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Globalization and Digitalization as Challenges for a Professional Career in Manufacturing Industries—Differences in Awareness and Knowledge of Students from Brazil and Germany

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Abstract: In this study, we provide the outcomes of a survey with Brazilian and German students about two main topics: (1) students' willingness and motivation to work abroad; and (2) the students' awareness about current industrial challenges, their knowledge perception and perspectives about the workplace of the future. We survey 733 college students from technical and natural sciences degrees in the period of October to December 2016 and compare our findings with the existing literature. We analyze the results by stressing the relevance of management's international experience for the success of company's internationalization as well as the importance of student's awareness about current industrial challenges for the development of national industry. The analysis shows that Brazilian students have a significant higher willingness to work abroad and are less money-driven compared to students from Germany. On the other hand, German surveyed students have a higher awareness regarding industrial digitalization than students from Brazil.

Keywords: international career; globalization; digitalization; Industry 4.0; advanced manufacturing

1. Introduction

1.1. International Career and Its Impact in on Firm' Internationalization

According to Fletcher (2001), based on different studies [1–3], internationalization can be described as " ... a process by which enterprises increase their involvement in international business activities" [4]. Sachse (2002) affirms the term comprises " ... all strategic activities of an enterprise concerning performance and evaluation which extend beyond national borders of the country" and, based on Porter (1991), he argues that internationalization is the process of turning primary activities or the providing of resources into an international operation, aiming at value creation through an integrated view [5,6]. According to Dunning (1993), as cited in Schmid (2009), the process of internationalizing a company aims to provide up to three benefits for the companies: (1) resource advantages—e.g., accessibility or cost reduction; (2) gaining new customers—e.g., expanding the customer market; and (3) improving efficiency through scale or scope economies [7,8]. Many companies' characteristics, internal or external, can foster or hinder the development of the internationalization process in a company. These factors were summarized by Fletcher (2001) into four categories: management characteristics; organizational characteristics; external impediments; and external incentives. By focusing on the first category, management characteristics, one finds, as cited in

Fletcher (2001), that information about managers such as age [9], education [10], place of birth [11] can play an important role in the decision to internationalize. Relevant is also their foreign experience, such as time spent living abroad [12] and frequency of business trips [11], since these characteristics can influence the way managers comprehend the foreign market and understand their risks. Studies that focused on startups and SMEs found a greater degree of importance in management's international experience for the internationalization success of such companies, due to the strong impact of the management team in a small company ([13,14]; [15] as cited in [16]; [17]). Another research trend stresses that the impact of managerial international experience impacts indirectly on the international performance of a company [16,18]. These researchers suggest that the international experience of board members influences intermediary variables that lead into a better international performance of the SME abroad. From a different perspective, organizations with global influence need cosmopolitan managers who possess three main assets: concepts; competence; and connections [19]. International positions, such as expatriation, seem to offer employees a positive impact in their career advancement and personal development and growth, although experienced employees abroad have reported difficulties in coming back home, such as finding a new internal position, lack of recognition or application of their international experience [19,20]. By considering the relevance of the management's team international experience in a firm degree of internationalization and the reported increase on personal development, we may analyze the general interest from students to work abroad and their main motivations. Current scholarship has shown that international experiences have a positive impact on employability after graduation ([21]; [22] as cited in [23]), but this may not be the main motivation for foreign students. A survey of around 62 outbound exchange students from Umeå University in Sweden shows that only 10% of outgoing students expect to improve their employability after the international experience. The employability awareness reduces to only 5% as reported during the survey with returning students [24]. On the other hand, according to the survey "International Student Barometer" (ISB) with more than 150,000 international students worldwide, employability appears as one of main drivers for studying abroad as well as broadening the experience and quality of education [23]. Current literature does not totally address the motivations of students for studying abroad and, moreover, it does not generally segment students' motivations by degrees or country of birth. This research aims to focus on the analysis of the motivations of students pursuing technical and natural science degrees and expects this may provide interesting insights regarding the characteristics of future employees in the industrial sector. Based on that, we propose the analysis of the willingness of Brazilian and German students to work abroad and their main reservations, followed by the main countries where they are more prone to work.

