from the proposed taxonomy, other research works could investigate the most suitable characteristics that equip personnel to work effectively in the OM and SCM context.

Further research could investigate the demand for skills in companies and significant international databases (e.g., O*Net and ESCO) and provide a weighting for each characteristic described for the roles in the market. This could define which soft skills, personality traits, or attitudes contribute the most to the activities for blue-collar positions in the OM and SCM sectors [46]. Moreover, as a logical next step to a classification, creating a correlation between what is required for each task by the company and personal predispositions makes it possible to optimise the recruitment and placement of each individual according to what is needed in companies.

- Finally, measuring these dimensions could be a crucial step for an appropriate consideration of personality traits, soft skills, and attitudes within the work context.

The aspect of measuring non-technical elements described so far is of considerable interest. It impacts both the research area of BeOps and the companies that widely require challenging-to-measure non-technical factors for managerial roles [1,4]. Developing measurement systems that combine business practices with scientifically developed systems is undoubtedly another path to be explored [24]. The significance of this type of analysis becomes even more pronounced when considering leadership development within the context of Industry 4.0 (I4.0) and the increasingly pivotal role of artificial intelligence (AI). In the I4.0 environment, where digital technologies and AI are revolutionising manufacturing operations and supply chain management, the need for leaders capable of navigating these transformations is critical. Non-technical competencies, as outlined in the macro-dimensions of our study, become essential for leaders tasked with managing diverse teams, fostering innovation, and driving change effectively [47].

The importance of this analysis also lies in its applicability to the advancement of AI. As companies adopt AI technologies, understanding which personality traits, soft skills, and attitudes contribute to optimal collaboration between humans and intelligent systems becomes crucial [48]. The ability to measure and assess these non-technical dimensions can enhance the selection and placement of personnel in roles where interaction with AI is frequent, thus optimising operational effectiveness and job satisfaction.

Furthermore, in the I4.0 context, analysing the competencies required for managerial and operational roles can guide the development of targeted training programs. These programs can equip workers to interact effectively with new technologies and to exhibit leadership that embraces change, promotes innovation, and supports an inclusive and adaptable organisational culture.

Lastly, integrating non-technical competencies with advanced technologies such as AI can help create more humane and productive workplaces, where technology enhances human capabilities rather than replacing them. This holistic approach to the role of AI and non-technical skills in Industry 4.0 underscores the importance of informed and attentive leadership, capable of steering organisations toward success in an era of unprecedented transformation.

6. Final Considerations

This study embarks on an in-depth analysis of three critical dimensions that delineate individual characteristics within the realm of Behavioural Operations Management (BeOps): “personality traits”, “attitudes”, and “soft skills”. Employing the Knowledge Development Process-Constructivist (ProKnow-C) approach, this research meticulously curates a collection of state-of-the-art scholarly works, aiming to dissect and understand the nuances of terminological meanings and applications within contemporary scientific discourse. The assembly of a targeted bibliographic portfolio, carefully selected to address the research inquiries pertinent to this study, sets the stage for a rigorous bibliometric and content assessment of the included articles. This methodical evaluation culminates in the articulation of a detailed and comprehensive taxonomy for the terminologies under consideration.

The taxonomy unveiled through this study not only broadens the burgeoning field of BeOps but also unveils new avenues for future investigation. Notably, the study opens the door to exploring the alignment of specific individual characteristics with particular roles

within operations management (OM) and supply chain management (SCM), leveraging the refined terminological framework established here. Future research endeavours might focus on crafting and validating a methodological framework capable of precisely evaluating these characteristics in practice. Moreover, while this study lays a significant foundation, it acknowledges certain limitations, such as the inherent subjectivity of keyword and research axis definition, which could potentially influence the analytical outcomes. Consequently, forthcoming research aimed at refining and expanding this taxonomic exploration is encouraged to consider the dynamic evolution of the terminologies in question and to broaden the scope by incorporating a more extensive selection of keywords, research axes, and academic journals. This expanded approach promises not only to enhance the robustness of the taxonomy but also to contribute to the evolving dialogue on the critical interaction between individual characteristics and operational excellence in the contemporary business landscape.

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Appendix A

Appendix A.1. Bibliographic Portfolio

Table A1. Bibliographic portfolio.

ID	Reference	Title	Journal	Year
1	[14]	Relationships between personality variables and burnout: A meta-analysis	<i>Work and Stress</i>	2009
2	[15]	The social benefits of kaizen initiatives in healthcare: an empirical study	<i>International Journal of Operations and Production Management</i>	2018
3	[16]	Perceptions of HR practices and innovative work behavior: the moderating effect of an innovative climate	<i>The International Journal of Human Resource Management</i>	2017
4	[17]	Clashing institutional interests in skills between government and industry: An analysis of demand for technical and soft skills of graduates in the UK	<i>Technological Forecasting and Social Change</i>	2017
5	[18]	Contextually enriched competence model in the field of sustainable manufacturing for simulation style technology enhanced learning environments	<i>Journal of Intelligent Manufacturing</i>	2011
6	[19]	The relationships between performance measures and employee outcomes: the mediating roles of procedural fairness and trust	<i>Conference on Performance Measurement and Management Control</i>	2014
7	[20]	The human side of humanitarian supply chains: a research agenda and systematisation framework	<i>Annals of Operations Research</i>	2021
8	[21]	Resilience for lean organisational network	<i>International Journal of Production Research</i>	2018

Table A1. Cont.

