



Green Skills Mismatch in Uzbekistan: Evidence from Employers, Vacancies and University Curricula

Nosirova Charos

Assistant, Department of Marketing, Tashkent State University of Economics, Uzbekistan

Charos1201434@mail.ru

<http://dx.doi.org/10.47814/ijssrr.v9i7.3486>

Abstract

The main contribution is that it does not focus only on green skill shortages but also makes an impact on other variables like workforce productivity and sustainable business development. In the context of Uzbekistan's green transition, this study also shows that the alignment of university curricula with labour-market needs assists in enhancing the employability of graduates and the competitiveness of firms as green skills are directly related to their operational performance. This study examines mismatch relations between the green skill requirements of two types of labour-market sources with different analytical functions: employer assessments and vacancy descriptions. A PROMETHEE model (for ranking green skill gaps) and regression model (for estimating relationships) were designed to study the effects of curriculum alignment and employer demand and find the relationship between such variables as required green skills and graduate preparedness with labour-market outcomes. The study adopted a mixed research design and utilized PROMETHEE to test the relative importance of green skill mismatch factors and regression to analyze the data. The data was analyzed with regression models to estimate the influence of employer skill requirements and curriculum coverage. This positive relationship was also noticed in the association between curriculum alignment and graduate preparedness, resulting in higher levels of employability as evidence of improved skill relevance. Results showed the evidence of significant relationships between green skill demand and curriculum responsiveness with measurable effects on workforce readiness. This approach provides a broader view of green skill relations within labour-market processing. It may also contribute to the policy reform that is ongoing to change higher education from traditional knowledge provision to demand-oriented green skills development and its users as active participants in Uzbekistan's sustainable economic transition.

Keywords: *Green Skills Mismatch; Curriculum Alignment; Employer Demand; Graduate Preparedness; PROMETHEE II; Labour Market; Uzbekistan*

1. Introduction

With respect to issues related to green skills mismatch, there are many variables utilized in different research including technical knowledge, environmental awareness, and problem-solving

competence of learners, curriculum relevance, employer expectations, and common errors such as outdated course content, insufficient practical training and the influence of changing environmental regulations. Moreover, previous studies have insisted on considering labour-market demand among the criteria for selecting the university curriculum material and training content [1, 2]. Skills mismatch models in fact are a formal means of assessing the alignment of labour demand and accepted as the main approach for analyzing differences between required and available competencies [3]. Two widely used approaches set the basis of skills mismatch models: The demand-side model and the supply-side model. However, green skill development is one of the most difficult skills for the higher education sector, as demonstrated by findings from a wide range of research about improving sustainability skills of graduates. Their problems lie in understanding the changing requirements and what they should do to improve different types of green competencies, adopting a proper curriculum strategy and understanding the causes of skills mismatch.

They are not willing to change their existing curricula or take the requisite measures to improve their training quality. Hence, due to all these challenges, universities have not been able to develop an effective green curriculum and allowed to develop skills gaps in the form of graduate unpreparedness or unmet employer demand [4]. For instance, green skills mismatch has been studied extensively: the skills mismatch framework is used to compare labour demand while green jobs research had been focusing on the skill content of the workforce. Several studies have attempted to highlight the distinctive characteristics of green employment in terms of skills [5, 6], suggesting a ‘green skill’ transition in labour markets where occupational requirements proceed from conventional to environmental skills or from general to specialized competencies; in terms of higher education, e.g. [7] and [8] in university curricula; and finally, in firm-level training where there is a frequent usage of practical instruction, and development of competencies for resource efficiency and environmental management or innovation for sustainability [9]. Despite the rapid growth of green skills research, only a few studies have directed attention towards integrated mismatch measurement, particularly in terms of whether employer demand is reflected as a relevant variety of green competencies by means of university curricula in Uzbekistan and whether an individual can be a sufficiently prepared graduate of higher education.

In the Uzbekistan context particularly the PROMETHEE method would assist both the researchers and the policymakers to go beyond the simple comparison and consider the relative importance aspects of a skill gap, along with employer and curriculum contexts and also derive the ranking from comparing a set of criteria. Contrary to integrated labour-market analysis, previous research argued that in many studies, these data sources are not used to jointly assess the mismatch. The existing measures are not sufficient to demonstrate relative priorities and statistical relationships in the development of green skills. However, no research has been conducted from the perspective of Uzbekistan’s employers, who are still in a green transition and carry different levels of environmental responsibility. There is no sufficient body of research on green skill related issues such as employer demand and curriculum responsiveness in order to understand the mismatch patterns and labour-market consequences [10, 11]. This study was designed to analyze green skill gaps and their relationships with various aspects like employer requirements, vacancy descriptions, curriculum coverage, graduate preparedness, workforce productivity, etc.

It intended to propose methods of improving graduates’ green skill ability and preparing them to participate in the sustainable labour market as well as in green business development.

Since this research belongs to the field of green skills which are facing the labour-market mismatch, this study is going to be a useful contribution to policy development. It will help to understand the employers’ and universities’ responses towards green skill demand and the curriculum alignment in Uzbekistan, since so far it is unclear whether their educational practices affect graduate preparedness in the labour market. Moreover, since the PROMETHEE method was used to identify the priority gaps, the

researchers were in a better position to work with the ranked criteria at the time of conducting the regression analysis. In the Uzbekistan context particularly the regression method would assist both the researchers and the policymakers to go beyond the descriptive results and consider the measurable effects of a skill mismatch, along with employer and curriculum contexts and also derive the relationships from estimating a statistical model. The universities are also in the process of curriculum reform, aiming to develop green competencies, often facing a delay in their course revision, and limited resources and expertise to align themselves with the labour market. The current study addressed these issues through a mixed-method investigation conducted with employers, vacancies and university curricula in Uzbekistan, followed by a regression analysis with a set of mismatch indicators to explain the findings of the PROMETHEE ranking.