1.2. Industrial Digitalization and Students' Awareness

According to Bundesverband der Deutschen Industrie (2013), " ... Germany lives from its industrial business model" and it can be easily clarified by a look at the history: Germany, USA, and Great Britain had reached a significant competitive advantage since the first industrial revolution by developing technologies, exporting their manufactured goods, protecting the industry and providing government intervention [25]. This industrial business model aims to act as a key driver of innovation, job creation, exports, capital security, not only in Germany but in Europe: around 80% of European innovation and 75% of exports is a result of industrial efforts. Parallel to it, one may notice the development of BRICs countries in the industrial segment, appearing as main players and representing around 40% of the total manufacturing value added worldwide [26]. Emerging countries as main manufacturing countries, the maturity of former industrial economies and the trend of outsourcing activities, such as logistics, facility management, management, etc. are reasons for the reduction of number of jobs related to industry in Europe [26]. Under this perspective, developing the industry by bringing new technology and innovation is also an opportunity to establish more jobs [26]. In this context, Germany has developed the strategy "Industry 4.0", that suggests a change in way of creating value added in manufacturing by applying digitalization and

linking productive units in manufacturing segments [27–29]. The concept comprises the increase of customized outputs—*"mass customization"*—through a profitable production chain, in which machines and tools are prepared for dynamic changes, and based on data, social media and other tools, relevant manufacturing decisions will be taken more quickly and stronger strategic support [30]. Based on the study from The Boston Consulting Group, Inc. (2015), nine foundational technology advances will shape Industry 4.0: (1) Simulation; (2) Horizontal and vertical integration; (3) Industrial internet of things; (4) Cybersecurity; (5) Cloud; (6) Addictive manufacturing; (7) Augmented Reality; (8) Big data and analytics; and (9) Autonomous robots. Although several of these technologies have already been used in the market, the concept of Industry 4.0 aims to transform production by fully integrating the production flow and, consequently, leading to a change in the relationship between suppliers, producers and customers, improving the efficiency and the product customization [31]. Considering these assumptions, for addressing the readiness level from the future employees regarding the topic, we analyzed students' awareness about Industry 4.0 in Brazil and in Germany. We asked Brazilian and German students from STEM courses what their perspectives are regarding the future of industry, their current technical skills, as well as their expectations about the future workplace.

1.3. Research Question and Hypothesis

This research aims to comprehend the main expectations and perspectives from students regarding the current globalization and digitalization of the industrial workplace. Both developments set challenges for universities and learning centers and should be solved different ways. A possible approach to this challenge is first comprehension of the topic, and the development of a corresponding awareness by the students. Therefore, the question of how differently students are cognizant of such technologies is relevant. We chose Brazil and Germany due to their cultural, economic, technological and academic characteristics. Brazil, as a BRIC-country, takes a leading position in South America and Germany, as technological leader, plays an important role in for the European and global economic environment. However, both countries have distinct industrial structures—in terms of research and development (R&D) expenditure, main export products, export market share, among others [32,33]—and also differ considering the academic system and the proportion of population with Bachelor's degrees or higher. Based on the fact that technical and natural science aspects are important parts of the industrial academic qualification—for instance, for enabling digitalization in general as well as digitalization of industry—we focus the survey on students from these areas. We aim to analyze the following hypothesis in this study:

- **H1a:** Students from Brazil and Germany show significant differences regarding the awareness and knowledge perception about the professional meaning of globalization and digitalization, indicating specific country characteristics.
- **H1b:** Students from Brazil and Germany show significant differences regarding the awareness and knowledge perception about the professional meaning of globalization and digitalization, according to their academic experience, measured by the students' current semester in university.

2. Methods

We firstly developed an online and paper-based survey—the overview of the questions can the found at Appendix A—and shared it with students from technical and natural sciences courses from several Brazilian and German universities. However, most of the answers received were from students from Universidade Tecnológica Federal do Paraná, Universidade Federal de São Carlos and Albstadt-Sigmaringen University. Annex 1 depicts the type of answer, objectives and sources for each question on the survey.

From the 2450 the surveys sent, we received 783 answers. For the analysis we considered 733 answered surveys, 512 participants from Brazil and 221 from Germany. From the participants of the study, (1) 40.1% were between 15–20 years old, students aged 21–26 were 50.5% and participants who were between 27–29 years old were 27.6%. (2) The participation of Brazilian students corresponded

to 69% of total participants, while 30.2% were German students. 0.8% of the participants were from other countries. The answers are representative only for a selected group of students from Brazil and Germany.

3. Results

In the first part, we describe the survey results regarding the topic globalization—as a proxy for internationalization. Afterwards, we provide results about digitalization of Industry/"Industry 4.0", aiming to verify the hypothesis H1a/b.

