sustainability

MDPI

Article

Sustainable Approach to Certification of Persons: Ensuring Reliability and Quality

Maija Kavosa [1,2], Inga Lapina [2,*] and Konstantins Kozlovskis [3]

[1] Construction Specialists Certification Division, State Construction Control Bureau of Latvia, K. Valdemāra Iela 157, LV-1013 Riga, Latvia; maija.kavosa@rtu.lv
[2] Institute for Quality Engineering, Faculty of Engineering Economics and Management, Riga Technical University, Kalnciema Iela 6, LV-1048 Riga, Latvia
[3] Institute of Business Engineering and Management, Faculty of Engineering Economics and Management, Riga Technical University, Kalnciema Iela 6, LV-1048 Riga, Latvia; konstantins.kozlovskis@rtu.lv
* Correspondence: Inga.Lapina@rtu.lv

Abstract: Nowadays, sustainability issues are gaining more and more topicality in the context of improving organizational processes, including in the field of conformity assessment. In the field of certification of persons, competence assessment institutions have also become interested in using new approaches as the quality of assessment execution does not fully meet the requirements of stakeholders regarding the ability of a person to apply the acquired knowledge and skills in situations related to the professional activity. The aim of the research is to analyze the aspects of professional competence assessment related to the certification of persons and its performance according to the stakeholder requirements in order to develop a new sustainable approach to the process of certification of persons that would ensure the quality and reliability of its execution. Qualitative and quantitative research methods have been used to analyze the elements of the concept of certification of persons and the main elements of the concept of professional competence. As a result of the research, a new sustainable approach to certification of persons is offered, where certification of persons transforms from a conformity assessment procedure into a professional competence assessment process and ensures that a person's ability is assessed not only in accordance with the industry requirements, but also with the stakeholder needs.

Keywords: certification of persons; professional competence; sustainability of the certification process; reliability and quality of certification

Citation: Kavosa, M.; Lapina, I.; Kozlovskis, K. Sustainable Approach to Certification of Persons: Ensuring Reliability and Quality. *Sustainability* **2022**, *14*, 1137. https://doi.org/10.3390/su14031137

Academic Editors: JinHyo Joseph Yun, Yuri Sadoi, Valentina Della Corte, JungHyun Yoon and Wookjoon Sung

Received: 23 November 2021
Accepted: 18 January 2022
Published: 19 January 2022

1. Introduction

As a result of the globalization process and technological developments, alongside competitiveness, quality, and social responsibility [1–5], the development of an integrated management system as a sustainable and holistic approach to governing and improving organizational processes has become the biggest challenge for organizations in any industry. The professional competence of individuals plays a key role in the creation of new knowledge and in innovation processes, as well as in the prevention of costs resulting from inefficient organizational governance [6–9]. Thus, modern researchers consider the knowledge, abilities, and skills of specialists in the field, i.e., their professional competence, as the most important potential of any organization [10–12]. In order to perform the specified functions successfully and efficiently, persons must have the competence defined in their professional field, which must comply with the requirements set out in the particular sector, confirmed by a certificate issued as a result of the competence examination.

However, a certificate issued by a certification body does not always certify a person's compliance with the professional competence requirements set out in the industry or eliminate the risk that an incompetent person's professional performance or unprofessionalism may pose. Consequently, in the field of certification of persons, competence assessment

institutions have also become interested in using new approaches, which can be described as innovative in the particular industry, in order to assess a person's professional competence. This is done in order to ensure the quality and reliability of the process execution that would meet the requirements not only of the industry but also of the stakeholders.

In Latvia, the process of certification of persons and the assessment of the level of achievement of the requirements for professional competence are neither standardized nor clearly defined [1,13]. A major role in the certification of persons in Latvia is played by the compliance of the service provided by the body of certification of persons with the international standard ISO/IEC 17024:2013 "Conformity assessment. General requirements for bodies operating certification of persons". However, the regulatory enactments regulating the field of certification of persons disregard several norms of this standard. In the process of assessing the professional competence, the certification bodies focus more on assessing the knowledge and professional experience of the persons to be certified in the specific field than their ability to apply the acquired knowledge and skills in situations related to their professional activity. Unfortunately, in practice, there are often cases when the certificate recipients' activity in the specialty is not properly monitored and professional skills are not improved in accordance with the awarded qualification level. Still, the quality of its execution does not fully meet the requirements of stakeholders regarding the ability of a person to apply the acquired knowledge and skills in situations related to the professional activity. Therefore, a new sustainable solution is needed in the field of certification of persons in order to ensure the quality and reliability of the execution of the specific process. The aim of the research is to analyze the aspects of professional competence assessment related to the certification of persons and assessment performance according to the stakeholder requirements in order to develop a new sustainable approach to the process of certification of persons that would ensure the quality and reliability of its execution.

The study includes an analysis of the aspects related to the certification of persons in order to identify whether the certification process, as a conformity assessment procedure, ensures the quality and reliability of the execution of the process according to the stakeholder requirements. Whereas, when performing the analysis of the aspects related to the certification of persons and the assessment of the performance of professional competence, the answers to the following research questions are sought:

- RQ1—is the assessment of professional competence an essential element of the process of certification of persons?
- RQ2—is certification of persons only a formal conformity assessment procedure, or does it provide an assessment of professional competence in accordance with the requirements of the industry and stakeholders?

The concept of certification as a conformity assessment procedure and the main elements of professional competence were analyzed using qualitative content analysis of the literature with open coding.

The survey and correspondence analysis were used to understand how professional competence is assessed in the process of certification of construction professionals. The authors selected certification of construction workers for in-depth analysis because the development of the construction sector is an essential precondition for sustainable development of the national economy, including not only efficient use of resources, minimization of construction waste, but also cooperation with stakeholders and continuous improvement of professional competence. Construction professionals also have an important role to play in ensuring public and occupational safety in order to prevent situations in which the employees' activities may cause damage to the environment and public safety because of the constructors' professional incompetence or non-compliance with professional requirements.

These methods were chosen taking into consideration their wide application in studying theoretical and practical aspects of literature analysis. As a result of using both methods, it is possible to get a profound idea of the problems of the particular study. Our research allows us to evaluate the process of certification of construction professionals from the

point of view of the persons involved, i.e., to determine which competencies are important for certified construction professionals, not just for certification or inspection bodies.

The description of the research methodology is provided in Section 2. Section 3 presents the results of the study on the concept of certification of persons and its relation to conformity assessment, as well as the main elements that make up the concept of competence. Section 4 contains the results of the survey and correspondence analysis. Sections 5 and 6 contain discussions and conclusions.

2. Research Methodology and Data Collection

Analysis of the research papers from 1996 (the year when certification of constructors was started in Latvia) to the present was conducted using Science Direct, Web of Science, IEEE Xplore Digital Library, EBSCO host, SCOPUS, ACM Digital Library, Wiley Online Library evidence databases using the keywords: certification, certification of persons, personnel certification, professional competence, competence, professional competence assessment in the certification process, assessment of competence, competence assessment in certification, professional competence elements. Keywords were identified and discussed by the authors in order to keep the selection terms as broad as possible, as well as to ensure that the study will cover the main research field. This involved searching for abstracts, titles, and keywords in all previously mentioned data bases in the period 1996–2021. Articles with full texts (including systematic reviews, narrative reviews, and meta-analyses) written in English were included. Articles of interest were those that contained studies of the main aspects according to the concept of certification of persons and the basic elements of professional competence. Articles focusing on product or process certification or professional competence assessment without mention of competence elements were excluded. Articles were selected from the search process according to the above-mentioned criteria and classified using a PRISMA flow diagram. As the result, the final summary contained evidence from 66 papers—25 papers that included analysis of the concept of certification of persons (see Figure 1) and 41 papers that considered the basic elements of "professional competence" (see Figure 2).

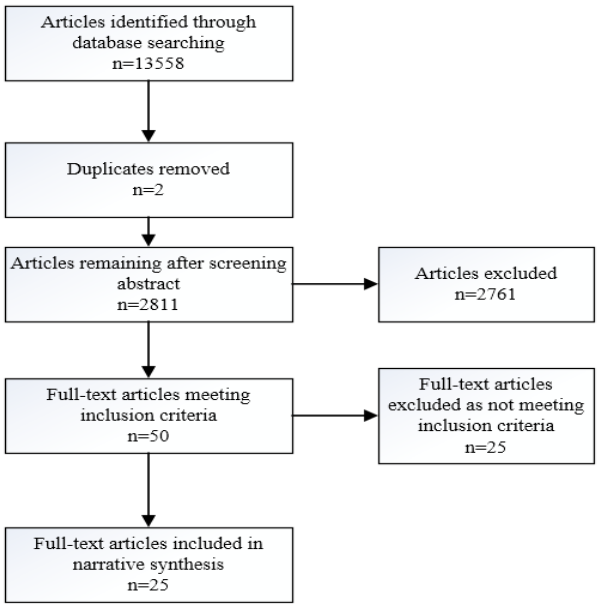

Figure 1. PRISMA flow diagram reporting items for the concept of certification of persons (created by the authors).

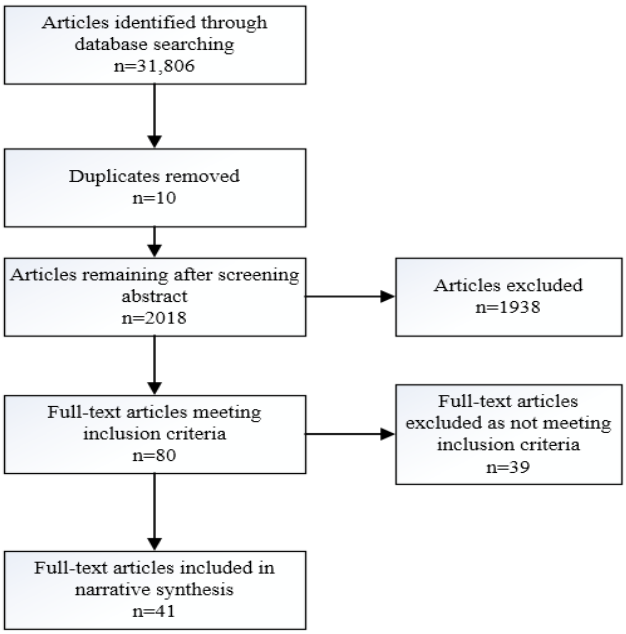

Figure 2. PRISMA flow diagram reporting items for the concept of professional competence (created by the authors).