2. Methods

This study therefore discussed these mismatch relations in the context of the green transition in a selection of key economic sectors. The universities in Uzbekistan's context face serious challenges in teaching relevant green skills to undergraduate learners, particularly when the labour-market requirements are a part of curriculum design and revision. A total of 120 responses were collected from the employers representing selected economic sectors; 300 vacancies were followed up by researchers via the online employment platforms and the researchers conducted curriculum reviews and employer assessments using structured survey questions. The study adopted a purposive sample selection process, and selected 120 respondents from an employer population. A validation exercise was also conducted with 18 randomly selected experts after completing the preliminary findings. The study adopted a purposive sample selection process, and selected 120 respondents from an employer population. It was ensured that the members of the sample possessed a sufficient level of green knowledge, in both theoretical and practical form.

Their previous employment experience was also checked to ensure that they had completed at least two years in the sector. From employers' perspectives, the selection of green skills should be related to their operational needs or environmental requirements of their firms for inclusion in employer assessments. Based on their relevance, survey questions were restricted to closed questions by removing a few repeated items. This provided an opportunity to validate the findings of the analysis (PROMETHEE ranking). The ranking model was developed based on the PROMETHEE II method. The design of the present study comprised a framework that included a questionnaire, vacancy-analysis form and curriculum-review checklist for data collection (Appendix A). Out of the two PROMETHEE approaches: PROMETHEE I and PROMETHEE II [1], this study adopted the PROMETHEE II approach as it enabled complete ranking of alternatives with the help of net preference flows [12]. A questionnaire was developed for the employer assessment using the Likert scale with five levels of answers reflecting the low or high level of agreement in relation to the survey statements about how they thought the curriculum aided in learning green skills.

The investigation was conducted through three stages starting from the initial collection of employers' green skill assessments, followed by a review about the requirements found in the vacancy descriptions and finally ending with the analysis containing information related to the green competencies chosen by the universities in the curricula. Hence, the researchers conducted employer assessments while collecting at the same time the data from online vacancy platforms for the analysis of employer demand, curriculum coverage, and graduate preparedness. A validation exercise was also conducted with 18 randomly selected experts after completing the preliminary findings. Reliability is assessed by examining each item loading, whose acceptable level should be greater than 0.70 [13]. This implies that any relationship with a p value of 0.05 and above was regarded as insignificant and not supported while any relationship with a p value of less than 0.05 was regarded as significant and supported by evidence. The measurement model exceeded the threshold value i.e. 0.70, which confirms its internal consistency.

Regression results were also examined, and they confirmed the measurable relationships of the variables. Since the skill priorities are decided by the employers and their preferences are numerically represented by weights, the employer perspective was given particular attention in this study. This paper thus conducted a quantitative study by using the PROMETHEE method, one of the multi-criteria techniques of decision analysis, to analyze green skill gaps from the point of view of employers. A higher mismatch score is a sign of some serious differences common among employer requirements and curriculum coverage. From the analysis of the data, two types of indicators emerged: demand indicators denoting employer requirements and supply indicators related to curriculum coverage. The questionnaire had three sections with five items each on green skill demand, curriculum responsiveness and their linkages with outcomes of graduate preparedness. The range of employer-demand scores came out as 1 to 5, whereas the range of curriculum-coverage scores was 1 to 5. The PROMETHEE results showed the positive and negative preference flows of the alternatives while the descriptive statistics explained the distribution of the data set in the form of means, standard deviations, minimum values, maximum values, and other summary measures [15].

The questionnaire items were then subjected to reliability analysis which resulted in Cronbach's alpha values of 0.82, 0.85 and 0.80 for each of the three sections of the instrument with an overall value of 0.84. All these procedures are required if a study has data containing dependent and independent, categorical, and continuous variables. However, the wording and structure of the employer questionnaire and curriculum checklist were modified because they were initially developed and adapted from a broader collection of green skill indicators by the researchers themselves prior to the analysis. A validation exercise was also conducted with 18 randomly selected experts after completing the preliminary findings. This provided an opportunity to validate the findings of the analysis (PROMETHEE ranking).

3.Results

The findings of common mismatches were classified into six main error categories, which formed the basis of the analysis and ranking procedure in this study. All three regression predictors are seen significant at the 5% level, showing p-values of less than 0.05, thus indicating the statistical relevance of all independent variables.

Table 1. Linear regression

graduate_prepared n~s	Coef.	St.Err.	t- value	p- value	[95% Conf	Interval]	Sig
curriculum_covera ge	.324	.128	2.54	.014	.068	.579	**
mismatch_index	-.761	.291	-2.61	.012	-1.345	-.177	**
training_hours	.143	.025	5.80	0	.094	.192	***
Constant	.347	.587	0.59	.557	-.83	1.524	
Mean dependent var	5.152		SD dependent var		1.586		
R-squared	0.683		Number of obs		60		
F-test	40.131		Prob > F		0.000		
Akaike crit. (AIC)	163.756		Bayesian crit. (BIC)		172.134		
*** $p<.01$, ** $p<.05$, * $p<.1$							

The moderating role of training hours is shown in the regression model, whose outcome is also shown significant for t-statistic and p-value values above the required confidence level, i.e., less than 0.05 as acceptable.