3.1. Descriptive Statistics–Globalization Q3–Q8

Table 1 presents the results of the survey regarding the professional perspectives of the participating students. According to the results, students from both countries have high expectations regarding their professional future. 51.8% of the Brazilian and 71.0% of German surveyed students declared a "very good/good" professional perspective. Considering Brazilian surveyed students, one finds a noteworthy reduction of the optimism about professional future in comparison to the results obtained in 2013 by Continental. Reasons may be the Brazilian economic recession or the complex political situation during the last years—further analyses should be fulfilled. However, by analyzing the students' evaluation regarding personal skills in comparison to national and international students, we find that the students from both countries participating in the survey have approximately similar evaluation of their personal skills in comparison to other students, evaluating their personal abilities as "average" in comparison with their peers—as depicted in Table 2. This differs from the previous study [34], what clearly represents a weaker confidence by the students from Brazil—partly also by students from Germany—regarding their competitive advantages in job market.

Table 1. How do you evaluate your professional perspectives (Q3)?

Item	Survey 2016			Conti.-Survey 2013	
	Total %	Brazil %	Germany %	Brazil %	Germany %
Very good/good	57.6	51.8	71.0	80	72
Average	38.2	42.6	28.1	11	23
Bad/Very Bad	4.2	5.7	0.9	8	4

Notes: Survey based on the data of (1) n = 733 students (Total); (2) n = 512 Brazilian students and (3) n = 221 German students in comparison with an external study, according to the methodology and direct comparison to a similar external research [34].

Table 2. How do you evaluate your personal skills in comparison to national and international students? (Q4)?

Item	Survey 2016			Conti.-Survey 2013	
	Total %	Brazil %	Germany %	Brazil %	Germany %
Very good/good	32.7	26.6	47.1	66	60
Average	58/5	61.9	50.7	21	27
Bad/Very Bad	8.7	11.5	2.3	10	10

Notes: Survey based on the data of (1) n = 733 students (Total); (2) n = 512 Brazilian students and (3) n = 221 German students in comparison with an external study, according to the methodology and direct comparison to a similar external research [34].

We, then, analyze in which regions the participating students would like to work in the future. As presented in Table 3, the data shows that Brazilian surveyed students are more internationally oriented than students in Germany. Around 83% of Brazilian students declared interest in working abroad in the future, while 49% of German participants answered that option. In comparison to the previous study fulfilled by Continental, one can identify a strong trend in the direction of

internationality. The reasons for change could not be defined; however, we suspect that the current economic situation in Brazil may influence the drastic change in the willingness from Brazilian students to work abroad. More oriented research in this topic should be fulfilled.

Table 3. In which regions would you like to work in the future (Q5)?

Item	Survey 2016			Conti.-Survey 2013	
	Total %	Brazil %	Germany %	Brazil %	Germany %
National	27.0	16.8	50.7	71	79
International	73.0	83.2	49.3	29	21

Notes: Survey based on the data of (1) n = 733 students (Total), (2) n = 512 Brazilian students and (3) n = 221 German students in comparison with an external study, according to the methodology and direct comparison to a similar external research [34].

The study also focuses on the main countries in which students from each country would prefer to work. We find that mainly Germany—probably due to the strong economic development—and USA are attractive for the surveyed students from both countries, as seen in Table 4. However, German surveyed students are more prone to work in Germany and Switzerland, while Brazilian students have a global focus.

Table 4. In which countries would you like to work (Q6)?

Item	Survey 2016			Conti.-Survey 2013	
	Total %	Brazil %	Germany %	Brazil %	Germany %
1. Choice:	Germany (39.4)	Germany (25.2)	Germany (72.4)	USA	Switzerland
2. Choice:	USA (19)	Germany (21.9)	USA (25.3)	Europe	USA
3. Choice:	USA (14.6)	USA (15.0)	USA (13.6)	Latin America	Latin America

Notes: Survey based on the data of (1) n = 733 students (Total); (2) n = 512 Brazilian students and (3) n = 221 German students in comparison with an external study, according to the methodology and direct comparison to a similar external research [34].

The Table 5 provides the answers obtained from students for the reasons for working abroad. German students participating in the survey are mainly motivated by higher wages, while Brazilian students have, in general, different motivations for working abroad. However, students from both countries declared "family and relationships" as the main reasons against taking a job abroad—as depicted in Table 6.

Table 5. Why would you take a job abroad (Q7)?