Of this sample, 36 articles were obtained from Science Direct, 20 articles from Web of Science, 2 articles from EBSCO host, and 8 articles from SCOPUS. Fewer articles were observed in 2003–2011 and in 2018–2021. In contrast, 2012–2017 was the most popular period for articles that included the terms professional competence and certification of persons; around 57% of articles selected for this study were published during this period. Due to the fact that the highest proportion of studies (68%) focus on the competence assessment process in the human resource management, engineering, and medical industry, it could be concluded that the role of professional competence assessment in the process of certification is increasing in industries related to high risk.

The results of the qualitative content analysis are presented in Part 3 of this article.

Survey and correspondence analysis were carried out in Part 4. During the period from April to July 2018, a survey of construction specialists certified by certification bodies of constructors in Latvia was carried out. The process of certification of construction specialists in Latvia has so far been viewed solely in the context of legislative changes where the main aim for the certification process is ensuring compliance with the regulatory requirements. Therefore, the aim of the survey was to clarify whether the certification process as a conformity assessment procedure contains formal attestation of conformity or it ensures compliance of professional competence laid down in the professional sphere. The population of the survey was 8362 construction specialists—the total number of certified construction specialists in the regulated sphere at the time of the survey. In order to enhance the reliability and validity of this survey the sample size for the 95% reliability statement was calculated according to general practice. According to the error selection traditionally accepted in research practice, the margin of error in the survey is 5% [14]. In order for the representative error not to exceed 0.05, the sample size must be 367 respondents.

A total of 673 construction specialists certified by 8 certification bodies of constructors took part in the survey (till May 2018), which is sufficient for the number of respondents to guarantee the representativeness of the research. The survey also allows assessing the process of certification of construction specialists from the customers' point of view, i.e., revealing which competences are important to the certified construction specialists, not just to the certification bodies or supervisory authorities. The authors' survey data obtained in the analyzed period are still relevant in 2021, because the data obtained provide a

justification for the development of the new approach regarding the process of certification of persons.

Correspondence analysis is one of the most popular data analyzing methods to recognize patterns and associations in a dataset with categorical variables in order to explore and visualize data [15,16]. This method also offers several advantages for researchers regarding data visualization in a perceptual map and relatively few limiting assumptions in interpretation and communication of findings [17]. Despite its wide usability, correspondence analysis also has some important limitations, such as sensitiveness to outliers and possibility that the representation of the relationships of objects and characteristics which are not included in the analysis can be distorted [18]. In the research the authors applied multiple correspondence analysis (further MCA) which uses coded qualitative data as input that begins the analysis by coding the qualitative data obtained. The analysis and interpretation involve a visual inspection of a two-dimensional perceptual map in order to show the associations between the category of professional competence and the respondents' age and the level of education.

In this paper, multiple correspondence analysis was chosen because it would help to identify and visualize relationships of the survey data that were not immediately visible or apparent, as well as help to interpret data in a convenient way.

3. The Results of Qualitative Content Analysis

One of the most widely used conformity assessment procedures is certification, and the concept of certification is very closely linked to the concept of conformity assessment which includes the evaluation of a particular subject, determining whether it meets the necessary requirements [19,20]. Due to the fact that the need for sustainability and open innovation is getting bigger worldwide [4,5,21–24], understanding the process of certification of persons and its related issues leads to a socially responsible and sustainable process [25] that does not end with obtaining the certificate, but continues by putting forward a certified person's professional competence development. In order to assess ways of improving competence assessment procedures for certification of persons in the future, especially in the field of construction where there are potential risks to human health and life, it is necessary to study and analyze the theoretical aspects of certification.

After examining the articles, where the definition of the concept of certification of persons is included, 25 reviews with references to explicit meanings and definitions regarding competence and conformity assessment activities were retrieved. In total, 6 basic meanings of the concept of certification of persons were reviewed performing qualitative content analysis and for the convenience of the analysis the meanings (M) were assigned codes (see Table 1):

1. M1—Conformity to professional requirements;
2. M2—Conformity assessment process;
3. M3—Confirmation of professional competence;
4. M4—Method of professional competence assessment;
5. M5—Attestation of conformity;
6. M6—Opportunity for professional improvement.

According to Table 1 many previous studies have attempted to explore the concept of certification of persons. Most of the earlier studies pointed to some aspects affecting the meaning of certification of persons. These aspects apply to conformity assessment including the statement that if persons meet specific standards, it guarantees their conformity with the requirements. Beside this, another group of studies emphasized that certification of persons includes the aspect of professional competence assessment to confirm that persons' knowledge, skills, and abilities are approved and it is an opportunity for continuous professional development. In addition, these studies concluded that certification of persons is one of the most common ways of assessing professional competence in order to certify that a person is able to perform their work in accordance with the requirements specified in the field of professional activity.

Table 1. Basic meanings of the concept of certification of persons (created by the authors).

Meaning (M)	Interpretation	Frequency	%	Authors
Conformity to professional requirements	The term is often used to indicate that persons meet specified standards for education, experience, and examination performance.	9	22	[26–33]
Conformity assessment process	The term is often used to describe certification as a process, where a third independent party assesses the conformity of persons and states publicly that they meet specific standards.	8	20	[27,29,32,34,35]
Confirmation of professional competence	The term is often used to emphasize that persons' knowledge, skills, and abilities are approved and represent a professional status.	11	26	[9,31,34,36–42]
Method of professional competence assessment	The term is often used to describe certification as a method to assess the professional competence of persons.	8	20	[30,35–37,41–44]
Attestation of conformity	The term is often used to describe certification as an apostille and guarantee of persons' conformity with the requirements.	3	7	[29,32,37,45]
Opportunity for professional improvement	The term is used to describe certification as an opportunity for continuous professional development.	2	5	[45,46]

After analyzing the definitions and evaluating the meanings of the concept of certification of persons, it was concluded that most frequently the concept of certification of persons is used with the meaning "confirmation of professional competence" (26%) or "conformity to professional requirements" (22%). The weight of each meaning was determined based on the frequency of its occurrence in the literature. In order to compare which meanings are more typically used according to the concept of certification of persons, the distribution of the weights of the meanings was depicted in a diagram (see Figure 3).

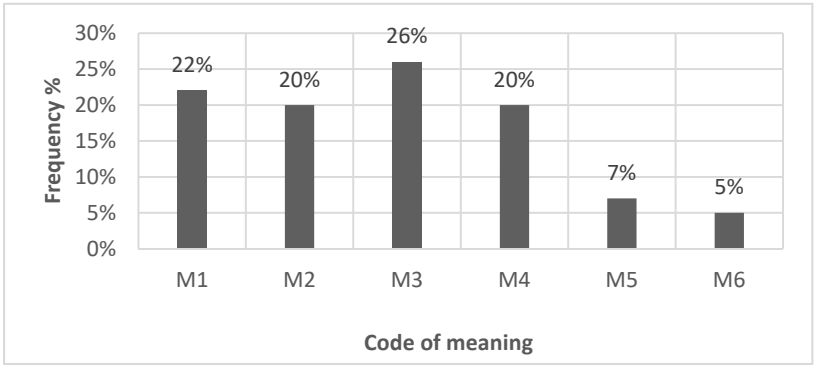

Figure 3. Distribution of the weights of the meanings of the concept of certification of persons (created by the authors).

The meanings "confirmation of professional competence" (M3, 26%) and "conformity to professional requirements" (M1, 22%) are obviously the most frequently used in the interpretation of certification of persons. However, from the distribution of the weights, very important categories which the authors of this study use for defining the concept certification of persons also include "conformity assessment process" (M2, 20%) and "method of professional competence assessment" (M4, 20%). It was concluded that the most rarely used meanings for defining the concept of certification of persons are "attestation of conformity" (M5, 7%) and "opportunity for professional improvement" (M6, 5%).

From the analysis of the texts the authors conclude that certification of persons is associated with professional competence and conformity assessment activities. There is

strong linkage between them, because in the certification process conformity assessment can be used to assess the professional competence of a person if explicit competences in the particular sphere for the person are defined.

The task of the certification body is not only to ensure that all the stages related to the certification process have appropriate procedures, but also to apply objective assessment tools in order to evaluate the person's professional competence. Due to the fact that, for certification bodies, assessment of how competence is achieved, measured, and maintained is not typically standardized, it is very important to identify the basic elements of the concept of professional competence in order to ensure competence assessment according to the competence-based professional requirements. Besides this, certification of persons serves not only as an essential tool for the assessment of professional competence, but also as a mechanism for the control of qualifications, thus becoming a key precondition for sustainable development of the economy. After examining the literature where the definition of the concept of professional competence is included, 41 reviews with the reference to the basic elements corresponding to professional competence were retrieved. In total, 10 basic elements of the concept of professional competence were reviewed performing qualitative content analysis and for the convenience of the analysis the elements (E) are assigned codes (see Table 2):

1. E1—Knowledge;
2. E2—Expertise;
3. E3—Skills;
4. E4—Abilities;
5. E5—Motivation;
6. E6—Personal characteristics;
7. E7—Ethics;
8. E8—Attitude;
9. E9—Values;
10. E10—Practice/Experience.

Table 2. Basic elements of the concept of professional competence (created by the authors).

Elements (E)	Interpretation	Frequency	%	Authors
Knowledge	It includes knowledge acquired experimentally as a result of learning and reasoning	32	23	[26,47–70]
Expertise	It includes skillfulness by virtue of possessing special knowledge	8	6	[10,50,56,63,66,71–73]
Skills	It includes an ability that has been acquired by training in order to produce solutions in some problem domain	30	21	[26,47,48,50–54,56–58,61,64–66,69,70,74–76]
Ability	It includes abilities required in a given area of work, learning, or social activity as well as the quality of being able to perform in the professional sphere.	32	23	[26,47,49–51,53,54,56,57,59–62,64,65,73,74,77,78]
Motivation	It includes an action toward a desired goal giving purpose and direction to behavior, thus providing incentive.	2	1	[66,79]
Personal characteristic	It includes psycho-social and psycho-motor elements, which help to manage special situations.	8	6	[52,58,62,64,66,67,72,78]
Ethics	It includes the principles of right and wrong that are accepted by the person in a particular sphere.	2	1	[51,78]

Table 2. *Cont.*

Elements (E)	Interpretation	Frequency	%	Authors
Attitude	It includes beliefs and feelings required to fulfil a certain role in a given context.	15	11	[10,47,48,51,53,54,56,58,61, 63–65,69,70]
Values	It includes specific personal and professional values, an ideal accepted by the person.	7	5	[51,53,64,66]
Practice/Experience	It includes professional experience or knowledge of how something is usually done in a particular professional sphere.	4	3	[51,55,61,62,78]

According to Table 2, a substantial number of articles revealed that knowledge, abilities, and skills required in a given area of professional field, as well as persons' attitude, which could be defined as interpersonal competence, are the basic elements of professional competence which is assessed in the process of certification of persons. This result is in alignment with the results announced by Lambrechts [80], wherein the authors found out that persons' professional competence including specific knowledge and ability to manage, analyze, and implement new strategies in collaboration with interpersonal competence are one of the key drivers for successful implementation of sustainable practices. This was followed by the analysis of the sustainability competences framework, where the lack of appropriate professional competence was identified as one of the main impact factors related to the barriers towards successful implementation of sustainable practices.