Table 2. Promethee Flow table

Rank	action	Phi	Phi+	Phi-
1	University-Industry Green Skills Councils	0,2795	0,3873	0,1078
2	Vacancy-Driven Curriculum Updating	0,2449	0,3751	0,1301
3	Employer-Led Modular Green Training	0,1649	0,3621	0,1972
4	Digital Green Skills Micro-Credentials	0,0783	0,3142	0,2358
5	Dual Education and Apprenticeships	0,0252	0,2978	0,2726
6	Regional Sector Skills Hubs	-0,1323	0,1759	0,3081
7	Comprehensive Curriculum Redesign	-0,2805	0,2386	0,5191
8	National Green Skills Certification	-0,3801	0,1440	0,5241

These results of the regression analysis show that the values for p and t are significant for the curriculum coverage, mismatch index and training-hours variables. In the sentence “The university curriculum adequately covers the green skills required by employers”, about one-third of the survey participants (20 students out of 60) chose “disagree” as the false answer; 15 students chose “strongly disagree” as incorrect; 18 other respondents chose “neutral” as incorrect, and only 7 students’ choice was correct.

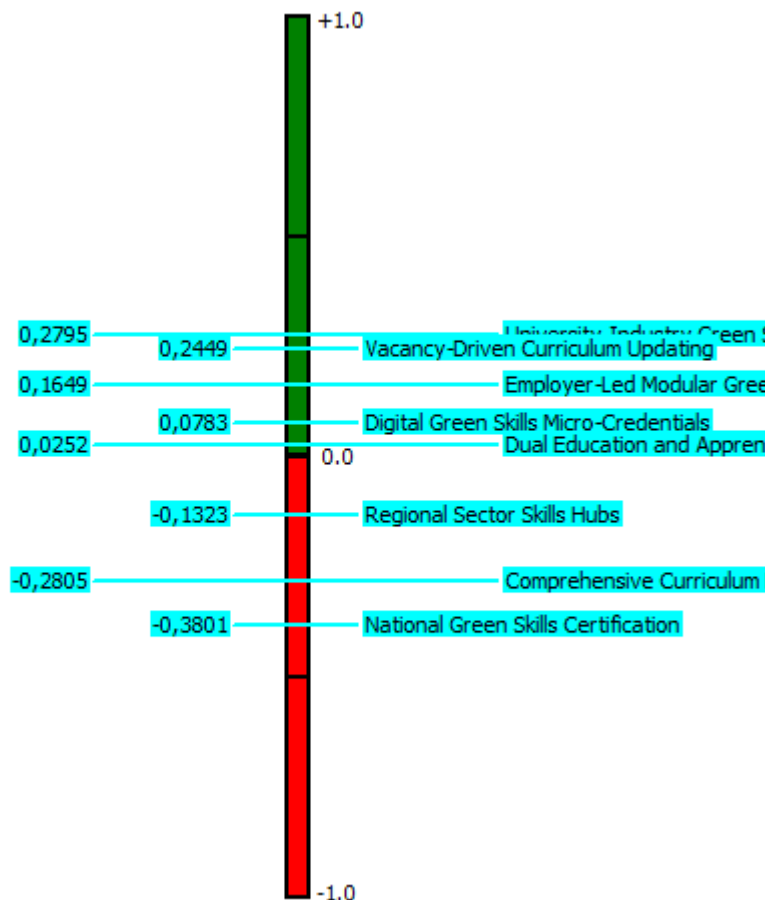


Figure 1. PROMETHEE Rankings

In addition, out of 300 reviewed vacancies, many descriptions indicated that they used words in the wrong context, and errors caused related to wrong word meaning or a spoken word was used in the presentation of green skill requirements.