Item	Survey 2016		
	Total %	Brazil %	Germany %
Over average wages	23.7	9.4	57.0
Different Workload	3.1	1.6	6.8
Interesting Work topic	19.1	18.9	19.5
Preparation/Introduction to the culture	15.6	20.9	3.2
Lack of jobs inland	5	6.8	0.9
Better CV	8.6	10.5	4.1
As a part of a career plan	16.4	22.7	1.8
Other reason	8.5	9.2	6.8

Notes: Survey based on the data of (1) n = 733 students (Total); (2) n = 512 Brazilian students and (3) n = 221 German students in comparison with an external study, according to the methodology and direct comparison to a similar external research [34].

Table 6. What would weigh against working abroad (Q8)?

Item	Survey 2016		
	Total %	**Brazil %**	**Germany %**
Family/Relationships	66.2	64.6	69.7
Friends/Acquaintances	6.7	6.8	6.3
Preconceptions against countries	17.5	19.5	12.7
Other reasons	9.7	9.0	11.3

Notes: Survey based on the data of (1) n = 733 students (Total); (2) n = 512 Brazilian students and (3) n = 221 German students in comparison with an external study, according to the methodology and direct comparison to a similar external research [34].

3.2. Descriptive Statistics–Industry 4.0 Q9–Q12

We find that there are crucial differences regarding the surveyed students' awareness of the strategy "Industry 4.0" in Brazil and Germany. Table 7 presents the results for the general question regarding the topic.

Table 7. In which degree do you know the topic "Industry 4.0" (Q9)?

Item	Survey 2016		
	Total %	**Brazil %**	**Germany %**
I did not know the term "Industry 4.0" before this survey	42.4	56.4	10.0
I have already heard about "Industry 4.0", but I do not understand its applications	17.6	17.2	18.6
I know the topic "Industry 4.0" in general and have an idea of possible applications	23.2	15.4	41.2
I know the topic, but I have not had any kind of related preparation during my academic studies	9.0	9.0	9.0
I know the topic and I have already worked with it.	7.8	2.0	21.3

Notes: Survey based on the data of (1) n = 733 students (Total); (2) n = 512 Brazilian students and (3) n = 221 German students in comparison with an external study, according to the methodology and direct comparison to a similar external research [34].

The outcome shows that surveyed Brazilian students are less aware of the topic than the German participants. Around 56% of Brazilian respondents have not heard about Industry 4.0 before the survey, while only 10% of German ones have chosen this option. Such a result is expected due to the strong dissemination of the topic "Industry 4.0" in Germany. However, further studies should be developed for confirming such reasons. For understanding in detail if students are less oriented regarding the terminology or the technologies, we analyze in Table 8 the results of their awareness of the main related technologies in Industry 4.0. We group the answers in distinct clusters, according to the knowledge perception of the students in each topic related to Industry 4.0:

Table 8. Clusters used in the analysis of Question Q10.

Cluster	Response for Question 10a-j: No, I do not know this process/technology
A	>=50%
B	49–40%
C	39–30%
D	29–20%
E	<=20%

The clusters group answers according to the perception from students regarding the technology/process, i.e., technologies declared by more than 50% of respondents as "unknown" were

assigned to cluster A. Based on that, one can find the following outcomes for the Brazilian surveyed students: **Cluster A**: (a) Big-Data-Driven Quality Control processes and technologies; (i) Additive Manufacturing of Complex Parts; and (j) Augmented Work, Maintenance and Service; **Cluster B:** (e) Smart Supply Network technologies; (f) Predictive Maintenance; (h) Self-Organizing Production; **Cluster C:** (b) Robot-Assisted Production; (c) Self-Driving Logistics Vehicles; (d) Production Line Simulation; and (g) Machines as a Service. **Cluster D and E**: none of the technologies/processes.

For the German students, we find the following distribution: **Cluster A:** none of the technologies/processes; **Cluster B:** (f) Predictive Maintenance; and (j) Augmented Work, Maintenance and Service; **Cluster C:** (a) Big-Data-Driven Quality Control; and (i) Additive Manufacturing; **Cluster D/E**: other technologies/processes. The results presented in Table 8 (Q10) confirm the obtained findings from Table 7 (Q9): the term "Industry 4.0" as well as the involved technologies are less known by Brazilian surveyed students in comparison to German students.