In addition, after analyzing the basic elements of the concept of professional competence, it was concluded that most frequently professional competence in the literature is associated with such elements as knowledge (E1, 23%), ability (E3, 23%), skills (E4, 21%), and attitude (E8, 11%). Most rarely professional competence in the literature is associated with motivation (E5, 1%) and ethics (E7, 1%). It could be explained by the fact that usually these elements are categorized as specific personal and professional values, named "ethical competence" [66].

The weight of each meaning was determined based on the frequency of its occurrence in the literature. In order to compare which elements are more frequently used when defining the concept of professional competence, the distribution of the weights of the elements was depicted in a diagram (see Figure 4).

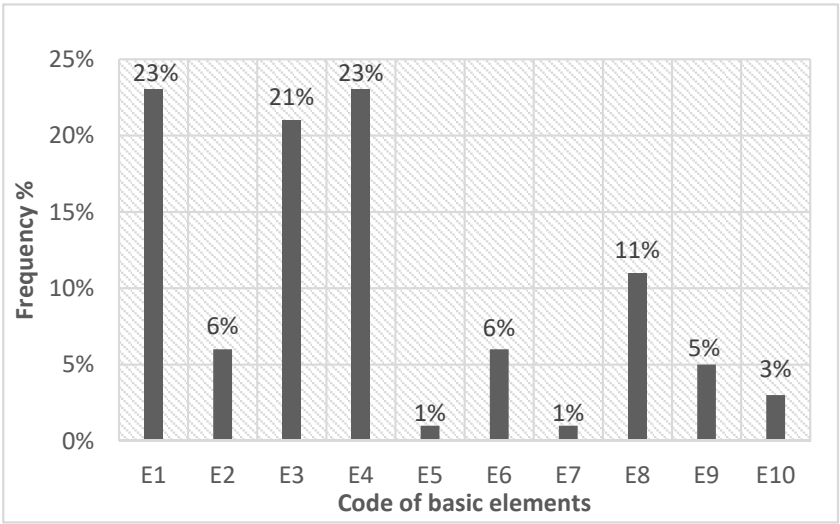

Figure 4. Distribution of the weights of the basic elements of the concept of professional competence (created by the authors).

From the analysis of the texts the authors conclude that the basic elements of professional competence are knowledge, skills, abilities, and attitude that a person needs to have and demonstrate in order to successfully accomplish the defined professional goals and perform the required professional tasks, duties, and responsibilities. When the certification bodies carry out certification of persons and assessment of their competence, a person's knowledge gained in the specific field cannot be considered to be the sole assessment criteria—their competence has to be assessed in the context of attitudes, along with their ability to apply this knowledge and practical skills in situations related to professional activities. Sustainable practice covers the social, economic, and environmental dimensions, and the assessment of professional competence can be classified as one of the essential aspects of the social dimension [80,81]. Employees whose professional competence does not meet the requirements of the industry are one of the main risk factors for successful implementation of sustainable practices.

4. The Results of the Survey and Correspondence Analysis

The construction industry is based on successful cooperation between stakeholders including manufacturers and suppliers of construction materials, customers, contractors, consultants, construction professionals, and users of construction sites [82]. Consequently, the construction industry is a knowledge-based industry that requires specific professional knowledge and problem-solving know-how in carrying out construction activities [83]. In order to ensure successful implementation of sustainable practices in the construction sector and to minimize the associated risks, an important role is played by the service provided by bodies of certification of constructors regarding the assessment of the professional competence of construction specialists. In assessing the professional competence of construction specialists in the certification process, we decided that in addition to the theoretical analysis of the area researched it is necessary to focus the subsequent survey on defining the professional competences of constructors from customers' point of view, i.e., from one of the most important stakeholder groups. This was followed by the study of Szymanski [84] which stated that the lack of stakeholders' involvement is one of the main barriers towards successful implementation of sustainable practices in the construction field.

At present, there are a total of 25 accredited bodies of certification of persons in Latvia, and 8 of them perform conformity assessment of constructors in accordance with the requirements of the specific field. The certification of energy constructors in Latvia is organized in such a way that it complies with the Construction Law of the Republic of Latvia and is carried out in accordance with ISO/IEC 17024 "Conformity assessment. General requirements for bodies operating certification of persons". In the period from 2014 to 2021, significant changes were made in the Construction Law of the Republic of Latvia regarding the requirements for obtaining a construction specialist's certificate in the regulated area, and now the certificates are open-ended. Previously, the certificates were issued for a fixed period and when they expired, construction specialists had to renew them. According to the new requirements, the majority of certified construction professionals whose education does not comply with the law, despite their long-term work experience and academic higher education in construction, will not be able to renew the certificate if an appropriate level of professional higher education is not obtained by a certain time. This, in turn, may adversely affect the implementation of construction projects, as construction specialists with experience and a high level of professional competence but inadequate education might be replaced by professionals with appropriate education, but lacking long-term work experience in the field. It should also be noted that the Construction Law of the Republic of Latvia does not provide for restrictions on the validity period of the certificate in the regulated area, i.e., it is open-ended, which is contrary to the procedure specified in ISO/IEC 17024, where the certificate must have a fixed validity period.

In accordance with the regulatory framework of the Republic of Latvia, the certificate of a construction specialist in the regulated field mainly serves as a confirmation of the academic education acquired by the construction specialist, rather than their professional

competence and experience. Therefore, it is necessary to make amendments to regulatory enactments, providing that in the certification process the ability of a construction specialist to use the acquired knowledge and skills in situations related to the specific field of activity is also assessed.

According to previously mentioned, the aim of the survey was to reveal which competences are important to the certified construction specialists, not just to the certification bodies or supervisory authorities.

The first part of the survey provides general information about the respondents. The sample includes certified construction specialists in the regulated sphere, where most respondents have been certified by the Latvian Association of Civil Engineers. The first part of the questionnaire shows that the majority of respondents, i.e., 35.1%, are aged between 50 and 65 years and 76.7% of respondents have the Latvian 2nd level professional higher education (which corresponds to the 6th level in the European Qualifications Framework (EQF) in European Higher Education Area), thus complying with the requirements of the Construction Law. A more specific description of the participating respondents is given in Table 3.

Table 3. Identification of the survey participants by their age, education, and the certification body (created by the authors).

Participants [Number—% of All] 673—100%		
Age	**%**	**Question**
20–30	6.5	q1_1
30–40	28.8	q1_2
40–50	23.9	q1_3
50–65	35.1	q1_4
65–more	5.6	q1_5
Education Level	**%**	**Question**
Secondary vocational education	14.7	q2_1
5th level EQF or short cycle of professional higher education	8.6	q2_2
6th level EQF or professional higher education	76.7	q2_3
Certification Body	**%**	
Latvian Association of Civil Engineers	47.4	
Latvian Association of Heat, Gas and Water Technology Engineers	17	
Latvian Association of Energy Constructors	14.2	
Latvian Railwaymen Association	7	
Latvian Association of Architects	5.7	
The State Construction Control Bureau of Latvia	3.8	
Latvia's Electricians' Brotherhood	2.8	
Latvian Association of Hydro Melioration Construction	2.2	

The second part of the survey provides information on the certified construction specialists' requirements for the professional competence assessment activities, identifying what competences are important and necessary for construction specialists to perform their work. The 10 most frequent professional competences concerning the profile of construction specialists are included in Table 4.

Table 4. The most frequent professional competences of construction specialists (created by the authors).

No	Competence	Question	Frequency	%	Order
1.	Technical knowledge	q12_1	525	78	1
2.	Ability to apply the knowledge in situations related to professional activities	q12_2	485	72	2
3.	Experience	q12_3	481	71	3
4.	Ability to make decisions	q12_4	384	57	4
5.	Ability to solve problems and conflict situations	q12_5	330	49	5
6.	Ability to work in a team	q12_6	211	31	8
7.	Communication skills	q12_7	227	34	7
8.	Ability to manage working processes	q12_8	312	46	6
9.	Motivation	q12_9	110	16	9
10.	Attitude	q12_10	38	6	10

From the results the authors can conclude that more than a half of all respondents cited "technical knowledge", "ability to apply the knowledge in situations related to professional activities", "experience", and "ability to make decisions" as the most important professional competences for construction specialists that should be evaluated in professional competence assessment activities by certification bodies. "Motivation" and "attitude" were mentioned as insignificant competences for successful work performance in the construction sphere; that could be explained by the fact that in Latvia's construction field lower price prevails and there are no clearly defined criteria for effective and high-quality work performance [85].

The FactoMineR library in R software and CHIC Analysis software v1.2 were used to conduct the MCA analysis. Performing MCA analysis, four groups of questions were analyzed: q1, q2, q12_1; q1, q2, q12_2; q1, q2, q12_3; and q1, q2, q12_4.

Conducting MCA analysis for three questions—q1, q2, and q12_1—the following results were obtained (see Table 5 and Figure 5).

Table 5. Statistics of MCA analysis for q1, q2, and q12_1 (created by the authors).

Axis (Dimension)	Cronbach's Alpha	ChiSq (Nishisato)	*df* (Nishisato)	*p* (Nishisato)	Inertia	Explained Variance, %	Cumulative Variance, %
1	0.276	896.533	690	0.000	0.408	15.315	15.315
2	0.163	800.103	688	0.002	0.374	14.026	29.340
3	0.107	759.276	686	0.027	0.359	13.458	42.798
4	0.062	730.053	684	0.108	0.348	13.043	55.842
5	−0.068	656.053	682	0.756	0.319	11.960	67.802
6	−0.105	637.719	680	0.876	0.312	11.685	79.487
7	−0.214	589.263	678	0.994	0.292	10.942	90.428
8	−0.459	503.343	676	1.000	0.255	9.572	100.000

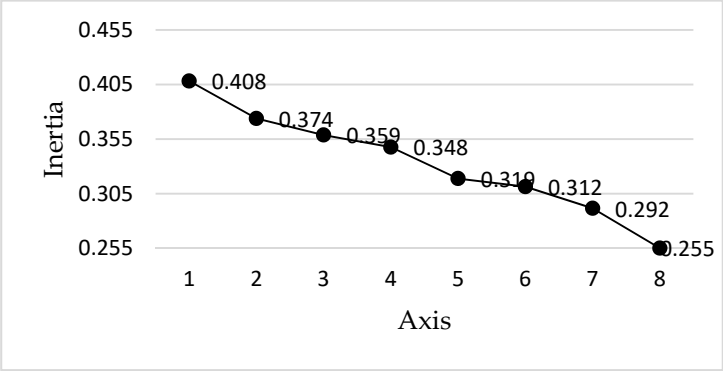

Figure 5. Scree plot for q1, q2, and q12_1 (created by the authors).