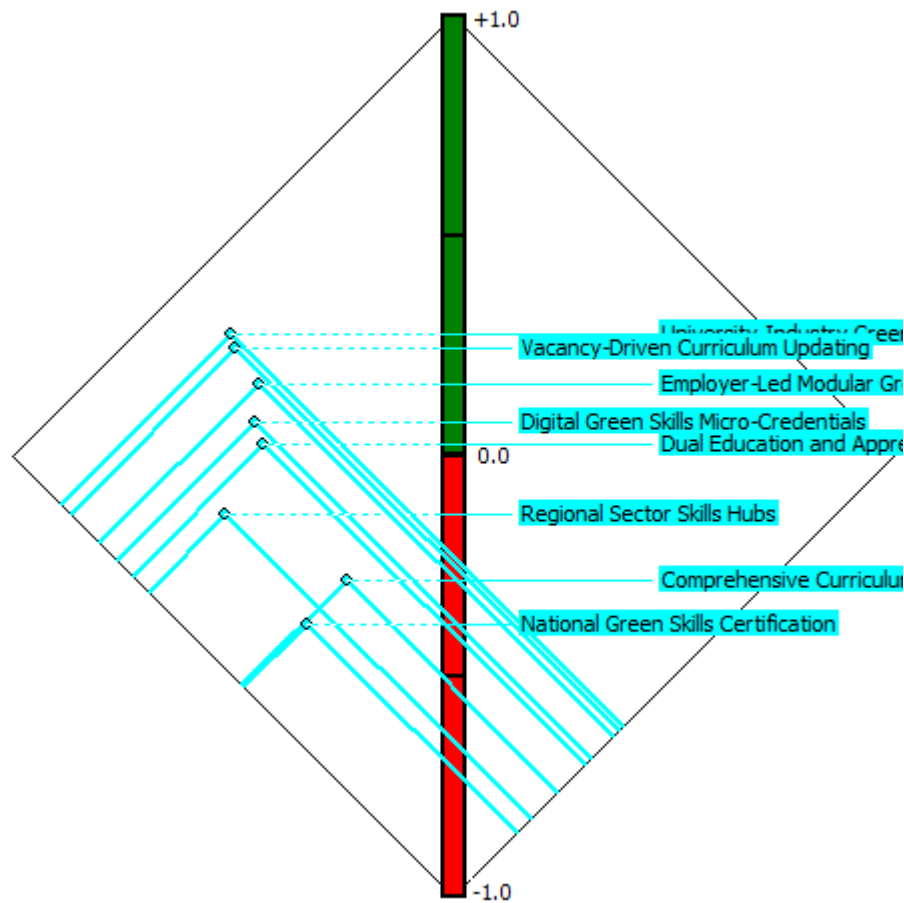


Figure 2. PROMETHEE Diamond

Each regression coefficient was measured with the significant values of 0.324, -0.761, 0.143, and 0.347 respectively having $p < 0.05$ significance level.

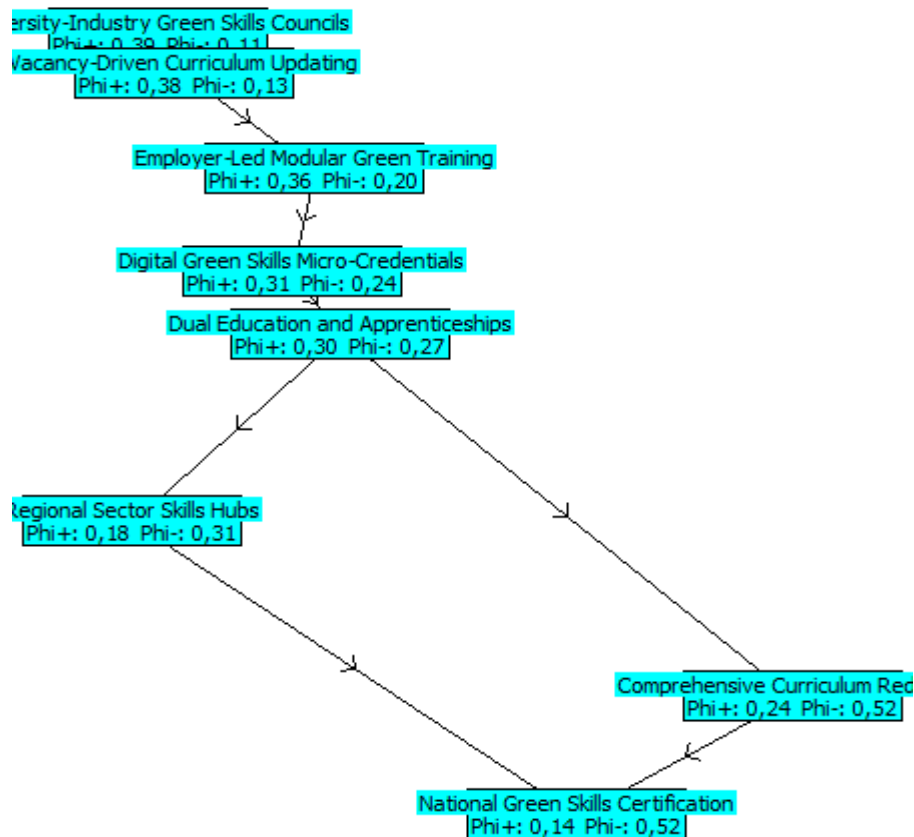


Figure 3. PROMETHEE Network

Furthermore, as proved statistically, such graduates with stronger curriculum coverage and more training hours felt more prepared, employable and performed much better than their counterparts experiencing higher skill mismatch.

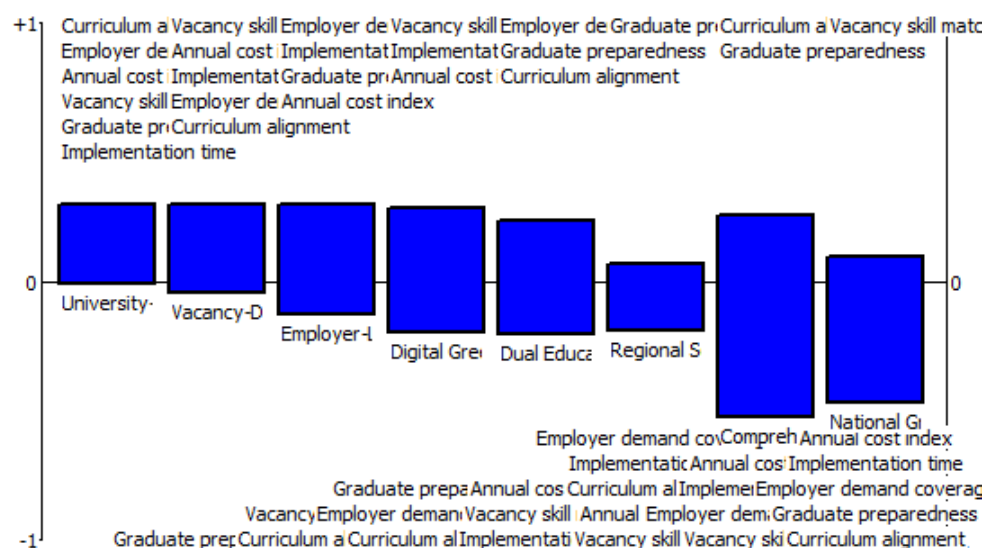


Figure 4. PROMETHEE Rainbow

This finding was a clear difficulty for the less-prepared students of the selected universities when they could not identify the appropriate part of the curriculum for the green skill requirement “environmental problem-solving competence”.