ID	Reference	Title	Journal	Year
9	[22]	Does people-related total quality management work for people? An empirical study of the Sri Lankan apparel industry	<i>The TQM Journal</i>	2021
10	[23]	What drives managers to insource production? Evidence from a behavioural experiment	<i>Journal of Purchasing and Supply Management</i>	2021
11	[24]	Skill and Performance	<i>British Journal of Industrial Relations</i>	2011
12	[24]	Causal relationship between HRM policies and organisational performance: Evidence from the Greek manufacturing sector	<i>European Management Journal</i>	2010
13	[25]	Person-organisation fit and employee outcomes: test of a social exchange model	<i>The International Journal of Human Resource Management</i>	2013
14	[6]	High commitment HR practices, the employment relationship and job performance: A test of a mediation model	<i>European Management Journal</i>	2016
15	[26]	Teaching Industrie 4.0 technologies in a learning factory through problem-based learning: Case study of a semi-automated robotic cell design	<i>Procedia Manufacturing</i>	2020
16	[27]	On industrial learning and training for the factories of the future: a conceptual, cognitive and technology framework	<i>Journal of Intelligent Manufacturing</i>	2011
17	[28]	Transformational leadership and the work outcomes of Chinese migrant workers: The mediating effects of identification with leader	<i>Leadership</i>	2012
18	[29]	Does Dispositional Aggression Feed the Narcissistic Response? The Role of Narcissism and Aggression in the Prediction of Job Attitudes and Counterproductive Work Behaviors	<i>Journal of Business and Psychology</i>	2012
19	[30]	A Project-based Learning curricular approach in a Production Engineering Program	<i>Production</i>	2017
20	[3]	Human factors: spanning the gap between OM and HRM	<i>International Journal of Operations and Production Management</i>	2010
21	[31]	Corporate social and environmental irresponsibilities in supply chains, contamination, and damage of intangible resources: A behavioural approach	<i>International Journal of Production Economics</i>	2021
22	[32]	Examining the relationship between strategic HRM and hospital employees' work attitudes: an analysis across occupational groups in public and private hospitals	<i>The International Journal of Human Resource Management</i>	2016
23	[33]	Trust in organisation as a moderator of the relationship between self-efficacy and workplace outcomes: A social cognitive theory-based examination	<i>Manufacturing and Service Operations Management</i>	2017
24	[34]	Field trips for sustainable transport education: Impact on knowledge, attitude and behavioral intention	<i>The International Journal of Logistics Management</i>	2018
25	[35]	Examining the frustration-aggression model among Tunisian blue-collar workers	<i>Journal of Managerial Psychology</i>	2015
26	[36]	How Employee Authenticity Shapes Work Attitudes and Behaviors: the Mediating Role of Psychological Capital and the Moderating Role of Leader Authenticity	<i>Journal of Business and Psychology</i>	2020
27	[7]	How to train supply managers—Necessary and sufficient purchasing skills leading to success	<i>European Journal of Operational Research</i>	2021
28	[37]	Do personal traits influence inventory management performance?—The case of intelligence, personality, interest and knowledge	<i>International Journal of Production Economics</i>	2013
29	[38]	Multiple dimensions of human resource development and organisational performance	<i>Journal of Organizational Behavior</i>	2014
30	[2]	Agent-system co-development in supply chain research: Propositions and demonstrative findings	<i>Journal of Operations Management</i>	2014
31	[39]	Leadership behaviors during lean healthcare implementation: a review and longitudinal study	<i>Journal of Manufacturing Technology Management</i>	2020
32	[40]	Personality characteristics and Six Sigma: a review	<i>International Journal of Quality and Reliability Management</i>	2018
33	[41]	Attitudes toward supplier integration: the USA vs. China	<i>International Journal of Operations and Production Management</i>	2017

Appendix A.2. Further Contributions

Table A2. European documents and standards.

ID	Reference	Title	Journal	Year
1	[42]	Recommendation on the European Qualifications Framework	<i>Official Journal of the European Union</i>	2017
2	[45]	e-Competence Framework (e-CF)—Framework	CEN-CENELEC Management Centre	2018
3	[44]	e-Competence performance indicators and common metrics	CEN-CENELEC Management Centre	2021
4	[43]	Foundational Body of Knowledge for the ICT Profession (ICT BoK)—Part 1: Body of Knowledge	CEN-CENELEC Management Centre	2021

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