Eigenvalues (inertia), percentages of inertia, and statistical significance of axes are shown in Table 1. These results show the decomposition of total inertia into eight axes (dimensions). The scree plot (see Figure 1) cannot clearly show the optimal number of dimensions using the elbow method because of inertia, as explained variance of each dimension decreases smoothly, signalizing the absence of prevailing dimensions. Thus, the selection of significant axes was based on the statistical significance test of the principal inertias proposed by Nishisato [86]. According to the *p*(Nishisato) values, only the first three principal components are statistically significant at 5% level (p_1(Nishisato) = 0 < 0.05, p_2(Nishisato) = 0.002 < 0.05, and p_3(Nishisato) = 0.027 < 0.05). Cronbach's alpha represents a measure of reliability of each principal inertia. Although the generally accepted cut-off value for Cronbach's alpha is 0.70, a smaller value is acceptable in exploratory research [87] where a small alpha score can be due to a reduced number of questions, poor interrelatedness between items, or heterogeneous constructs.

The options for column points include principal coordinates with respect to the dimensionality of the solution (see Table 6), total quality (QLT), inertias (INR), masses (MASS), squared cosines (Cos2), which measures the degree of association between variable categories and a particular dimension, and contributions (CTR).

Table 6. Column projections, contributions, and squared cosines (created by the authors).

	Total				**Dimension 1**				**Dimension 2**			
	QLT	**Mass**	**Inertia**	**Best**	**Cos2**	**Sqcor1**	**Ctr1**	**Best1**	**Cos2**	**Sqcor2**	**Ctr2**	**Best2**
q1-1	0.497	0.022	0.311	2	0.002	−0.047	0.002	0	0.495	0.703	0.412	2
q1-2	0.315	0.096	0.237	1	0.315	0.561	0.183	1	0.000	−0.003	0.000	0
q1-3	0.098	0.080	0.254	1	0.081	0.285	0.050	0	0.016	−0.128	0.011	0
q1-4	0.463	0.116	0.217	1	0.449	−0.670	0.239	1	0.014	−0.120	0.008	0
q1-5	0.107	0.019	0.314	2	0.038	−0.194	0.029	0	0.069	−0.263	0.058	0
Sum.CTR							0.502				0.490	
q2-1	0.461	0.036	0.297	2	0.095	−0.309	0.069	2	0.366	−0.605	0.291	2
q2-2	0.331	0.028	0.305	1	0.212	0.461	0.159	1	0.119	−0.344	0.097	0
q2-3	0.542	0.257	0.076	2	0.013	−0.116	0.003	0	0.529	0.727	0.108	2
q2-4	0.021	0.012	0.321	2	0.007	0.086	0.006	0	0.014	−0.117	0.012	0
Sum.CTR							0.236				0.507	
q12-1	0.323	0.074	0.259	1	0.320	−0.566	0.203	1	0.003	0.058	0.002	0
q12-2	0.323	0.259	0.074	1	0.320	0.566	0.058	0	0.003	−0.058	0.001	0
Sum.CTR							0.261				0.003	

Additional significance criteria of individual points include correlations (SQCOR), which are the equivalent of the factor loadings in PCA and the Best index, which, similar to CTR, is an indicator of which points best explain the inertia of each dimension.

Although there are three defined statistically significant dimensions, the authors use a two-dimensional picture of data because it facilitates and allows for data interpretation and visualization. The MCA plot (see Figure 6) shows a global pattern within the data (observations and categories). The density curves show zones with highly concentrated individuals.

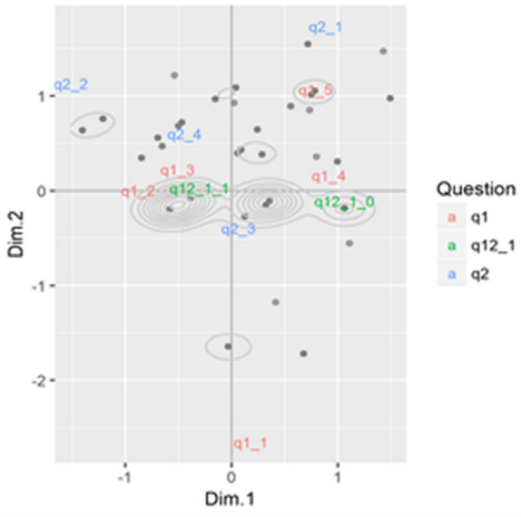

Figure 6. MCA plot for q1, q2, and q12_1 (created by the authors).

The coordinates of the column points are shown in Table 7. The distance between the points gives a measure of their similarity (or dissimilarity). The closer the points, the more similar are the variables. Figure 6 shows the correlation between the professional competence "technical knowledge" marked by the respondents (q12_1), their age group (q1) and level of education (q2). The results of the analysis show that there is a close correlation between the competence marked by the respondents (q12_1_1), the age group "30–40 years" (q1_2), and the 6th level EQF (q2_3).

Table 7. Coordinates of variables (columns) (created by authors).

	G1	G2
V1-1	−0.179	2.653
V1-2	0.880	−0.005
V1-3	0.508	−0.229
V1-4	−0.915	−0.164
V1-5	−0.789	−1.070
M2-1	−0.887	−1.738
M2-2	1.515	−1.132
M2-3	−0.063	0.397
M2-4	0.444	−0.602
M3-1	−1.059	0.108
M3-2	0.302	−0.031

The results of MCA analysis for the last three groups of questions are very similar (see Appendices A–C).

According to Figure 7, the coordinates of species profiles are the same as these unit profile points, up to scaling factors along the principal axes equal to the square roots of the corresponding variances. Rows are plotted in the principal coordinates and columns in the standard coordinates. With this scaling of the row and column points, each sample is at the weighted average of the species points, the weights being the relative frequencies. With this scaling the coordinates of each species are directly related to their contributions to each axis, so that species that are outlying have truly high correlation and thus are important to the interpretation. The specific link between the contribution coordinates and the contributions is as follows: the squared length of the species point on the principal axis is equal to its part contribution to that axis.

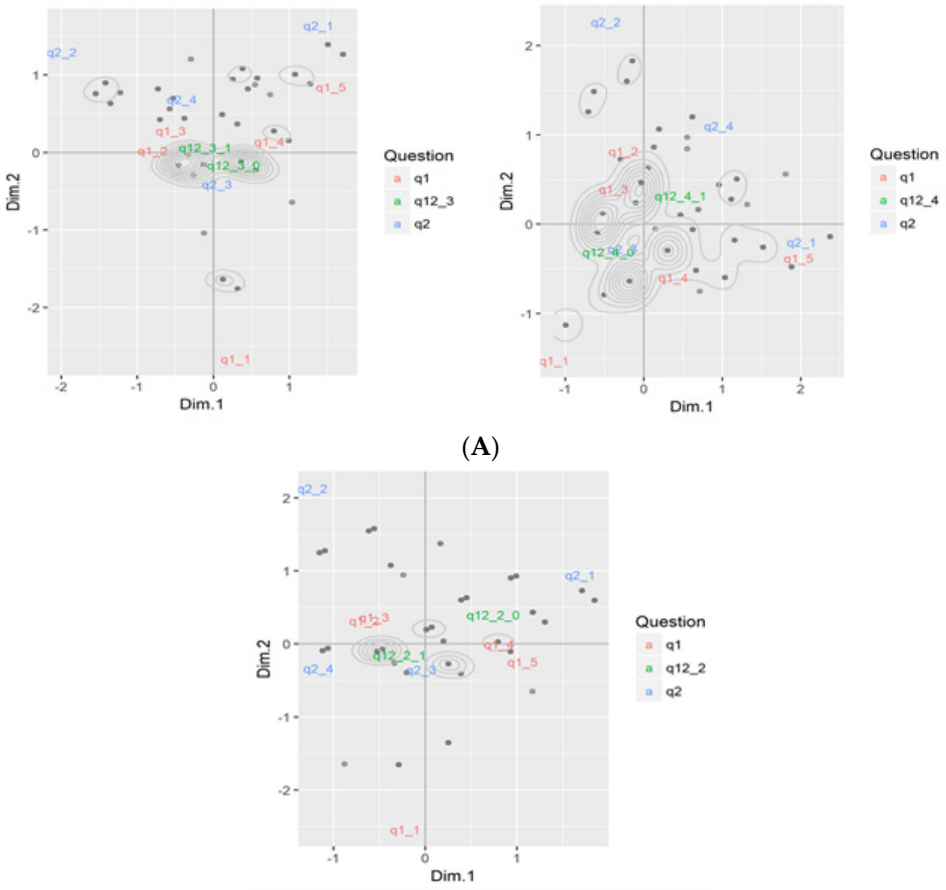

Figure 7. MCA plot for q1, q2, q12_2 (**B**); q1, q2, q12_3, and q1, q2, q12_4 (**A**) (created by the authors).

The top left image shows the correlation between the professional competence "experience" marked by the respondents (q12_3), their age group (q1), and level of education (q2). From the results of the analysis it can be concluded that there is a close correlation between the competence marked by the respondents (q12_3_1), the age group "30–40 years" (q1_2), and the 6th level EQF (q2_3). The top right image shows the correlation between the professional competences "ability to apply the knowledge in situations related to professional activities" and "ability to make decisions" marked by the respondents (q12_4), their age group (q1), and level of education (q2). From the results of the analysis it can be concluded that there is a close correlation between the competence marked by the respondents (q12_4_1), the age groups "40–50 years" and "50–65 years" (q1_2; q1_3), and the 6th level EQF (q2_3). The bottom image shows the correlation between the professional competence "ability to apply the knowledge in situations related to professional activities" marked by the respondents (q12_2), their age group (q1), and level of education (q2). From the results of the analysis it can be concluded that there is a close correlation between the competence

marked by the respondents (q12_2_1), the age groups "40–50 years" and "50–65 years" (q1_2; q1_3), and the 6th level EQF (q2_3).

Utilizing the data from the professional competence assessment study, correspondence analysis facilitated a more comprehensive interpretation of the qualitative data. We can conclude that respondents who noted "technical knowledge" and "experience" as the most important professional competences for construction specialists that should be evaluated in professional competence assessment activities by certification bodies are aged between 30 and 40 years and have the 6th level EQF or professional higher education. The respondents who mentioned the "ability to apply the knowledge in situations related to professional activities" and "ability to make decisions" as the most important professional competences for construction specialists also have the 6th level EQF or professional higher education, but are aged from 40 to 65. It indicates that for older constructors with superior professional experience, the importance of practical competences related to real working situations is much more significant than for younger specialists.