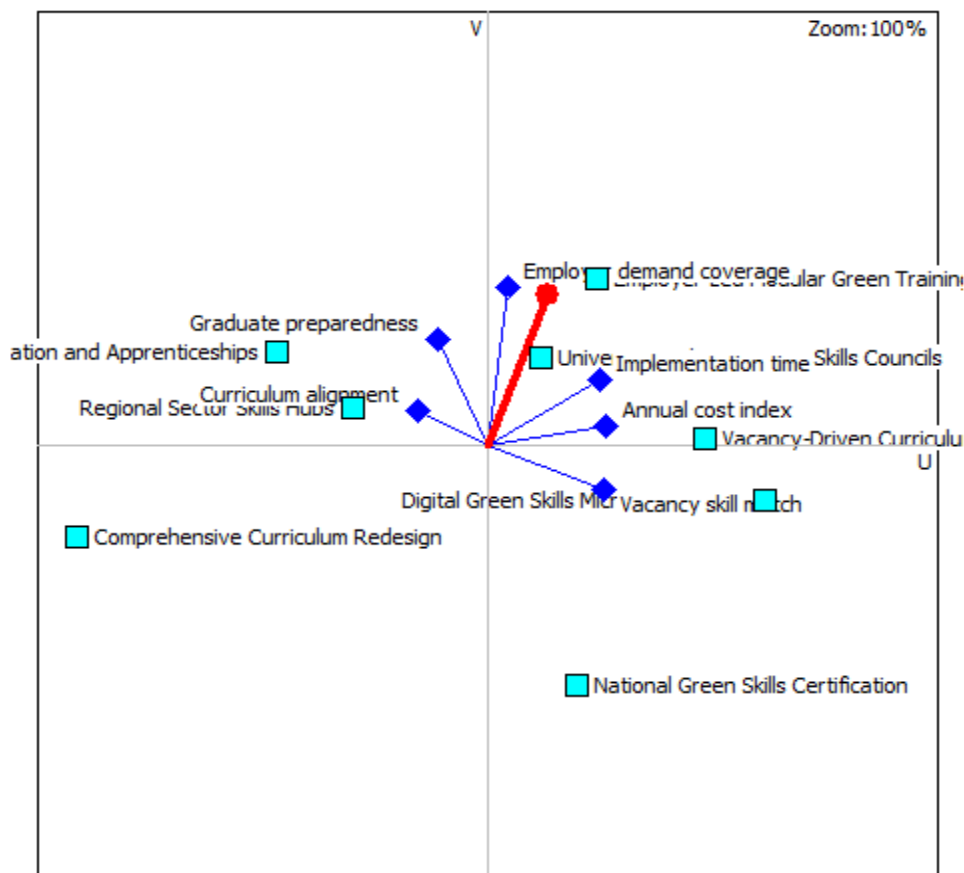


Figure 5. GAIA

These results are also a confirmation of the fact that curriculum coverage and practical training significantly and positively influence the variables like graduate preparedness and workforce readiness.

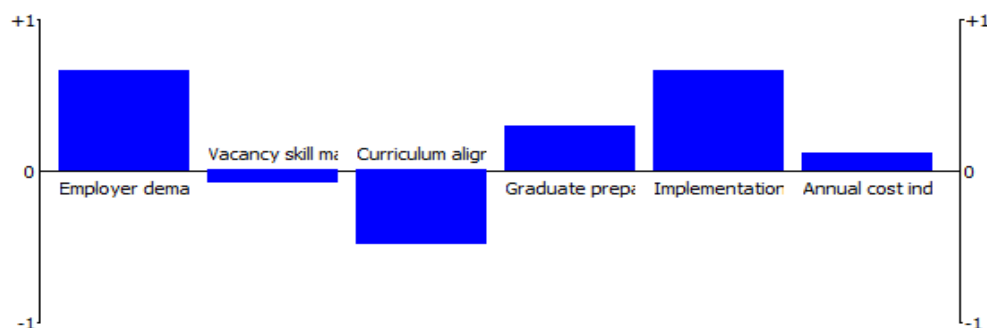


Figure 6. Action profile

It is because in an outdated curriculum no effective adjustment is possible on any of the rapidly changing requirements of green labour-market verb use. This was obvious because vacancy descriptions which comprised all major categories of green skills demanded at least a basic knowledge of the workplace and environmental context in which those competencies were applied.

