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# The sustainability-to-employment pipeline: the impact of SDG-related curricula on graduates' employability

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## ABSTRACT

Public and private organizations—including higher education institutions—frequently adopt the Sustainable Development Goals (SDGs) to facilitate a better future. In their efforts to realize the Agenda 2030, universities are focusing on how teaching and curricula shape students' competencies in interpreting and contributing to current societal challenges. Likewise, with businesses increasingly engaged in sustainable development issues, students will need SDG-related skills to align with current job-market requirements. Here, we examine the relationship between master graduates' employability and the presence and type of SDGs in their curricula. We run a series of logistic regressions where we use three different model specifications: (i) curriculum with an SDG-related ECTS above the mean, (ii) curriculum related to a specific class of SDG (well-being, environment, economy, governance), and (iii) curriculum related to a specific SDG. Further, we consider three aspects of employability: having a job, job coherence (i.e. the match between a job and one's field of study), and employment quality (i.e. having a higher salary). For this purpose, we collected data from 5,784 master's graduates at the University of Bologna in 2017. We derived employability measures from 2020 AlmaLaurea data to have a three-year time lag from graduation. Generally, we find that students who attended courses with SDG-related content achieved a higher and better occupation or a better skill match. At a grouped level, we find that SDG categories have a different impact on the students' working outcomes. For instance, students with more SDG-related ECTS in the economy area have higher odds of being employed, finding a better job-skill match, and getting better salaries. In addition, the single goals were studied by showing the effects on finding work, having a skill match and earning a better salary.

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Higher education; sustainable development goals; teaching sdgs; employability; higher salary; skill match

## 1. Introduction

Universities are pivotal in sustainable development (Figueiró and Raufflet 2015; Lozano et al. 2013; Swaim et al. 2014), prioritizing the implementation of Sustainable Development Goals (SDGs) as part of their social responsibility (EUA, 2018). Also, the Times Higher Education Impact Ranking highlights the growing connection between a university's reputation and its contribution to Agenda 2030 (THE 2023). HEIs integrate sustainability into teaching and research, aligning with the 17 SDGs since 2015 (Fia, Ghasemzadeh, and Paletta 2022). Emphasis on teaching SDGs enhances students' sustainability

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competencies, producing skilled practitioners for SDGs and imparting sustainability lessons to all graduates that they can apply in their future careers (Sánchez-Carracedo et al. 2021; THE 2023).

Within this context, the concept of employability becomes particularly relevant (Williams et al. 2016; Yorke 2006). Employability encompasses skills, knowledge, and attitudes essential for navigating and succeeding in modern employment's dynamic and complex landscape (Aragon-Correa et al. 2017; Figueiró and Raufflet 2015). Without an education system aligned with the SDGs, universities risk producing graduates who are ill-equipped for current challenges, potentially compromising their employability and, by extension, the institutions' reputations and rankings.

Nevertheless, it has been unclear whether the job market has fully appreciated those competencies. Despite the private sector's undeniable role in the UN 2030 Agenda and support from bodies such as the Global Reporting Initiative (Nonet et al. 2022), companies are slowly integrating the SDGs into their sustainability strategies (Mio, Panfilo, and Blundo 2020). While there is a consensus on the importance of sustainability skills for employability due to the growing demand for socially responsible practices (Banerjee 2011; Winfield and Ndlovu 2019). CEOs are prioritizing the 'sustainability literacy' (Gordon 2021), prompting business schools to integrate sustainability (Amaeshi, Muthuri, and Ogbechie 2019). More than 15,000 global companies, including Leonardo, ALDI, Lindt, and Pedius, have committed to the SDGs through the UN Global Compact (UN 2022). Recognizing the need to foster SDG-related skills, universities must strengthen their curricula for professionals entering the workforce (Jelonek and Urbaniec 2019; Moosmayer et al. 2019).

Not surprisingly, different streams of literature addressed the topic from different angles. Several theoretical studies explore and map sustainability competencies required by the job market (Fang and O'Toole 2023; Lambrechts and Ceulemans 2013; Osagie et al. 2016). Other studies explore which pedagogical tools to introduce SDGs-related content into teaching programs (Berchin, de Aguiar Dutra, and de Andrade Guerra 2021; Paletta et al. 2020). Lastly, a stream of qualitative studies explored the relationship between the sustainability competencies of graduates and the employability (Jelonek and Urbaniec 2019; Winfield and Ndlovu 2019; Zinkunegi-Goitia and Rekalde-Rodríguez 2022). Moreover, graduates' employability determinants are a consolidated field of study that point toward a crucial role of academic performance, internship, international experience, and socio-economic background.<sup>1</sup> However, the literature on sustainability in HEIs still lacks quantitative research, and the literature on graduate employability determinants lacks considerations on the sustainability content of curricula (Lozano et al. 2015). Qualitative studies, effective for exploring complex phenomena and, especially for exploratory research (Eisenhardt 1989; Yin 2013), face criticism for limited generalizability (Yin 2013). A parametric quantitative approach provides more generalizable results, highlighting patterns in the population under study (Bell, Bryman, and Harley 2022). The literature has highlighted that the definition of employability remains unclear (Römgens, Scoupe, and Beausaert 2020), with some distinguishing between employment and employability. The former refers to having a job, while employability focuses on possessing the necessary skills for job acquisition (Yorke 2006). To the extent of this paper, we study employability as a bundle of skills and competencies necessary for finding a job, matching studies to skills, and earning a better salary (Broadley et al. 2022; Yorke 2006).<sup>2</sup>