The survey results also show that in Latvia the certification process as a conformity assessment procedure contains formal attestation of conformity and it does not fully ensure compliance of professional competence in accordance with the requirements set out in the professional sphere. In addition to that, we conclude that evaluation of the causes of main impact factors related to the competence assessment activities by certification bodies is recommended in order to obtain information about the main barriers to professional competence assessment in the process of certification of persons. In this regard, it could be noted that certification bodies need to develop a new approach to the assessment of the professional competence of persons, based on mutual cooperation with stakeholders and certain process management principles that would ensure sustainable development of professional competence.

5. Discussion

Due to the fact that sustainability has been regarded as essential for organizations to remain competitive, leveraging technology and innovation is becoming essential in gaining competitive advantage [88]. In a highly competitive business environment, organizations are increasingly opening up to external partners and gathering their knowledge to improve internal innovation processes [89]. Open innovation involves knowledge recombination that may result in the creation and appropriation of economic value and possibly competitive advantage [90]. Professional competence diversity of the organization's employees is positively associated with the employees' ability to identify and absorb external knowledge, which aggregates to increased organization-level openness—that is, organizations' use of external knowledge in their pursuit of innovation-oriented and entrepreneurial action [90,91]. For an organization's professional performance to be sustainable and competitive, employees must each be able to demonstrate a high level of professional competence in their field.

In the process of certification of persons, a sustainable approach means that the certification of persons transforms from a conformity assessment procedure into a process of assessment of professional competence, thus ensuring the quality and reliability of the results in accordance with the interests of all stakeholders. A sustainable approach ensures that, as a result of the certification of persons, not only the person's knowledge and professional experience in the specific field, but also the person's competence or ability to apply the acquired knowledge and skills in situations related to the person's professional activity are assessed. A competent and professional employee is able to ensure the creation of products (technology, goods, or services) with high quality and reliability, as well as the creation of innovations, which in turn ensures sustainability.

We offer a new sustainable approach to the process of certification of persons, where quality and reliability are the evidence of a person's ability to apply the acquired knowledge and skills not only in accordance with the industry requirements, but also with the stakeholders' interests (see Figure 8).

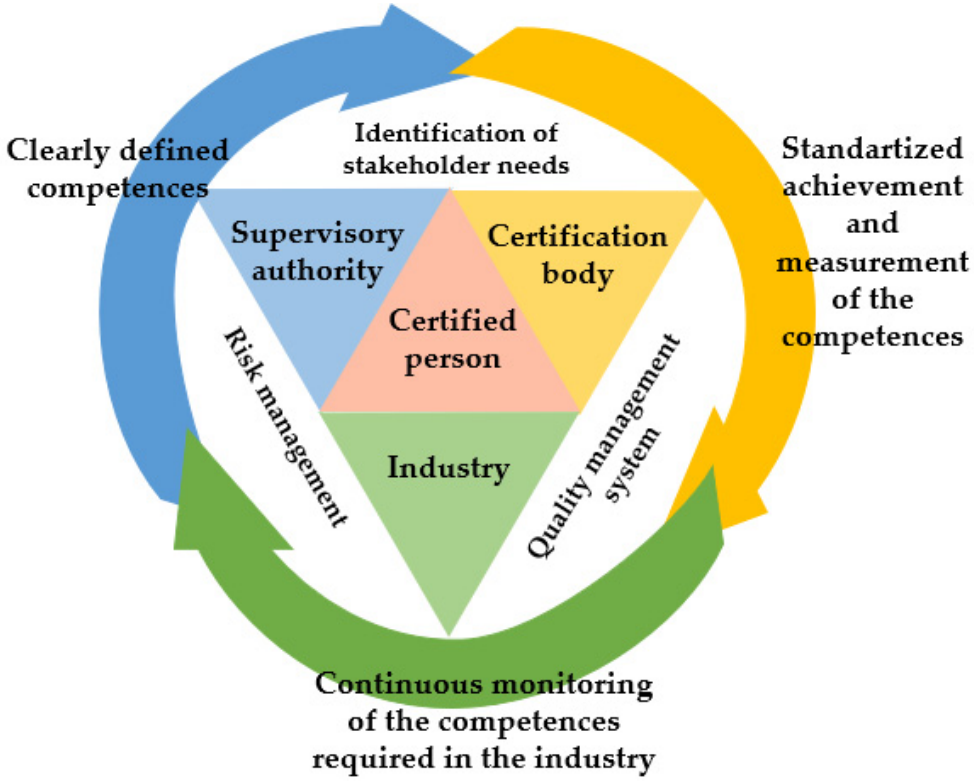

Figure 8. Sustainable approach to the process of certification of persons (created by the authors).

Figure 8 presents a new approach to the assessment of the professional competence of persons, based on mutual cooperation with stakeholders and certain principles of process management in order to ensure sustainable development of professional competence. This is followed by the literature analysis of the concepts of certification of persons and professional competence. The results indicate that certification of persons is associated with professional competence and conformity assessment activities. Therefore, in the certification process, conformity assessment can be used to assess the professional competence of a person if explicit competences in the particular sphere for the person are defined.

Taking into consideration the fact that the concept of certification of persons includes aspects such as "confirmation of professional competence" and "conformity to professional requirements", it provides that the process of certification of persons must include not only clearly defined requirements in the professional field, but also a framework of professional competence. As the concept of certification of persons in the context of literature analysis is also used in connection with the aspect of professional development, certification bodies must ensure "continuous monitoring of competencies" and "standardized achievement and measurement of competencies". Within the analysis of the concept "professional competence", it was identified that all elements of professional competence are closely related to a person's ability to apply the acquired knowledge, skills, and personal characteristics in accordance with the requirements of the professional field. Therefore, in order to assess the compliance of professional competence not only in accordance with the requirements of the industry, but also in accordance with the principles of good practice accepted in the industry, the definition of the professional competence framework also requires the identification of the needs of the stakeholders. The literature review revealed that the lack of appropriate professional competence was identified as one of the main impact factors related to the barriers towards successful implementation of sustainable practices. Taking into consideration all the above mentioned, the process of certification of persons should be organized in such a way that it would ensure timely identification of risks to the assessment of professional competence and the compliance of the quality management system with the requirements of ISO/IEC 17024.

If certification bodies, supervisory authorities, industry organizations, and certified persons have clearly defined professional competencies required for the industry, which are periodically monitored according to the stakeholder requirements, the results of the process of certification of persons will not be just a formal statement of compliance but a reliable and qualitative proof of competence. Stakeholders who participate in the development of the certification system create a holistic integrated management system and create an environment for open systems and for process innovation, thus for a sustainable development of the system. Furthermore, at the organizational level open innovation shows how organizations rely on external sources of knowledge to accelerate the innovation process [90].

To ensure the quality and reliability of the process of certification of persons, certification bodies should manage the main risks that may arise in the certification process, identify the key stakeholder requirements, and maintain an integrated quality management system taking into consideration the principle of continuous improvement and process approach.

6. Conclusions

After analyzing the concepts, elements, preconditions, and various aspects of professional competence related to the certification of persons, we can conclude that certification of persons is very closely related to both the assessment of professional competence and conformity. The assessment of professional competence is one of the most important components of the process of certification of persons. Therefore, so that the final result of the certification of persons ensures the quality requirements and reliability set for it, the assessment of professional competence in the process of certification must be executed in accordance with the framework of professional competence of the industry defined by the stakeholders.

The aim of certification of persons is to convince professionals, employers, and clients that certified employees deliver more efficient and higher quality work [27]. Certification of persons also has an indirect effect on:

1. the process of obtaining the relevant qualification by testing the knowledge and skills acquired by the person, i.e., their competence [1,13];
2. the process of quality improvement in the particular organization, by demonstrating their professional competence in the daily activities [2,13,78];
3. standardization of the field to be certified, ensuring a level corresponding to the standards of the specific qualification [19,40].

Another significant benefit for each organization from the certification of persons is the customers' trust in the services provided by the organization and the long-term improvement of the organization's performance, which has a positive effect on the overall image and reputation of the organization [92,93]. Certification not only has a positive effect on the reputation of an organization, but also enhances the importance of the certificate holder and their professional activities, helping the organization to become more competitive in the industry [40]. Thus, we can conclude that certification of persons has a significant and sustainable positive impact both at the "micro" level, i.e., by improving the individual performance and results of the certificate holder, improving the overall image of the organization and its performance, and at the "macro" level, i.e., by improving reliability and quality of organizations in the industry as a whole, and also mitigating various safety-related risks.

As a result of a survey of certified construction specialists in the regulated sphere, it was found that the process of certification of persons in Latvia currently includes a formal assessment of professional conformity. Thus, the certification of persons in the field of construction in Latvia can currently be evaluated only as a conformity assessment procedure, and not as an assessment of professional competence. We can conclude that the certification process only partially ensures quality and reliability.

The sustainable approach to the process of certification of persons that we offer means that the process of certification of persons transforms from a conformity assessment

procedure into a professional competence assessment process. This ensures that as the result of the process a person's ability is assessed not only in accordance with the industry requirements, but also with the stakeholder needs. However, it should be noted that our study has several logical limitations that apply to the empirical part of the study, namely survey data and correspondence analysis. Qualitative content analysis of the literature was conducted in a very broad perspective, but the empirical research was conducted in the construction industry in Latvia, so further research would be needed to research the problem in other countries and industries.

Author Contributions: Conceptualization, M.K. and I.L.; methodology, I.L. and M.K.; software, M.K. and K.K.; validation, M.K. and I.L.; formal analysis, M.K. and K.K.; investigation, M.K.; resources, M.K. and I.L.; data curation, M.K. and K.K.; writing—original draft preparation, M.K.; writing—review and editing, I.L.; visualization, M.K. and K.K.; supervision, I.L.; project administration, I.L.; funding acquisition, I.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Statistics of MCA analysis for q1, q2, and q12_2.