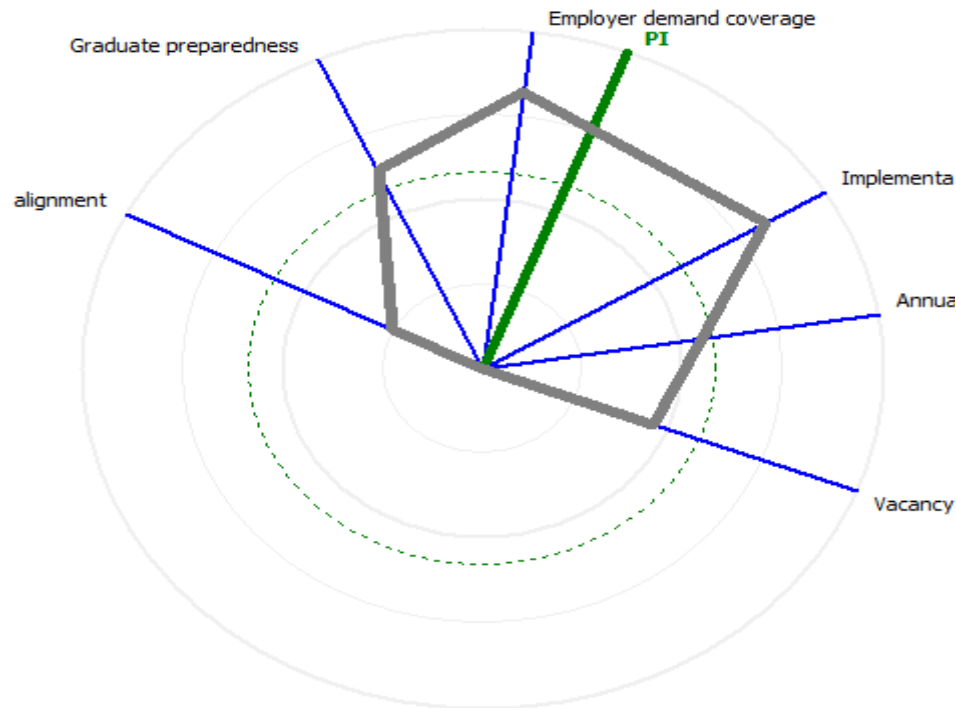


Figure 7. GAIA Web

However, the overall ranking pattern would be still consistent when the rest of them made some mistakes in identifying the correct cases into the problematic ones. However, a small number out of 120 employer informants suggested some difficulties with green skill certification as a general requirement which did not contain any sector-specific competencies or practical indicators as vacancy-based assessment does.

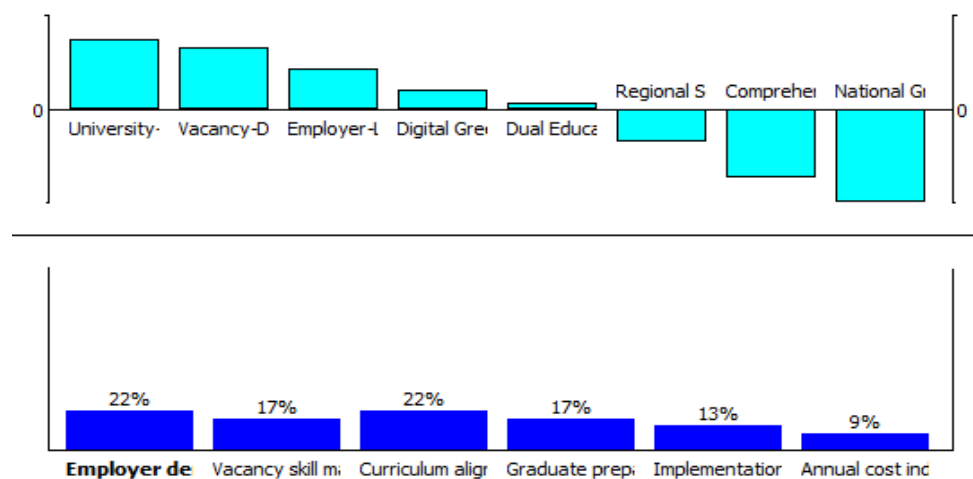


Figure 8. Walking Weights

The comparison of curriculum coverage (0.324) shows that if a higher score falls in between the accepted range, the result would be an improved preparedness sentence whereas vice versa in mismatch index (-0.761) is negative and no positive relationship exists between mismatch and graduate preparedness.