We used data on 5,784 master graduates from the University of Bologna to study the probability of becoming employed based on the presence and type of SDG-related curricula.<sup>3</sup> We considered three types of SDG-related curricula: (i) curriculum with an SDG-related university educational credits (ECTS) above the mean, (ii) curriculum related to a specific class of SDG, and (iii) curriculum related to a specific SDG. Moreover, we did not limit our analysis solely to graduate employment rate; there are cases where universities might achieve a high employment rate but be less effective at guaranteeing high wages and job quality (Smorenburg and van der Velden 1995). For this reason, we also investigated the job quality in terms of wages and educational/skill mismatch.<sup>4</sup>

This paper addresses gaps in employability and sustainability literature in higher education. The contribution is twofold. We add evidence based on a hypothetical-deductive model to explore whether graduates with SDGs-related themes in the curricula have more and better employment

opportunities (Winfield and Ndlovu 2019). We also advance three original measures of a curricula's SDG-relatedness and study their impact on three employability dimensions. Thus, our paper improves scholarly understanding of whether teaching strategies regarding sustainability relate to employment opportunities.

## 2. Literature review

The higher education literature on SDGs primarily examined how universities' policies can support the implementation of SDGs into teaching programs. Policies mainly focus on SDG 4 – ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Goal 4 can be achieved by strengthening the teaching staff's personal and professional capabilities (Kopnina 2018), leveraging digital learning systems (O'Keeffe 2020), and creating new university programs that are more just and inclusive (Kester 2019). Other studies have focused on the importance of developing evaluation systems that can measure the implementation of SDGs in teaching programs or identified teaching methods and pedagogies that better convey SD education (Paletta and Bonoli 2019). These methods range from stakeholders' involvement (Paletta and Bonoli 2019) to interdisciplinary activities and the promotion of holistic approaches to address complex problems (Berchin, de Aguiar Dutra, and de Andrade Guerra 2021). Another stream of literature studied the integration of SDGs in teaching activities at a more granular level (UNESCO 2017), arguing that teaching programs should deal with not only raising students' awareness about sustainability (Zermeño and de la Garza 2020), but also providing a complete curriculum for achieving the UN SDG targets and indicators (Desha, Rowe, and Hargreaves 2019).<sup>5</sup> Moreover, the integration of sustainability in the curricula has roots since the 90s, gaining recognition through the Organizations and the Natural Environment Division of the Academy of Management (Stead and Edward Stead 2010). The United Nations' 2007 introduction of responsible management principles (PRME) prompted higher education institutions to embed sustainability in business courses (Montiel, Gallo, and Antolin-Lopez 2020). Recent studies highlight the significance of CSR initiatives involving multinational companies and NGOs in addressing SDGs-related challenges, emphasizing the need to educate workers and managers on sustainability (Chavan, Gowan, and Vogeley 2022). A separate stream of literature points toward the key competencies HEIs should ensure students address sustainable development challenges. Future managers and workers require diverse skills, including ethical responsibility, problem-solving, and forward-thinking capacities (Lambrechts and Ceulemans 2013; Osagie et al. 2016). Fang and O'Toole (2023) contribute students' perspectives on integrating SDGs into curricula, emphasizing the crucial role of SDG training in acquiring key employability competencies. While significant streams of work on sustainability in HEIs operate either at the level of pedagogies and teaching methods (Cotton et al. 2009) or of workers' and managers' sustainability competencies for the job market (Rieckmann 2012), only a few studies have specifically investigated the relationship between sustainability and employability, particularly concerning introducing SDGs-related themes into the curricula.

For example, Jelonek and Urbaniec (2019) investigated the link between sustainability competencies and employability for higher education graduates in Poland using qualitative methods. Findings showed a market-oriented focus on current job-market needs. Essential skills are communication, proactive attitudes, and leadership. However, other competencies emerged as necessary, which are also compatible with sustainability ones: strategic actions competencies, interpersonal competencies, and system thinking competencies (Jelonek and Urbaniec 2019, 5715). The focus group supported the introduction of sustainability competencies, emphasizing their importance in addressing challenges posed by globalization and technological development (Jelonek and Urbaniec 2019, 5715). Ali, Murphy, and Nadkarni (2014) investigated the relationship between technology-based learning tools, the acquisition of sustainability competencies, and employability on a sample of UAE, UK, and Swiss hospitality students. Findings from focus groups revealed that only UK students perceived e-learning as positively impacting their employability. Zinkunegi-Goitia and Rekalde-Rodríguez (2022) analyzed the impact on students' employability competencies by introducing an innovative teaching project to address the challenge of reducing plastic pollution. Based on nine

interviews with students of the University of the Basque Country and the University of Bordeaux, the authors found that the project permitted interaction between academia and social agents to develop skills demanded by the job market. Lastly, Winfield and Ndlovu (2019) the impact of embedding sustainability into the curriculum on students' employability. Focusing on Nottingham Business School, the case study introduced sustainability topics to six modules in 2017. The research found that the new modules enhanced self-awareness and sustainability literacy, contributing to a rise in students' employability from 71% in 2011/2012 to 89.6% in 2018. While these analyses highlight how the sustainability content in an educational program may foster employability-relevant competencies, qualitative studies limit broad generalization to diverse contexts.