Axis	Cronbach's Alpha	ChiSq (Nishisato)	*df* (Nishisato)	*p* (Nishisato)	Inertia	Explained Variance, %	Cumulative Variance, %
1	0.240	863.522	690	0.000	0.397	14.882	14.882
2	0.171	806.062	688	0.001	0.376	14.108	28.989
3	0.125	771.866	686	0.012	0.364	13.635	42.624
4	0.058	726.983	684	0.124	0.347	12.999	55.623
5	−0.031	675.213	682	0.566	0.327	12.245	67.868
6	−0.184	601.810	680	0.986	0.297	11.136	79.004
7	−0.259	571.063	678	0.999	0.284	10.657	89.662
8	−0.314	550.890	676	1.000	0.276	10.338	100.000

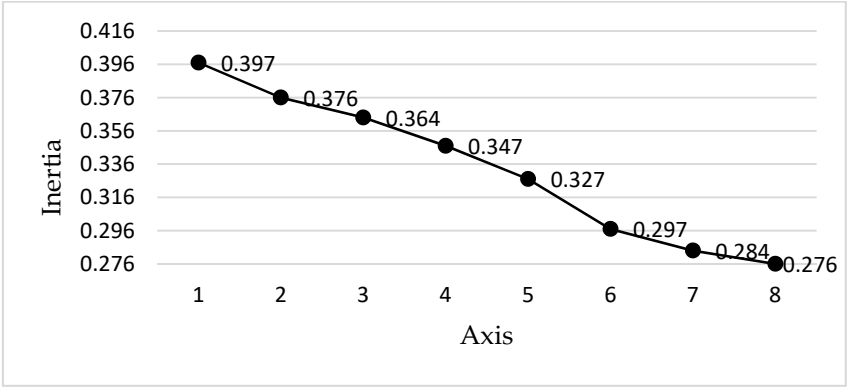

Figure A1. Scree plot for q1, q2, and q12_2.

Table A2. Column projections, contributions, and squared cosines for q1, q2, and q12_2.

	Total				Dimension 1				Dimension 2			
	QLT	**MASS**	**Inertia**	**Best**	**Cos2**	**SQCOR1**	**CTR1**	**Best1**	**Cos2**	**SQCOR2**	**CTR2**	**Best2**
q1-1	0.457	0.022	0.311	2	0.003	−0.058	0.003	0	0.453	0.673	0.375	2
q1-2	0.222	0.096	0.237	1	0.181	−0.425	0.108	1	0.041	−0.203	0.026	0
q1-3	0.141	0.080	0.254	1	0.098	−0.313	0.063	1	0.043	−0.208	0.029	0
q1-4	0.346	0.116	0.217	1	0.346	0.588	0.189	1	0.000	0.000	0.000	0
q1-5	0.071	0.019	0.314	1	0.068	0.261	0.054	0	0.004	0.060	0.003	0
Sum.CTR							0.416				0.433	
q2-1	0.453	0.036	0.297	1	0.345	0.588	0.259	1	0.108	−0.328	0.085	1
q2-2	0.560	0.028	0.305	2	0.141	−0.375	0.108	2	0.420	−0.648	0.340	2
q2-3	0.421	0.257	0.076	2	0.007	−0.084	0.001	0	0.413	0.643	0.084	0
q2-4	0.056	0.012	0.321	1	0.052	−0.227	0.042	0	0.004	0.064	0.004	0
Sum.CTR							0.410				0.513	
q12_2-1	0.268	0.092	0.241	1	0.207	0.455	0.126	1	0.061	−0.246	0.039	0
q12_2-2	0.268	0.241	0.092	1	0.207	−0.455	0.048	0	0.061	0.246	0.015	0
Sum.CTR							0.174				0.054	

Appendix B

Table A3. Statistics of MCA analysis for q1, q2, and q12_3.

Axis	Cronbach's Alpha	ChiSq (Nishisato)	*df* (Nishisato)	*p* (Nishisato)	Inertia	Explained Variance, %	Cumulative Variance, %
1	0.216	842.531	690	0.000	0.389	14.602	14.602
2	0.164	800.427	688	0.002	0.374	14.030	28.632
3	0.084	743.966	686	0.062	0.353	13.242	41.874
4	0.049	721.564	684	0.155	0.345	12.921	54.795
5	−0.006	688.985	682	0.418	0.332	12.448	67.243
6	−0.107	636.771	680	0.881	0.311	11.670	78.913
7	−0.234	580.875	678	0.997	0.288	10.811	89.724
8	−0.325	546.943	676	1.000	0.274	10.276	100.000

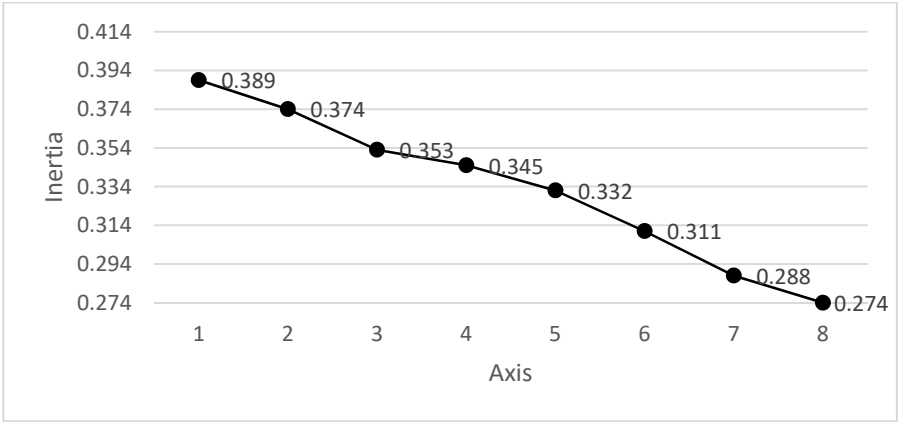

Figure A2. Scree plot for q1, q2, and q12_3.

Table A4. Column projections, contributions, and squared cosines for q1, q2, and q12_3.

	Total				Dimension 1				Dimension 2			
	QLT	**MASS**	**Inertia**	**Best**	**Cos2**	**SQCOR1**	**CTR1**	**Best1**	**Cos2**	**SQCOR2**	**CTR2**	**Best2**
q1-1	0.504	0.022	0.311	2	0.006	−0.077	0.005	0	0.498	0.706	0.415	2
q1-2	0.260	0.096	0.237	1	0.260	0.509	0.158	1	0.000	−0.018	0.000	0
q1-3	0.123	0.080	0.254	1	0.098	0.313	0.064	0	0.025	−0.159	0.017	0
q1-4	0.303	0.116	0.217	1	0.292	−0.540	0.162	1	0.011	−0.106	0.007	0
q1-5	0.188	0.019	0.314	1	0.144	−0.380	0.116	1	0.044	−0.209	0.037	0
Sum.CTR							0.505				0.475	
q2-1	0.557	0.036	0.297	2	0.230	−0.480	0.176	2	0.327	−0.572	0.260	2
q2-2	0.524	0.028	0.305	1	0.368	0.607	0.288	1	0.156	−0.395	0.127	1
q2-3	0.560	0.257	0.076	2	0.007	−0.084	0.001	0	0.553	0.744	0.113	0
q2-4	0.025	0.012	0.321	2	0.007	0.081	0.005	0	0.018	−0.134	0.015	0
Sum.CTR							0.471				0.515	
q12_3-1	0.039	0.096	0.237	1	0.028	−0.167	0.017	0	0.011	0.103	0.007	0
q12_3-2	0.039	0.237	0.096	1	0.028	0.167	0.007	0	0.011	−0.103	0.003	0
Sum.CTR							0.024				0.010	

Appendix C

Table A5. Statistics of MCA analysis for q1, q2, and q12_4.

Axis	Cronbach's Alpha	ChiSq (Nishisato)	*df* (Nishisato)	*p* (Nishisato)	Inertia	Explained Variance, %	Cumulative Variance, %
1	0.222	847.598	690	0.000	0.391	14.670	14.670
2	0.206	834.273	688	0.000	0.386	14.491	29.161
3	0.111	762.246	686	0.023	0.360	13.500	42.660
4	0.020	704.337	684	0.287	0.338	12.672	55.333
5	−0.062	658.789	682	0.732	0.320	12.001	67.334
6	−0.101	639.337	680	0.866	0.312	11.709	79.043
7	−0.261	570.294	678	0.999	0.284	10.645	89.688
8	−0.318	549.234	676	1.000	0.275	10.312	100.000

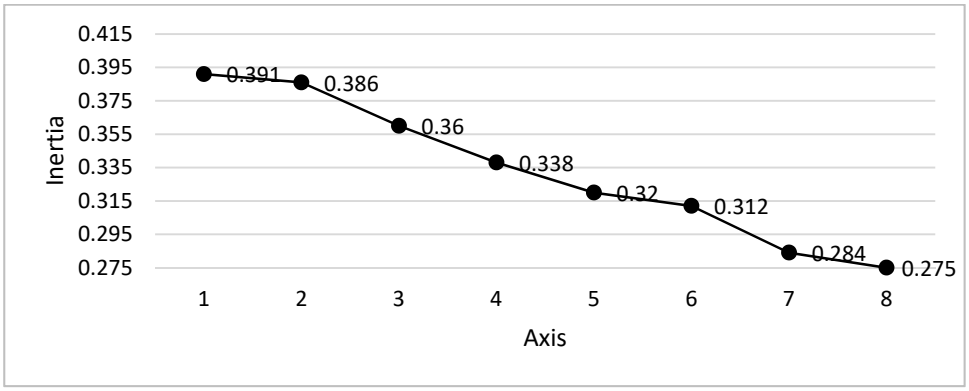

Figure A3. Scree plot for q1, q2, and q12_4.

Table A6. Column projections, contributions, and squared cosines for q1, q2, and q12_4.