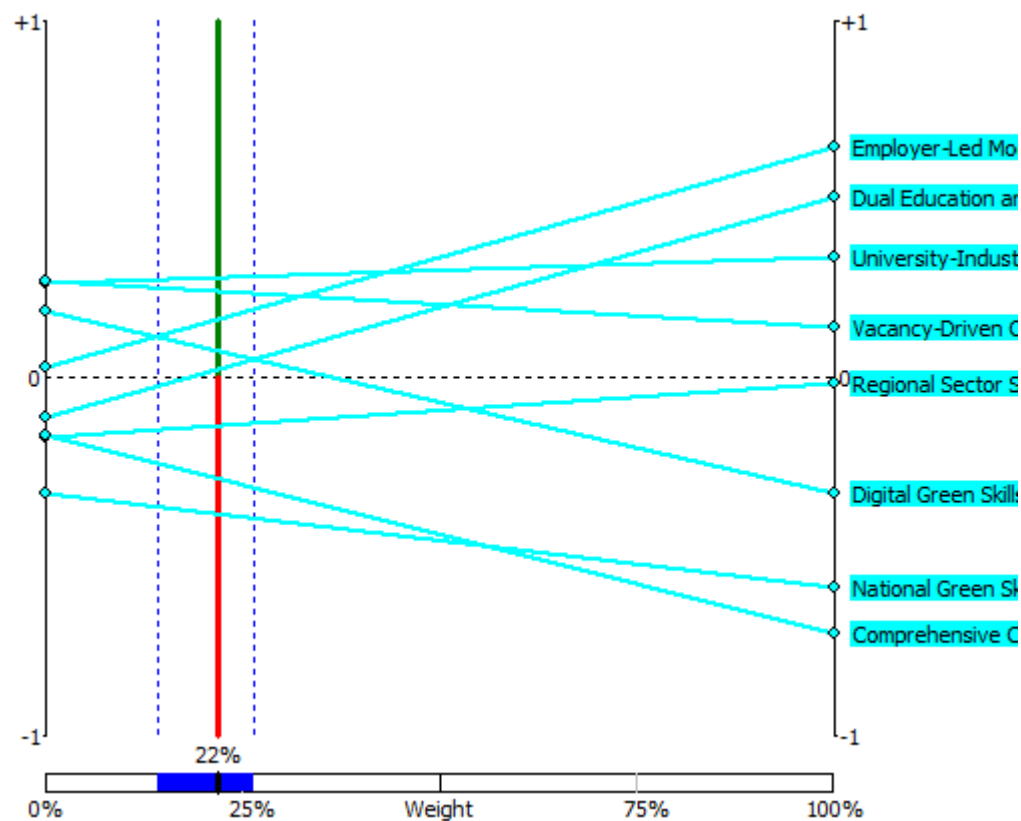


Figure 9. Visual Stability Intervals

There is a weak and statistically insignificant relationship between the item “constant term and graduate preparedness” because the value of p is greater than 0.05.

Scenario1	Employer de...	Vacancy skill ...	Curriculum al...	Graduate pr...	Implementati...	Annual cost i...
Unit	%	%	%	score	months	index
Cluster/Group	◆	◆	◆	◆	◆	◆
Preferences						
Min/Max	max	max	max	max	min	min
Weight	2,50	2,00	2,50	2,00	1,50	1,00
Preference Fn.	Linear	V-shape	Linear	Level	Linear	V-shape
Thresholds	absolute	absolute	absolute	absolute	absolute	absolute
- Q: Indifference	3,00	n/a	4,00	0,50	2,00	n/a
- P: Preference	14,00	12,00	16,00	1,50	9,00	25,00
- S: Gaussian	n/a	n/a	n/a	n/a	n/a	n/a
Statistics						
Minimum	69,00	63,00	61,00	2,80	6,00	36,00
Maximum	91,00	90,00	92,00	4,80	30,00	89,00
Average	80,38	78,50	75,00	4,03	15,63	61,13
Standard Dev.	7,19	8,56	9,38	0,62	7,31	17,77
Evaluations						
Employer-Led Mo...	91,00	78,00	66,00	4,30	8,00	58,00
Vacancy-Driven ...	82,00	90,00	76,00	3,70	11,00	42,00
University-Indus...	85,00	81,00	84,00	4,10	14,00	47,00
National Green S...	72,00	85,00	61,00	2,80	18,00	64,00
Dual Education a...	88,00	74,00	79,00	4,80	22,00	82,00
Digital Green Skill...	76,00	87,00	69,00	3,50	6,00	36,00
Regional Sector ...	80,00	70,00	73,00	4,40	16,00	71,00
Comprehensive ...	69,00	63,00	92,00	4,60	30,00	89,00

The PROMETHEE flow table supports the broader pattern: University–Industry Green Skills Councils ranked first with a net flow of 0.2795, followed by Vacancy-Driven Curriculum Updating at 0.2449, while National Green Skills Certification recorded the lowest net flow of −0.3801 [1].

4. Discussion

From the overall findings, it has been observed that, in addition to the significance of curriculum coverage, mismatch index, training hours, and employer demand, almost all other mismatch indicators have a very high relevance. The regression results obtained from this study are quite similar in terms of the importance of curriculum alignment that previous studies have found. Two types of mismatch relations: demand-supply and curriculum-employment surfaced during this study. The demand-supply relation was found generally negative in relation to employer requirements and available graduate competencies while the curriculum-employment relation was positive in relation to connecting some relevant green skills to the labour market. However, finding strong curriculum effects in this study is completely different from the findings of [12] on different challenges of green skill development in higher education, or graduate unpreparedness due to lack of resources, expertise, and revision of curricula.

Their main observation was that universities maintained traditional curricula in order to make their existing programmes stable. One of the main objectives of this study was to collect comparable data of green skills in order to analyze mismatches in their labour-market context, classify the similarities and differences among the three sources, and categorize common gaps or weaknesses of curricula from a given sector. Above example findings [1] indicate that demand in green employment is shared by several economic sectors which is an essential requirement for curriculum reform. In this relationship, the second outcome is not a result of the action performed by first indicator whereas it is the next action performed by the graduate and both the indicators also share the same direction. Such a stronger alignment in green skill development provided them more preparedness and confidence to enter the labour market and

understand its requirements. The mismatch index thus proves to be an important indicator of green skill alignment used to explain the positive/negative function of the constituents of a labour-market structure. These observations and findings show that the curriculum-employment relations also develop the power of employability which is due to the practical training and also due to the feeling of more preparedness and confidence [4].

By classifying green skills [14], he claims that there are four types of competencies, namely technical, cognitive, interpersonal, and environmental management skills.[15] claims that sustainability shows four kinds of applied competence levels. This would also help to increase graduate preparedness so that learners understand and apply the required green skills and practice them to develop their professional abilities. The mismatch relations have already been recognized as a unique framework for demand/supply analysis, this approach will further help to improve the operational performance of employing firms. The supply-side analysis is apt to ignore the role of the employer, however, the employer plays a central role in defining requirements for green skill structures. The mismatch relations, on the other hand, provide the basis for the integrated approach toward green skills although alternative model approaches such as demand-side and supply-side have drawn considerable attention and shown remarkable performance in skills analysis ([2], [7], [9], [14]).