In the literature on traditional employability determinants,<sup>6</sup> the relatedness of curricula to SDGs can be an important factor by preparing students not just for the current job market but for a future workforce that demands agility in sustainable practices and thinking (Winfield and Ndlovu 2019). By doing so, HEIs can equip graduates to meet the challenges of tomorrow's economic, environmental, and social landscapes. The expectation is that graduates who are well-versed in the SDGs will not only find their skills in higher demand but will also command roles that entirely use their unique competencies, thus achieving better employability. The study of Clemente, Giner, and Vélez (2020) represents a first attempt to quantitatively investigate the impact of introducing SDG-related content into graduate curricula on employability. While their study focuses only on SDG4 (quality in education), they show that students achieving SDG4, received higher employer assessments, suggesting a positive contribution to employability and sustainable development through quality higher education.

Thus, given this scenario, we aim to provide novel quantitative empirical evidence on the relationship between the curricula's orientation toward SDGs – what we labeled the SDGs-relatedness of curricula – and the employability of graduates. Also, we go beyond the understanding of employability as the fact of getting a job to incorporate a broader notion that account for quality in term of salary and the use of acquired competencies.

### 3. Methodology

#### 3.1. Data source

We focused on the University of Bologna's (UNIBO) pioneering approach to measuring its performance related to the Agenda 2030, showcased at the G7 Environment Ministerial Meeting (Paletta et al. 2020). This initiative significantly impacted the planning of teaching and research programs to address the Agenda 2030 (Paletta and Bonoli 2019; UNIBO 2017).

Our database covers 6,068 master's degree students who graduated from UNIBO in 2017. We excluded 284 cases that were missing data, producing a final sample of 5,784 students. For each academic year 2016/17 subject, all UNIBO lecturers used their syllabi to indicate how their course related to one or more SDGs, according to the UN format (UNIBO 2017). Based on this information, we could determine the number of exams associated with each SDG (see Table 1 for SDGs' distribution in each field of study).<sup>7</sup> Also, we included data from the Italian Survey on graduates' employment status from AlmaLaurea Inter-university Consortium. The data on employability, collected in 2020 for those graduating in 2016/2017, presents a three-year lag. Note that pandemic-induced fluctuations may affected employability. Nevertheless, the general occupational rate in 2020 was 4.9% lower than in 2019 (AlmaLaurea, 2021).

#### 3.2. Model setup

To evaluate the effect of an SDG-related curriculum on employment, salary, and skill mismatch, we adopted the following logit model:

$$Y_i = \beta_0 + \beta_1 \mathbf{SDG}_j + \mathbf{T}_j(\beta_2 \mathbf{Marks} + \beta_3 \mathbf{Regular} + \beta_4 \mathbf{Internship} + \beta_5 \mathbf{Working\_studies}) \\ + \mathbf{P}_j(\beta_6 \mathbf{Gender} + \beta_7 \mathbf{FamilyStatus} + \beta_8 \mathbf{OffSite} + \beta_9 \mathbf{Age} + \beta_{10} \mathbf{ParentsStudies}) + \beta_{11} \mathbf{FS}_j.$$