	Total				Dimension 1				Dimension 2			
	QLT	**MASS**	**Inertia**	**Best**	**Cos2**	**SQCOR1**	**CTR1**	**Best1**	**Cos2**	**SQCOR2**	**CTR2**	**Best2**
q1-1	0.256	0.022	0.311	2	0.092	−0.303	0.073	2	0.164	0.404	0.132	2
q1-2	0.300	0.096	0.237	2	0.028	−0.166	0.017	0	0.272	−0.522	0.167	2
q1-3	0.097	0.080	0.254	2	0.047	−0.218	0.031	0	0.049	−0.222	0.032	0
q1-4	0.269	0.116	0.217	2	0.076	0.275	0.042	0	0.193	0.440	0.109	2
q1-5	0.244	0.019	0.314	1	0.235	0.485	0.189	1	0.009	0.093	0.007	0
Sum.CTR							0.352				0.447	
q2-1	0.495	0.036	0.297	1	0.491	0.700	0.373	1	0.005	0.069	0.004	0
q2-2	0.497	0.028	0.305	2	0.022	−0.148	0.017	0	0.475	−0.689	0.375	2
q2-3	0.503	0.257	0.076	2	0.252	−0.502	0.049	0	0.251	0.501	0.050	2
q2-4	0.080	0.012	0.321	2	0.034	0.186	0.028	0	0.046	−0.215	0.038	0
Sum.CTR							0.467				0.467	
q12_4-1	0.312	0.169	0.164	1	0.212	−0.460	0.089	1	0.100	0.317	0.043	0
q12_4-2	0.312	0.164	0.169	1	0.212	0.460	0.092	1	0.100	−0.317	0.044	0
Sum.CTR							0.181				0.086	

References

1. Kavosa, M.; Lapiņa, I.; Briņķis, K. Certification of persons: Empirical study in the field of energy construction in Latvia. *Cogent. Bus. Manag.* **2017**, *4*, 1–14. [CrossRef]
2. Medne, A.; Lapiņa, I. Sustainability and continuous improvement of organization: Review of process-oriented performance indicators. *J. Open Innov. Technol. Mark. Complex.* **2019**, *5*, 49. [CrossRef]
3. Mjakuškina, S.; Lapiņa, I. Evaluation of Market Surveillance Implementation and Sustainability. In *Global Value Chains, Flexibility and Sustainability. Flexible Systems Management*; Connell, J., Agarwal, R., Sushil, S., Dhir, S., Eds.; Springer: Singapore, 2018; pp. 257–269.
4. Yun, S.; Jung, W. Benchmarking sustainability practices use throughout industrial construction project delivery. *Sustainability* **2017**, *9*, 1007. [CrossRef]
5. Yun, J.J.; Jeong, E.; Kim, S. Collective intelligence: The creative way from knowledge to open innovation. *Technol. Soc.* **2021**, *26*, 201–222. [CrossRef]
6. Martinez-Leon, I.M.; Olmedo-Cifuentes, I.; Ramon-Llorens, M.C. Work, personal and cultural factors in engineers' management of their career satisfaction. *J. Eng. Technol. Manag.* **2018**, *47*, 22–36. [CrossRef]
7. Pudzis, E.; Krutova, U.; Geipele, S.; Kaļinka, M.; Auziņš, A. Smart and sustainable local communities in global COVID-19 pandemic conditions. *Landsc. Archit.* **2020**, *17*, 78–88. [CrossRef]
8. Tupenaite, L.; Kaklauskas, A.; Lill, I.; Geipele, I.; Naimaviciene, J.; Kanapeckiene, L.; Kauskale, L. Sustainability Assessment of the new residential projects in the Baltic States: A multiple criteria approach. *Sustainability* **2018**, *10*, 1387. [CrossRef]
9. Yik, F.W.H.; Lai, J.H.K.; Chan, K.T.; Chau, C.K.; Lee, W. A portrait of building services engineers in Hong Kong. *Eng. Constr. Archit. Manag.* **2013**, *20*, 63–82. [CrossRef]
10. Van Minh, N.; Badir, Y.J.; Ngoc Quang, N.; Afsa, B. The impact of leader's technical competence to employees' innovation and learning. *J. Eng. Technol. Manag.* **2017**, *44*, 44–57. [CrossRef]
11. Ņikitina, T.; Lapiņa, I.; Ozoliņš, M.; Irbe, M.; Priem, M.; Smits, M.; Nemilentsev, M. Competences for strengthening entrepreneurial capabilities in Europe. *J. Open Innov. Technol. Mark. Complex.* **2020**, *6*, 62. [CrossRef]
12. Markowitsch, J.; Plaimauer, C. Descriptors for competence: Towards an international standard classification for skills and competences. *J. Eur. Ind. Train.* **2009**, *33*, 817–837. [CrossRef]
13. Kavosa, M.; Lapiņa, I. Value Stream Mapping: Effective Process Improvement Tool in the Certification Process. In Proceedings of the 24th World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI 2020), Orlando, FL, USA, 13–16 September 2020; International Institute of Informatics and Systemics (IIIS): Winter Garden, FL, USA, 2020; Volume 3, pp. 59–64.
14. Bell, M.L.; Teixeira-Pinto, A.; McKenzie, J.E.; Olivier, J. A myriad of methods: Calculated sample size for two proportions was dependent on the choice of sample size formula and software. *J. Clin. Epidemiol.* **2015**, *67*, 601–605. [CrossRef]
15. Theodorou, Y.; Drossos, C.; Alevizos, P. Correspondence analysis with fuzzy data: The fuzzy eigenvalue problem. *Fuzzy Sets Syst.* **2007**, *158*, 704–721. [CrossRef]

16. Fithian, W.; Josse, J. Multiple correspondence analysis and the multilogit bilinear model. *J. Multivar. Anal.* **2017**, *157*, 87–102. [CrossRef]
17. Kudlats, J.; Money, A.; Hair, J.F. Correspondence analysis: A promising technique to interpret qualitative data in family business research. *J. Fam. Bus. Strategy* **2014**, *5*, 30–40. [CrossRef]
18. Bendixen, M. A practical guide to the use of correspondence analysis in marketing research. *Mark. Res. On-Line* **1996**, *1*, 16–36.
19. Kavosa, M.; Lapiņa, I. Risk analysis in certification process in the field of energy construction: Case in Latvia. *Total Qual. Manag. Bus. Excell.* **2018**, *29*, 1129–1142. [CrossRef]
20. Liepiņa, R.; Lapiņa, I.; Mazais, J. Contemporary issues of quality management: Relationship between conformity assessment and quality management. *Procedia Soc. Behav. Sci.* **2014**, *110*, 627–637. [CrossRef]
21. Danileviciene, I.; Lace, N. The features of economic growth in the case of Latvia and Lithuania. *Sustainability* **2018**, *10*, 3516. [CrossRef]
22. Roša (Rosha), A.; Lace, N. The open innovation model of coaching interaction in organisations for sustainable performance within the life cycle. *Sustainability* **2018**, *10*, 3516. [CrossRef]
23. Dubickis, M.; Gaile-Sarkane, E. Tacit vs. explicit knowledge dichotomy: State-of-the-art review for technology transfer purposes. *Financ. Dev.* **2017**, *4*, 423–433.
24. Seenaiah, K.; Rath, B.N. Determinants of innovation in selected manufacturing firms in India: Role of R&D and exports. *Technol. Soc.* **2018**, *23*, 65–84.
25. Mjakuškina, S.; Kavosa, M.; Lapiņa, I. Achieving sustainability in the construction supervision process. *J. Open Innov. Technol. Mark. Complex.* **2019**, *5*, 47. [CrossRef]
26. Goldrick, B.A. The Certification board of infection control and epidemiology white paper: The value of certification for infection control professionals. *Am. J. Infect. Control* **2007**, *35*, 150–156. [CrossRef]
27. Lengnick-Hall, M.; Aguinis, H. What is the value of human resource certification? A multi-level framework for research. *Hum. Resour. Manag. Rev.* **2012**, *22*, 247–256. [CrossRef]
28. Guerrero, D.; De los Rios, I. Learning model and competences certification in the project management scope: An empirical application in a sustainable development context. *Procedia Soc. Behav. Sci.* **2012**, *46*, 1295–1303. [CrossRef]
29. Liepiņa, R.; Lapiņa, I.; Mazais, J. Sustainability in Conformity Assessment: Flexibility of Technical Harmonization. In *Global Value Chains, Flexibility and Sustainability. Flexible Systems Management*; Connell, J., Agarwal, R., Sushil, S., Dhir, S., Eds.; Springer: Singapore, 2018; pp. 241–256. [CrossRef]
30. Straka, K.L.; Burkett, M.; Flook, D.; Houck, P.; Schenkel, K. The impact and perception of nursing certification in paediatric nursing. *J. Pediatr. Nurs.* **2014**, *29*, 205–211. [CrossRef]
31. Teixeira, J.F.; Maio, R.; Immer, F.; Dominguez, J.M.; Papalois, V.; Mihaly, S.; Paredes, D. The certification of transplant coordinators in Europe. *Transplant. Proc.* **2014**, *46*, 1265–1273. [CrossRef]
32. Lachaud, E. Why the certification process defined in the general data protection regulation cannot be successful. *Comput. Law Secur. Rev.* **2016**, *32*, 814–826. [CrossRef]
33. Castillo, J.; Caruana, C.J.; Morgan, P.S.; Westbrook, C.; Mizzi, A. An international survey of MRI qualification and certification frameworks with an emphasis on identifying elements of good practice. *Radiography* **2017**, *23*, 8–13. [CrossRef] [PubMed]
34. Fitzpatrick, J.J. The value of nursing certification: Revisited and reinforced. *J. Vasc. Access* **2017**, *22*, 131–134. [CrossRef]
35. Blomquist, T.; Farashah, A.D.; Thomas, J. Feeling good, being good and looking good: Motivations for, and benefits from project management certification. *Int. J. Proj. Manag.* **2018**, *36*, 498–511. [CrossRef]
36. Hawotniak, R.H. The Why and how of coordinator certification. *J. Curr. Surg.* **2006**, *63*, 55–57. [CrossRef] [PubMed]
37. Niebuhr, B.; Biel, M. The value of specialty nursing certification. *Nurs. Outlook* **2007**, *55*, 176–181. [CrossRef] [PubMed]
38. Chiu, C. Certification of international allied professionals in cardiac pacing and electrophysiology: Opportunities? *Can. J. Cardiol.* **2010**, *26*, 24–26. [CrossRef]
39. Cohen, D.J. Identifying the value of HR certification: Clarification and more complex models required. *Hum. Resour. Manag. Rev.* **2012**, *22*, 258–265. [CrossRef]
40. Uhlir, Z. The effect of the project manager certification process on the development of project management—A Croatian perspective. *Procedia Soc. Behav. Sci.* **2013**, *74*, 223–232. [CrossRef]
41. Laukhuf, G.; Myrthil, M.; Cramer, S.J. Joint association for radiologic and imaging nursing, radiologic nursing certification board, and radiologic nursing certification task force position paper: The value of certification in radiologic nursing. *J. Radiol. Nurs.* **2015**, *34*, 157–159. [CrossRef]
42. Ponichtera, K. Certification in transport nursing: Adding power to the privilege. *Air Med. J.* **2017**, *36*, 167–172. [CrossRef]
43. Vassiliou, M.C.; Feldman, L.S. Objective assessment, selection, and certification in surgery. *J. Surg. Oncol.* **2011**, *20*, 140–145. [CrossRef]
44. Horak, J. The role of certification in GIS&T education. *Procedia Soc. Behav. Sci.* **2014**, *174*, 1356–1363.
45. Malangoni, M.A. Maintenance of certification. *Adv. Surg.* **2016**, *50*, 105–116. [CrossRef] [PubMed]
46. Sullivan, T. Development of a certified emergency nurse certification initiative. *J. Emerg. Nurs.* **2009**, *35*, 234–236. [CrossRef]
47. Boritz, J.E.; Carnaghan, C.A. Competency-based education and assessment for the accounting profession: A critical review. *Account. Perspect.* **2003**, *2*, 7–42. [CrossRef]