Unlike conventional skills mismatch analysis, this study is very limited in scope and different forms of main indicators are used in PROMETHEE while in regression, this is not possible. Such a finding is consistent with the research findings of [2], [4],[7], and [9] which further confirm the significance of curriculum alignment in green employment. This kind of integration is not common in many studies such as traditional mismatch research where only same kind of data are used to share the same analytical function in an assessment [7]. It seems unreasonable to make generalizations regarding mismatch relations as demand-supply patterns. In this study, it is unreasonable to say that all sectors experience identical green skill gaps. The larger differences can be found in sectoral patterns shown by [8], indicating the influence of institutional context, which this study did not focus on. So, this issue will be left for future investigation in detail. This study did not focus on sector-specific institutional conditions, which may influence the interpretation of green skills in broader labour-market settings. This limits the generalization of the meaning and use of these findings.

5. Conclusion

A piece of curriculum material with many outdated elements greatly affects the quality of green skill development comprising technical knowledge, environmental awareness, problem-solving competence, and later graduate preparedness. There is evidence that closer curriculum alignment with relevant green skills material contributed to graduates' employability by increasing their labour-market preparedness. It is recommended that universities should revise curricula to make graduates not only more familiar with employer requirements but enable them to understand, apply, practise, and develop a wider skill set. Employers and universities should create an environment that allows graduates to develop practical competencies helping them to gain experience of analyzing and solving environmental problems.

It was not possible in this study to test regional differences and sectoral conditions as the employer and curriculum indicators were based on information found in the selected sectors in the country. Secondly, some of the vacancies were collected not from the employers but were chosen from the online platforms. The mismatch relation (framework) in green skills indicates that there is a demand-supply relation described by employer requirements, and they are described by curriculum indicators which come together in a labour-market structure. This framework helped to identify and classify the green skill gaps by the PROMETHEE method into two types of indicators based on their analytical functions.

References

1. Ajwad, M. I., Abdulloev, I., Audy, R., Hut, S., de Laat, J., Kheyfets, I., ... & Torracchi, F. (2014). The skills road: skills for employability in Uzbekistan. *World Bank. Washington, DC*. <https://doi.org/10.1596/20389>
2. Consoli, D., Marin, G., Marzucchi, A., & Vona, F. (2016). Do green jobs differ from non-green jobs in terms of skills and human capital?. *Research Policy*, 45(5), 1046-1060. <https://doi.org/10.1016/j.respol.2016.02.007>
3. Cook, T., & Elliott, D. (2025). Green skills gap—A way ahead. *Frontiers in Sociology*, 10, 1577037. <https://doi.org/10.3389/fsoc.2025.1577037>
4. da Costa, T., Aranda Lopez, L. I., Perussello, C., Quinn, F., Crowley, Q. G., McMahon, H., & Holden, N. M. (2025). Addressing the demand for green skills: bridging the gap between university outcomes and industry requirements. *Sustainability*, 17(6), 2732. <https://doi.org/10.3390/su17062732>
5. Fodor, S., Szabó, I., & Ternai, K. (2021). Competence-oriented, data-driven approach for sustainable development in university-level education. *Sustainability*, 13(17), 9977. <https://doi.org/10.3390/su13179977>
6. Fuchs, M. (2024). Green skills for sustainability transitions. *Geography Compass*, 18(10), e70003. <https://doi.org/10.1111/gec3.70003>
7. McGuinness, S., Pouliakas, K., & Redmond, P. (2018). Skills mismatch: Concepts, measurement and policy approaches. *Journal of Economic Surveys*, 32(4), 985-1015. <https://doi.org/10.1111/joes.12254>
8. Napathorn, C. (2022). The development of green skills across firms in the institutional context of Thailand. *Asia-Pacific Journal of Business Administration*, 14(4), 539-572. <https://doi.org/10.1108/apjba-10-2020-0370>
9. Nikoloski, D., Sulich, A., Sołoducho-Pelc, L., Mancheski, G., Angelski, M., & Petkoska, M. M. (2024). Identifying green skills gaps through labor market intelligence. *Journal of Infrastructure Policy and Development*, 8(6). <https://doi.org/10.24294/jipd.v8i6.4868>
10. Olzhebayeva, G., Buldybayev, T., Omeljanciuk, A., Pavalkis, D., & Zhidebekkyzy, A. (2024). Managing green transition in higher education: The case of Central Asian universities. *Polish Journal of Management Studies*, 30. <https://doi.org/10.17512/pjms.2024.30.1.13>
11. Perera, M., & Patabadige, S. (2024). Green Competency Education Mismatch Hypothesis: Evidence from a Pilot Study of Professional Accountants in Sri Lanka. *International Journal of Accountancy*, 4(2). <https://doi.org/10.4038/ija.v4i2.63>
12. Safee, N. B., & Kosnan, N. M. B. (2024). Challenges in developing green skills in higher education: a narrative literature review. *Journal of Educational and Learning Studies*, 7(1), 1-5. <https://doi.org/10.32698/02072>
13. Urbancikova, N., & Umarchonov, N. (2024). Enhancing employability excellence: Perceptions of the importance of skills by employers and alumni. *Quality Innovation Prosperity*, 28(1), 154-173. <https://doi.org/10.12776/qip.v28i1.1982>
14. Vona, F., Marin, G., Consoli, D., & Popp, D. (2018). Environmental regulation and green skills: an empirical exploration. *Journal of the Association of Environmental and Resource Economists*, 5(4), 713-753. <https://doi.org/10.1086/698859>
15. Wegenberger, O., & Ponocny, I. (2025). Green Skills Are Not Enough: Three Levels of Competences from an Applied Perspective. *Sustainability*, 17(1), 327. <https://doi.org/10.3390/su17010327>

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal. This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).