**Table 1.** ECTS sum and average per field of study.

Field of Study	ECTS	Goals																
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
<b>Education</b>	<i>Sum</i>	–	–	2 340	17 527	–	–	1 026	1 142	–	4 865	981	–	–	–	920	–	–
261 Students	<i>Avg</i>	0,00	0,00	8,97	67,15	0,00	0,00	3,93	4,38	0,00	18,64	3,76	0,00	0,00	0,00	3,52	0,00	0,00
<b>Arts and Humanities</b>	<i>Sum</i>	–	–	521	39 622	1 230	–	–	54	390	2 210	1 228	123	8	–	222	1 232	–
1031 Students	<i>Avg</i>	0,00	0,00	0,51	38,43	1,19	0,00	0,00	0,05	0,38	2,14	1,19	0,12	0,01	0,00	0,22	1,19	0,00
<b>Social Sciences</b>	<i>Sum</i>	184	–	7 968	3 486	2 021	–	156	3 369	1 006	2 438	2 836	1 948	–	–	240	7 742	92
838 Students	<i>Avg</i>	0,22	0,00	9,51	4,16	2,41	0,00	0,19	4,02	1,20	2,91	3,38	2,32	0,00	0,00	0,29	9,24	0,11
<b>Business Administration and Law</b>	<i>Sum</i>	–	–	683	1 872	30	–	138	9 256	5 789	620	564	2 141	234	–	–	3 238	690
1255 Students	<i>Avg</i>	0,00	0,00	0,54	1,49	0,02	0,00	0,11	7,38	4,61	0,49	0,45	1,71	0,19	0,00	0,00	2,58	0,55
<b>Natural Sciences, Mathematics and Statistics</b>	<i>Sum</i>	84	830	33 533	5 940	–	1 063	1 999	15	1 929	9	268	1 356	1 020	2 238	1 405	360	–
772 Students	<i>Avg</i>	0,11	1,08	43,44	7,69	0,00	1,38	2,59	0,02	2,50	0,01	0,35	1,76	1,32	2,90	1,82	0,47	0,00
<b>Engineering, manufacturing and construction</b>	<i>Sum</i>	–	–	1 440	3 972	–	1 458	3 758	597	26 440	–	7 197	5 589	1 947	306	1 443	–	102
956 Students	<i>Avg</i>	0,00	0,00	1,51	4,15	0,00	1,53	3,93	0,62	27,66	0,00	7,53	5,85	2,04	0,32	1,51	0,00	0,11
<b>Agriculture, forestry, fisheries and veterinary</b>	<i>Sum</i>	–	4 438	1 214	12	–	48	282	700	2 791	–	191	966	352	–	1 131	–	–
253 Students	<i>Avg</i>	0,00	17,54	4,80	0,05	0,00	0,19	1,11	2,77	11,03	0,00	0,75	3,82	1,39	0,00	4,47	0,00	0,00
<b>Health and Welfare</b>	<i>Sum</i>	–	–	71 135	142	135	–	35	–	594	–	308	18	–	–	–	–	48
311 Students	<i>Avg</i>	0,00	0,00	228,73	0,46	0,43	0,00	0,11	0,00	1,91	0,00	0,99	0,06	0,00	0,00	0,00	0,00	0,15
<b>Services</b>	<i>Sum</i>	–	–	18	427	–	–	–	–	3	731	105	–	–	–	–	–	–
107 Students	<i>Avg</i>	0,00	0,00	0,17	3,99	0,00	0,00	0,00	0,00	0,03	6,83	0,98	0,00	0,00	0,00	0,00	0,00	0,00
<b>Total</b>	<i>Sum</i>	268	5 268	118 852	73 000	3 416	2 569	7 394	15 133	38 942	10 873	13 678	12 141	3 561	2 544	5 361	12 572	932
5.784 Students	<i>Avg</i>	0,05	0,91	20,55	12,62	0,59	0,44	1,28	2,62	6,73	1,88	2,36	2,10	0,62	0,44	0,93	2,17	0,16

The dependent variable  $Y_i$  stands for employment status; it is captured by three variables: (Y01) employment, (Y02) higher salary, (Y03) skills mismatch. The independent variable  $SDG_j$  stands for the SDG-relatedness of a curriculum. The SDG-relatedness variables are based on university educational credits (ECTS):

- $SDG1_j$  is a binary variable that takes the value 1 if the student has accumulated more SDG ECTS than the mean; 0 otherwise.
- $SDG2_j$  groups the SDG ECTS into four categories: Well-Being (SDG:1,3,4,5,10); Governance (SDG:16,17); Economy (SDG:2,6,7,8,9,11,12); Environment (SDG:13,14,15). For each group, we created a binary variable that equals 1 if the total ECTS is above average; 0 otherwise.
- $SDG3_j$  considers the total ECTS for each of the 17 SDGs.<sup>8</sup>

The controls (Table 2 and Table 3) are: training characteristics  $T$ ; personal characteristics  $P$ ; field of study  $FS$ .

#### 4. Results

Table 4 presents the results of the logistic regressions. The M1 specifications (M1A, M1B, M1C) capture the effect of accumulating SDG-related ECTS over the mean on employment (Y01), skill mismatch (Y02), and salary (Y03). Specifically, students with a curriculum where the SDG-related ECTS exceeded the mean were almost three times more likely to find a job, had an almost 66% higher chance of job-skill match, and were 4.3 times more likely to be better paid than those whose ECTS was less than the average.

The M2 specifications (M2A, M2B, M2C) covered the curriculum related to different SDG areas. Students accumulating more than the average SDG-related ECTS for *well-being* were 16% more likely to find a good skill match but 20% less likely to be better paid. This may be because the well-being SDGs are correlated with the social sciences rather than higher-paying fields (Bol and Heisig 2021). Meanwhile, students with SDG-related ECTS above the mean in the *economy* area were almost four times more likely to be employed, achieve a job-skill match, and earn a better salary. Like before, this finding may stem from the fact that economy-SDGs relate more to fields with better opportunities (Klein 2016). A similar pattern emerged for employment and salary for *governance*, while *environment* was not statistically significant.

Adopting a demand-side perspective (i.e. relating employability to features of the job market) revealed further insights (Klein 2016). For instance, *well-being* goals provide competencies required by professions dealing with poverty (e.g. managing social or health services for children or the elderly). Organizations in these sectors typically require motivated workers who can tolerate lower salaries (Borzaga and Tortia 2006). Meanwhile, *economy* goals provide competencies for sustainable production and consumption that are increasingly demanded by the job market (Zinkunegi-Goitia and Rekalde-Rodríguez 2022). Similarly, *governance* goals produce competencies that are necessary for generating the institutional conditions that underpin sustainable development.