48. Lupou, R.; Crasovan, M.; Mitruti, A. Competence assessment as a mean to facilitate employability, career progress and accreditation towards a qualification. *Procedia Soc. Behav. Sci.* **2011**, *15*, 1115–1119. [CrossRef]
49. Dalton, M.; Davidson, M.; Keating, J. The Assessment of Physiotherapy Practice (APP) is a valid measure of professional competence of physiotherapy students: A cross-sectional study with Rasch analysis. *J. Physiother.* **2011**, *57*, 239–246. [CrossRef]
50. Smith, S.A. Professional competence: A concept analysis. *Int. J. Nurs. Knowl.* **2012**, *23*, 172–182. [CrossRef]
51. Guerrero, D.; De los Rios, I. Professional competences: A classification of international models. *Procedia Soc. Behav. Sci.* **2012**, *46*, 1290–1296. [CrossRef]
52. Wen-Hwa, K. The relationship among professional competence, job satisfaction and career development confidence for chefs in Taiwan. *Int. J. Hosp. Manag.* **2012**, *31*, 1004–1011.
53. Kajander-Unkuri, S.; Salminen, L.; Saarikoski, M.; Suhonen, R.; Leino-Kilpi, H. Competence areas of nursing students in Europe. *Nurse Educ. Today* **2013**, *33*, 625–632.
54. Guillaume, R.; Houe, R.; Grabot, B. Robust competence assessment for job assignment. *Eur. J. Oper. Res.* **2014**, *238*, 630–644. [CrossRef]
55. Nicolaou, C.T.; Constantinou, C.P. Assessment of the modeling competence: A systematic review and synthesis of empirical research. *Educ. Res. Rev.* **2014**, *13*, 52–73. [CrossRef]
56. Blaškova, M.; Blaško, R.; Kucharčikova, A. Competences and competence model of university teachers. *Procedia Soc. Behav. Sci.* **2014**, *159*, 457–467. [CrossRef]
57. Shamshina, I.G. Professional competence necessary for the bachelor-degree-holding engineer specialising in engineering industries. *Pac. Sci. Rev.* **2014**, *16*, 85–88. [CrossRef]
58. Nilsson, J.; Johansson, E.; Egmar, A.C.; Florin, J.; Leksell, J.; Lepp, M.; Lindholm, C.; Nordstrom, G.; Theander, K.; Wilde-Larsson, B.; et al. Development and validation of a new tool measuring nurses self-reported professional competence—The nurse professional competence (NPC) Scale. *Nurse Educ. Today* **2014**, *34*, 574–580. [CrossRef]
59. Bayarystanova, E.; Arenova, A.; Nurmuhametova, R. Education system management and professional competence of managers. *Procedia Soc. Behav. Sci.* **2014**, *140*, 427–431. [CrossRef]
60. Figueroa-Rodriguez, B.; Figueroa-Sandoval, B. A methodological proposal for assessing competences of project managers in rural Mexico and its application to providers of farming professionals services (PSP) as a case study. *Procedia Soc. Behav. Sci.* **2014**, *119*, 725–729. [CrossRef]
61. Guerrero, D.; La Rosa, G.; Lopez, P.; Bayona, A.L. Domain analysis of the research in professional competences, technology and engineering cluster. *Procedia Soc. Behav. Sci.* **2015**, *182*, 163–172. [CrossRef]
62. Baitukayeva, A.; Baitukayeva, D.; Aktayev, E.; Shagirova, K.; Krykbaeva, S. Formation of the professional competence of the future specialists. *Procedia Soc. Behav. Sci.* **2015**, *185*, 141–145.
63. Gallagher, R.W.; Polanin, J.R. A meta-analysis of educational interventions designed to enhance cultural competence in professional nurses and nursing students. *Nurse Educ. Today* **2015**, *35*, 333–340. [CrossRef] [PubMed]
64. Blazun, H.; Kokol, P.; Vosner, J. Survey on specific nursing competences: Student's perceptions. *Nurse Educ. Today* **2015**, *15*, 359–365.
65. Kuvin, J.T.; Williams, E.S. Defining, Achieving, and maintaining competence in cardiovascular training and practice. *J. Am. Coll. Cardiol.* **2016**, *68*, 1342–1347. [CrossRef]
66. Bohlouli, M.; Mittas, N.; Kakarontzas, G.; Theodosiou, T.; Angelis, L.; Fathi, M. Competence assessment as an expert system for human resource management: A mathematical approach. *Expert Syst. Appl.* **2016**, *70*, 83–102. [CrossRef]
67. Sturm, R.E.; Vera, D.; Crossan, M. The entanglement of leader character and leader competence and its impact on performance. *Leadersh. Q.* **2017**, *28*, 349–366. [CrossRef]
68. Dubickis, M.; Gaile-Sarkane, E. Factors influencing technology transfer in companies at emerging economies. *Technol. Soc.* **2021**, *26*, 1–31. [CrossRef]
69. Llaurado-Serra, M.; Rodríguez, E.; Gallart, A.; Fuster, P.; Monforte-Royo, C.; De Juan, M.Á. Assessing the competences associated with a nursing Bachelor thesis by means of rubrics. *Nurse Educ. Today* **2018**, *66*, 103–109. [CrossRef]
70. Zieber, M.; Sedgewick, M. Competence, confidence and knowledge retention in undergraduate nursing students—A mixed method study. *Nurse Educ. Today* **2018**, *62*, 16–21. [CrossRef]
71. Griffin, P. The comfort of competence and the uncertainty of assessment. *Stud. Educ. Eval.* **2007**, *33*, 87–99. [CrossRef]
72. Tragel, M.V.; Shemilina, E.M. The model of competences of specialists working in training groups as integration of professional knowledge, skills, values and beliefs. *Procedia Soc. Behav. Sci.* **2015**, *186*, 1101–1108. [CrossRef]
73. Mirzagitova, A.L.; Mukhametgaliyeva, S.H.; Tirigulova, R.H. Realization of competence-based approach in preparation of the competitive specialists. *Procedia Soc. Behav. Sci.* **2015**, *191*, 1938–1940. [CrossRef]
74. McKinley, R.K.; Strand, J.; Ward, L.; Gray, T.; Alun-Jones, T.; Miller, H. Checklists for assessment and certification of clinical procedural skills omit essential competencies: A systematic review. *Med. Educ.* **2008**, *42*, 338–349. [CrossRef]
75. Gallagher, P.; Smith, T.; Ousey, K. Problems with competence assessment as it applies to student nurses. *Nurse Educ. Pract.* **2012**, *12*, 301–303. [CrossRef]
76. Decius, J.; Schaper, N. The Competence Management Tool (CMT)—A new instrument to manage competences in small and medium-sized manufacturing enterprises. *Procedia Manuf.* **2017**, *9*, 376–383. [CrossRef]

77. Kireev, V.; Guseva, A.; Silenko, A. Social and personal competence assessment within qualification certification of nuclear industry university graduate. *Procedia Soc. Behav. Sci.* **2015**, *214*, 150–158. [CrossRef]
78. Ņikitina, T.; Lapiņa, I. Creating and managing knowledge towards managerial competence development in contemporary business environment. *Knowl. Manag. Res. Pract.* **2019**, *1*, 96–107. [CrossRef]
79. Lettl, C. User involvement competence for radical innovation. *J. Eng. Technol. Manag.* **2007**, *24*, 53–75. [CrossRef]
80. Lambrechts, W.; Gelderman, C.J.; Semeijn, J.; Verhoeven, E. The role of individual sustainability competences in ec-design building projects. *J. Clean. Prod.* **2019**, *208*, 1631–1641. [CrossRef]
81. Tabassi, A.A.; Roufechaei, K.M.; Ramli, M.; Bakar, A.A.; Ismail, R.; Pakir, H.K. Leadership competences of sustainable construction project managers. *J. Clean. Prod.* **2016**, *124*, 339–349. [CrossRef]
82. Ametepey, O.; Aigbavboa, C.; Anshan, K. Barriers to successful implementation of sustainable construction in the Ghanaian construction industry. *Procedia Manuf.* **2015**, *3*, 1682–1689. [CrossRef]
83. Serpella, A.F.; Ferrada, X.; Howard, R.; Rubio, L. Risk management in construction projects: A knowledge-based approach. *Procedia Soc. Behav. Sci.* **2014**, *119*, 653–662. [CrossRef]
84. Szymanski, P. Risk management in construction projects. *Procedia Eng.* **2017**, *208*, 174–182. [CrossRef]
85. Partnership of Latvian Construction Entrepreneurs. Construction in Latvia. Challenge for Sustainability. Available online: http://www.latvijasbuvnieki.lv/content/uploads/2017/07/LBP_Buvniecibas_nozares_parskats-compressed.pdf (accessed on 8 March 2018).
86. Nishisato, S. *Analysis of Categorical Data: Dual Scaling and Its Applications*; University of Toronto Press: Toronto, ON, Canada, 1980; 276p.
87. Johnson, R.A.; Wichern, D.W. *Applied Multivariate Correspondence Analysis*, 6th ed.; Prentice-Hall: Upper Saddle River, NJ, USA, 2007; 393p.
88. Sun, H.; Wong, S.Y.; Zhao, Y.; Yam, R. A systematic model for assessing innovation competence of Hong Kong/China manufacturing companies: A case study. *J. Eng. Technol. Manag.* **2012**, *29*, 546–565. [CrossRef]
89. Markovic, S.; Bagherzadeh, M.; Dubiel, A.; Cheng, J.; Vanhaverbeke, W. Do not miss the boat to outside-in open innovation: Enable your employees. *Ind. Mark. Manag.* **2020**, *91*, 152–161. [CrossRef]
90. Bogers, M.; Foss, N.J.; Lyngsie, J. The "human side" of open innovation: The role of employee diversity in firm-level openness. *Res. Policy* **2018**, *47*, 218–231. [CrossRef]
91. Edwards-Schachter, M.; Garcia-Granero, A.; Sanchez-Barrioluengo, M.; Quesada-Pineda, H.; Amara, N. Disentangling competences: Interrelationships on creativity, innovation and entrepreneurship. *Think. Ski. Creat.* **2015**, *16*, 27–39. [CrossRef]
92. Kells, J. The changing landscape of human resource management certification: An interview with Dr. Amy Dufrane, Ed.D. SPHR, CAE, CEO, Human Resource Certification Institute (HRCI). *Bus. Horiz.* **2015**, *58*, 259. [CrossRef]
93. Wagner, M. A European perspective on country moderation effects: Environmental management systems and sustainability—Related human resource benefits. *J. World Bus.* **2015**, *50*, 381. [CrossRef]