The M3 specifications (M3A, M3B, M3C) encompassed single SDGs. The results largely reflect the results at the group level, with some exceptions. Generally, the results show that all SDGs significantly affected the three outcomes. Most goals improve the odds of finding work, having a skill match, and earning a better salary. For instance, each ECTS acquired had the following effects: Goal 02 (Zero hunger) increased the odds of gaining employment and slightly improved the odds of a better salary. Goal 07 (Affordable and clean energy) improved the odds of a higher salary by 1.4%. Goal 08 (Decent work and economic growth), significantly impacted all three outcomes, improving the odds of each by 1.2%, 1.4%, and 1.8%, respectively. Goal 09 (Industry, innovation, and infrastructure) produced significant but lower odds for each outcome. Goal 10 (Reduced inequality) improved the odds of each outcome by 1.8%, 2.6% and 4%, respectively. Goal 12 (Responsible consumption and production) significantly improved the odds of a higher salary by 1.7%. For Goal 17 (Partnerships to achieve the Goal) heightened the odds of finding a job by 4.3%. However,



**Table 2.** Variables' description.

	Variable domain	Variable Name	Type	Description	Source
<b>Y<sub>i</sub></b> Working status	Employment (Y01)	Y01_occupation	Binary	Employed (1), Not employed (0)	AlmaLaurea
	Skill mismatch (Y02)	Y02_using_degree_skills	Binary	Occupied and using to a high degree the skills acquired with the degree (1), Occupied but not using skills (0)	AlmaLaurea
	Salary Level (Y03)	Y03_high_salary	Binary	Monthly salary above 1.250 Euro (1), Below 1.250 Euro (0).	AlmaLaurea
<b>SDG<sub>i</sub></b> Curriculum SDGs	SDG <sub>1</sub>	SDG1_Mean	Binary	students' ECTS are above average (1); otherwise (0)	UNIBO
	SDG <sub>2</sub>	SDG2_Wellbeing	Binary	(1) if the students' ECTS total for SDG 1, 3, 4, 5 and 10 are above average; (0) otherwise	UNIBO
		SDG2_Governance	Binary	(1) if the students' ECTS total for SDG 16 and 17 are above average; (0) otherwise	UNIBO
		SDG2_Economy	Binary	(1) if the students' ECTS total for SDG 2, 6, 7, 8, 9, 11 and 12 are above average; (0) otherwise	UNIBO
	SDG2_Environment	Binary	1 if the students' ECTS total for SDG 13, 14 and 15 are above average; 0 otherwise	UNIBO	
SDG <sub>3</sub>	Goal01 – Goal 17	Binary	The number of ECTS accumulated for Goal 01 – Goal 17	UNIBO	
<b>T</b> Training characteristics	High Marks	Marks	Binary	1 if the students' marks are lower than the schools' median; 0 otherwise	AlmaLaurea
	Regular Period	Regular	Binary	1 if the student has graduated regularly; 0 if the student has not graduated into the regular period	AlmaLaurea
	Internship	Internship	Binary	1 if the student has followed an internship; 0 otherwise	AlmaLaurea
	Working during the studies	work_studies	Binary	1 if the student has worked during the studies; 0 otherwise	AlmaLaurea
	Gender	Gender	Categorical	1 if male; 0 if female	AlmaLaurea
	Socio Economic Status	SES	Binary	1 if the student comes from a family with a high economic and social status; 0 otherwise	AlmaLaurea
	Off Site	Offsite	Binary	1 if the student comes from another region; 0 otherwise	AlmaLaurea
	Age Parents' Studies	Age parents_studies	Categorical Binary	The age of the person in years 1 if at least one of the parents has a higher education; 0 otherwise	AlmaLaurea AlmaLaurea
FS Field of Studies	Field of studies FS <sub>(1-9)</sub>	Binary	9 dummy variables capturing the effects relating to degree subject/field of study: FS1 – Agriculture, forestry, fisheries and veterinary; FS2 – Engineering, manufacturing and construction; FS3 – Natural sciences, mathematics and statistics; FS4 – Business, administration and law; FS5 – Services; FS6 – Education; FS7 – Arts and humanities; FS8 – Health and welfare; FS9 – Social sciences, journalism and information	AlmaLaurea	



**Table 3.** Descriptive statistics.

	Variable	Obs	Mean	Std. dev.	Min	Max
$Y_i$ – Working status	Y01_occupation	6,046	.5646709	.495841	0	1
	Y02_using_degree_skills	6,046	.2777043	.4479038	0	1
	Y03_high_salary	6,046	.308303	.4618306	0	1
SDG <sub>i</sub> – Curriculum SDGs	SDG1_Mean	6,046	.8537876	.3533482	0	1
	SDG2_Wellbeing	6,046	.2573602	.4372157	0	1
	SDG2_Governance	6,046	.194178	.3955993	0	1
	SDG2_Economy	6,046	.1599405	.3665811	0	1
	SDG2_Environment	6,046	.2815084	.449772	0	1
	Goal01	6,046	.0443268	.5450917	0	8
	Goal02	6,046	.8774396	7.312545	0	90
	Goal03	6,046	20.36404	62.17806	0	325
	Goal04	6,046	12.51059	29.32526	0	163
	Goal05	6,046	.619087	2.734994	0	72
	Goal06	6,046	.424909	2.531372	0	30
	Goal 07	6,046	1.260007	4.557641	0	35
	Goal08	6,046	2.657459	9.333483	0	72
	Goal09	6,046	6.612471	16.99464	0	90
	Goal10	6,046	1.841217	6.840032	0	45
	Goal11	6,046	2.335925	9.436223	0	157
	Goal12	6,046	2.083196	6.872406	0	62
Goal13	6,046	.6147866	2.723966	0	30	
Goal14	6,046	.4311942	4.819949	0	78	
Goal15	6,046	.9211049	4.078335	0	51	
Goal16	6,046	2.197651	6.272036	0	40	
Goal17	6,046	.163083	1.317516	0	27	
P – Personal Characteristics	Age	6,046	26.2003	3.226074	22.75	66.56
	Gender	6,046	.4202779	.4936443	0	1
	parents_studies	5,784	.3843361	.48648	0	1
	Offsite	6,046	.402911	.4905237	0	1
T – Training characteristics	SES	5,790	.2909879	.4542573	0	1
	Regular	6,046	.7226265	.4477394	0	1
	Marks	6,046	1.633807	.4818028	0	1
	work_studies	6,046	.6513397	.4765856	0	1
FS – Field of Studies	Internship	6,046	.1786305	.3830743	0	1
	FS1	6,046	.0434998	.2039963	0	1
	FS2	6,046	.1809461	.3850053	0	1
	FS3	6,046	.146047	.3531825	0	1
	FS4	6,046	.2208071	.414825	0	1
	FS5	6,046	.1303341	.3366985	0	1
	FS6	6,046	.1617598	.3682608	0	1
	FS7	6,046	.043169	.2032543	0	1
	FS8	6,046	.0544161	.2268558	0	1
	FS9	6,046	.0190208	.1366094	0	1

other goals demonstrated a negative impact. For instance, for Goal 03 (Good health and well-being), each point of ECTS coincided with lower odds of finding work or earning a higher salary (by 0.2% for both); for Goal 04 (Quality education), the odds of earning a higher salary declined by 0.4%. These results confirm the negative effects of well-being goals. Meanwhile, for Goal 06 (Clean water and sanitation), ECTS lowered the odds of finding a job by 2% and making a higher salary by 3.1%. This result diverges from the other economy-related goals, although the effect is negligible on both outcomes. Lastly, for each ECTS earned, Goal 13 (Climate action) and Goal 15 (Life on land) lowered the odds of having a skill match by 2.4% and 1.8%, respectively. These reflect the weak effects of environment-related goals. Regarding controls, our findings mainly overlap with past studies, barring a few exceptions which are discussed in the supplementary material.

## 5. Conclusions and future research trajectories

The relationship between SDG-related curricula and employability is critically important for students and universities. Universities are evaluated on their ability to enhance students' employability (i.e. in

**Table 4.** Logit results in odds ratio.

		Models 1 (SDG1)			Models 2 (SDG2)			Models 3 (SDG3)		
		Model 1A	Model 1B	Model 1C	Model 2A	Model 2B	Model 2C	Model 3A	Model 3B	Model 3C
		Y01.	Y02.	Y03.	Y01.	Y02.	Y03.	Y01.	Y02.	Y03.
Variables		Employment	Skill Mismatch	Salary Level	Employment	Skill Mismatch	Salary Level	Employment	Skill Mismatch	Salary Level
SDG1	SDG1_mean	<b>3.029***</b>	<b>1.662***</b>	<b>4.316***</b>						
SDG2	well-being				0.953	<b>1.163*</b>	<b>0.802**</b>			
	economy				<b>1.442***</b>	<b>1.399***</b>	<b>1.409***</b>			
	environment				1.000	1.027	1.028			
	governance				<b>1.348***</b>	1.115	<b>1.233**</b>			
SDG3	Goal 01							0.987	0.977	0.990
	Goal 02							<b>1.008*</b>	1.003	<b>1.011**</b>
	Goal 03							<b>0.998***</b>	1.001	<b>0.998**</b>
	Goal 04							0.999	1.001	<b>0.996**</b>
	Goal 05							1.006	0.992	1.002
	Goal 06							<b>0.980*</b>	0.997	<b>0.969**</b>
	Goal 07							1.009	1.007	<b>1.014**</b>
	Goal 08							<b>1.012***</b>	<b>1.014***</b>	<b>1.018***</b>
	Goal 09							<b>1.010***</b>	<b>1.006***</b>	<b>1.009***</b>
	Goal 10							<b>1.018***</b>	<b>1.026***</b>	<b>1.040***</b>
	Goal 11							0.995	<b>0.994*</b>	<b>0.977***</b>
	Goal 12							1.007	1.004	<b>1.017***</b>
	Goal 13							0.994	<b>0.976*</b>	0.988
	Goal 14							1.000	0.989	0.990
	Goal 15							1.001	<b>0.982**</b>	0.992
	Goal 16							1.007	1.000	1.008
	Goal 17							<b>1.043*</b>	1.011	1.017
T	marks	<b>1.190***</b>	<b>0.780***</b>	1.101	<b>1.198***</b>	<b>0.764***</b>	1.115	<b>1.200***</b>	<b>0.754***</b>	1.117
	regular	1.061	1.116	<b>1.227***</b>	<b>1.169**</b>	1.128	<b>1.419***</b>	<b>1.152**</b>	1.131	<b>1.349***</b>
	work_studies	<b>1.789***</b>	<b>1.135*</b>	<b>1.348***</b>	<b>1.774***</b>	<b>1.139*</b>	<b>1.335***</b>	<b>1.790***</b>	<b>1.149**</b>	<b>1.354***</b>
P	gender	1.064	<b>1.185**</b>	<b>1.588***</b>	<b>1.123*</b>	<b>1.231***</b>	<b>1.690***</b>	1.091	<b>1.205***</b>	<b>1.634***</b>
	SES	0.940	0.960	1.016	<b>0.887*</b>	0.933	0.942	0.895	0.950	0.959
	offsite	<b>0.613***</b>	<b>0.743***</b>	<b>0.766***</b>	<b>0.622***</b>	<b>0.752***</b>	<b>0.782***</b>	<b>0.620***</b>	<b>0.757***</b>	<b>0.782***</b>
	age	<b>1.040***</b>	0.996	<b>1.056***</b>	<b>1.043***</b>	0.998	<b>1.058***</b>	<b>1.044***</b>	1.003	<b>1.064***</b>
	parents_studies	<b>0.870**</b>	0.929	<b>0.880*</b>	<b>0.857**</b>	0.924	0.858**	<b>0.859**</b>	0.923	<b>0.863**</b>
FS	FS1	<b>2.741***</b>	<b>4.615***</b>	<b>2.143***</b>	<b>2.085***</b>	<b>4.039***</b>	<b>1.661***</b>	1.014	<b>4.263***</b>	1.377
	FS2	<b>3.921***</b>	<b>3.840***</b>	<b>5.239***</b>	<b>3.599***</b>	<b>3.522***</b>	<b>4.656***</b>	<b>1.913***</b>	<b>3.759***</b>	<b>5.151***</b>
	FS3	1.093	<b>1.832***</b>	<b>2.036***</b>	<b>1.347**</b>	<b>1.954***</b>	<b>2.596***</b>	0.811	<b>2.068***</b>	<b>2.870***</b>
	FS4	<b>1.538***</b>	<b>1.620***</b>	<b>3.106***</b>	1.032	<b>1.418***</b>	<b>1.965***</b>	<b>0.530***</b>	1.247	<b>1.747***</b>
	FS5	<b>4.585***</b>	<b>4.092***</b>	<b>0.475**</b>	<b>5.905***</b>	<b>5.037***</b>	<b>0.580*</b>	<b>2.819***</b>	<b>3.860***</b>	<b>0.467**</b>
	FS6	<b>4.000***</b>	<b>5.924***</b>	<b>1.894***</b>	<b>4.844***</b>	<b>6.007***</b>	<b>2.379***</b>	<b>2.176***</b>	<b>3.877***</b>	<b>1.503*</b>

(Continued)

Table 4. Continued.

Variables	Models 1 (SDG1)			Models 2 (SDG2)			Models 3 (SDG3)		
	Model 1A Y01. Employment	Model 1B Y02. Skill Mismatch	Model 1C Y03. Salary Level	Model 2A Y01. Employment	Model 2B Y02. Skill Mismatch	Model 2C Y03. Salary Level	Model 3A Y01. Employment	Model 3B Y02. Skill Mismatch	Model 3C Y03. Salary Level
<b>FS7</b>	<b>1.321***</b>	<b>1.766***</b>	0.891	<b>1.732***</b>	<b>2.006***</b>	1.225	0.930	<b>1.846***</b>	1.208
<b>FS8</b>	0.962	<b>3.528***</b>	<b>1.887***</b>	1.172	<b>3.612***</b>	<b>2.560***</b>	<b>0.587**</b>	<b>3.223***</b>	<b>3.431***</b>
<b>FS9</b>	1	1	1	1	1	1	1	1	1
<b>r2_p</b>	0.123	0.066	0.128	0.114	0.067	0.110	0.119	0.074	0.134
<b>N</b>	5784	5784	5784	5784	5784	5784	5784	5784	5784
<b>aic</b>	6983.719	6420.614	6243.122	7060.906	6420.083	6373.353	7046.288	6392.742	6233.760
<b>bic</b>	7110.313	6547.208	6369.717	7207.489	6566.666	6519.936	7279.488	6625.942	6466.960

Significant values in bold and italic: \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ .

terms of their labor market outcomes; Burke, 2015) and their contribution to sustainable development (Lozano et al. 2013; Swaim et al. 2014). However, scholars under-investigated the relationship between employability and universities' teaching strategies concerning Agenda 2030.

This paper fills that gap by empirically evaluating the impact of graduates' curricula (and SDG-relatedness, in particular) on employability in terms of finding a job, matching studies to skills, and earning a better salary. UNIBO serves as an exemplary case, adopting UN Agenda 2030, enhancing sustainable development. Results confirm universities equip students with the competencies improving employability prospects. (Römgens, Scoupe, and Beusaert 2020). Corroborating the current literature, our results confirm that students' employability increases almost three-fold when SDGs are embedded into their curricula (Winfield and Ndlovu 2019). This effect is only statistically significant for SDGs related to the economy and governance. Indeed, this also relates to the fields of study effect, which influences the students' self-perception of employability (Donald, Ashleigh, and Baruch 2018).

Moreover, and in support of the extant qualitative literature, we found that the SDG-relatedness of the curriculum positively increases the odds of finding work that matches one's studies suggesting the value of sustainability competencies (Lambrechts and Ceulemans 2013; Osagie et al. 2016). Using a quantitative approach substantially enriches the existing literature by providing empirical evidence and statistical verification of the relationship between SDG-oriented curricula and students' employability. It allowed us to discern the differential effects of various SDGs on employability, reaching a level of generalization that is challenging to achieve with qualitative methods. The consequent insights augment the theoretical debate, lending a deeper understanding of the mechanisms at play in the SDGs-employability relationship.

Lastly, we observed that a higher level of SDGs in the curriculum positively and significantly impacts one's likelihood of earning a better salary. This result aligns with evidence that pre-work formal education correlates positively with salary (Xiao 2002). Notably, we discovered that some SDGs improve this relation. In contrast, others (such as well-being goals) are detrimental—perhaps because, as the extant literature suggests, some fields (such as education) offer fewer high-salary opportunities (Bol and Heisig 2021). Finally, this paper advances three original measures of a curricula's SDG-relatedness, which can be adopted as starting point in future research.

Our results are relevant for policymakers, business leaders, academic administrators, and students in general. For instance, academic administrators might consider conducting periodic reviews of current curricula to assess the extent of SDG integration. Where there are gaps, faculties should be encouraged to embed relevant SDGs more deeply into their courses, especially focusing on those SDGs that have shown a significant relationship with employability outcomes.

Our findings suggest that expanding students' sustainability literacy may also positively impact the culture that permeates businesses, encouraging leaders' interests in the sustainable development (Arruda Filho, Hino, and Beuter 2019). However, the sustainability content cannot be driven only by an employer-led demand for sustainability competencies (Fang and O'Toole 2023). Moreover, current literature highlights that students don't actively require SDGs-related content in their curricula (Leal Filho, Salvia, and Eustachio 2023), while our findings provide evidence about employability which may support students in being more proactive toward SDGs and also promote future initiatives. The results are essential for higher education administrators, which also may incentivize the adoption of new teaching methods and pedagogies to convey sustainability competencies better.

Our work features some notable limitations that could open avenues for future research. For instance, our study only assessed whether sustainability topics were present in specific courses. Future research could explore how courses conceptualize sustainability at the micro-level (see Sánchez-Carracedo et al. 2021). However, given that HEIs impart not only technical knowledge but also 'generic graduate attributes' (e.g. problem-solving, teamwork, etc.) (Barrie 2007; Denson and Zhang 2010), it is worth exploring whether sustainability operates more at the level of 'generic attribute' or specific knowledge. In this vein, further analysis could also explore pedagogical

considerations, including the importance of emotional engagement in learning (Shrivastava, 2010). Scholars could also deepen our results regarding the effectiveness of different teaching techniques about sustainability, e.g. students' active participation (Juárez-Nájera, Dieleman, and Turpin-Marion 2006), experience-learning characteristics (Steiner and Posch 2006), or interdisciplinary approaches (Kurland et al. 2010).

Moreover, we do not investigate the barriers and drivers of introducing SDG themes into teaching programs, which could serve as mediating factors in developing employability-relevant skills (Chang and Lien 2020; Weiss et al. 2021). Additionally, future investigations should consider the effects of SDGs on a longer time scale (3–10 years after graduation) to capture effects related to the university and career path. In addition, hypothetical-deductive models uncover relationships and test propositions, but qualitative methods, like single or comparative case studies (Eisenhardt 1989; Yin 2013), are valuable for further exploring processes and meanings between variables (Gephart 2004). For example, scholars could conduct in-depth interviews on both the demand and supply side to add nuance to our understanding of courses' impact and changes in employers' needs. Similarly, researchers can conduct interviews on graduates' perspectives to understand *how SDGs-related curricula* may affect employability.

## Notes

1. This paper centers on the link between employability and sustainability competences. But, recognizing the traditional employability literature's importance, its discussion and findings are in supplementary material for those seeking a broader context.
2. See supplementary material for a broader discussion on the topic.
3. Note that we analyzed the relationship between SDGs-relatedness of curricula and employability, which refers to the relatedness of teaching programs with SDGs-themes or in other words to the presence of courses with SDGs-related content (see Section 3 for details).
4. Educational/skill mismatch is the lack of coherence between the education provided by the university and the one required by the job (among others (Wiers-Jenssen and Try 2005).
5. Note that sustainability education is not a new topic: In 2002, the UN established the Education for Sustainable Development to equip people with the sustainability competencies to address the multiple challenges (Cotton et al. 2009). In this context, universities play a major role in imbuing future workers and managers with the competencies and values of responsible behavior (Escudero, 2006).
6. See the supplementary material for a discussion of that literature, including its connection with SDGs.
7. In cases where an exam covers content related to two SDGs, full ECTS recognition will be granted for each respective theme. This acknowledges and rewards a comprehensive understanding of competencies in multiple sustainability dimensions.
8. See <https://sdgs.un.org/goals> for the list of goals.

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