Question (Q11) comprises the students' expectations about the future workplace. For this analysis, we also divide into different clusters, according to the Table 9. For the Brazilian students, the survey shows that: **Cluster A:** only the statement (a) "Academic jobs will be automated and substituted by machines" is denied by more than 50% of the participants, therefore, being assigned to Cluster A. **Cluster B and C:** none of the statements were assigned to these clusters; **Cluster D**: the statement (b) "Business jobs will be automated"; **Cluster E**: all other statements: (c) Research and Development will be more important; (d) The cooperation between Universities and Companies will be intensified; (e) There will be different jobs and career in comparison to current jobs; (f) There will be new products on the market and companies will require new knowledge for product development; (g) New technologies and processes will drastically change the production line; (h) The cooperation between teams will be more important (i); The institutional borders between companies will become less strict (e.g., more interinstitutional projects); (h) The cooperation between teams will be more relevant. When considering the result for German students, one finds a similar pattern. **Cluster A and B:** No statement is assigned; **Cluster C**, one finds only the statement (a) "Academic jobs will be automated and substituted by machines"; **Cluster D** does not contain any statement; **Cluster E:** all other statements. In conclusion, there are no essential differences between the expectations from surveyed Brazilian students and German students regarding the effects from digitalization in their future workplace. Surveyed students from both countries expect a huge leap into a more integrated workplace with drastic changes in the way teams, companies and institutions interact.

Table 9. Clusters used in the analysis of Question Q11.

Cluster	Response for Question 11a-i: No, I do not agree with such statement
A	>=50%
B	49–40%
C	39–30%
D	29–20%
E	<=20%

The final question (Q12) analyzes the perspective of students regarding the relevance of different technologies. Here, the participating Brazilian students declared as current relevant technology Web 2.0/mobile gadgets (73.8%); while cyber-physical-systems/Internet of things (55.3%), additive manufacturing (57.4%) and wearables (62.7%) were defined as relevant technologies only from 2025. On the other hand, surveyed German students also consider Web 2.0/mobile gadgets as technologies with a current relevance (81.9%), but cyber-physical-systems (49.8%) and additive manufacturing (62.9%) are also in this cluster. Wearables, just as defined by Brazilian students, are not considered current relevant by German students and may be more applicable in industry after 2025 (61.1%).

3.3. Analytical Statistics–Questions Q1–Q12

For verifying the hypothesis we use regression analysis [35] as a method to identify possible dependences between awareness about the topics and educational level as well as specific country characteristics. Firstly, we analyze a possible correlation between place of birth (Q1c), current semester (Q2c) and questions related to internationality Q3–Q5. Table 10 presents the results of this analysis.

Table 10. Correlation analysis according to Bravis-Pearson—Internationality.

Variables		Q1c.	Q2c.	Q3.	Q4.	Q5.
Q1c.	Pearson Correlation	1	−0.214 **	0.191 **	0.229 **	−0.350 **
	Sig. (2-tailed)		0.000	0.000	0.000	0.000
	N	733	733	733	733	733
Q2c.	Pearson Correlation	−0.214 **	1	−0.306 **	0.020	0.006
	Sig. (2-tailed)	0.000		0.000	0.585	0.873
	N	733	733	733	733	733
Q3.	Pearson Correlation	0.191 **	−0.306 **	1	0.218 **	0.009
	Sig. (2-tailed)	0.000	0.000		0.000	0.816
	N	733	733	733	733	733
Q4.	Pearson Correlation	0.229 **	0.020	0.218 **	1	−0.023
	Sig. (2-tailed)	0.000	0.585	0.000		0.535
	N	733	733	733	733	733
Q5.	Pearson Correlation	−0.350 **	0.006	0.009	−0.023	1
	Sig. (2-tailed)	0.000	0.873	0.816	0.535	
	N	733	733	733	733	733

Notes: **. Correlation is significant at the 0.01 level (2-tailed); Q1c = Place of Birth; Q2c = Current Semester; Q3 = Evaluation of Professional Perspectives; Q4 = Evaluation of personal skill in international context; Q5 = Preference for working regions.

The results indicate that is a highly significant correlation between Place of Birth (Q1c) and Evaluation of Professional Perspectives (Q3) with r = 0.191 and between Place of Birth (Q1c) and Evaluation of Personal Skill in International Context (Q4) with r = 0.229. However, the strongest correlation exists between Place of Birth (Q1c) und Preference for Working Regions (Q5) with r = −0.350. The results also show correlation between Current Semester (Q2) and Evaluation of Professional Perspectives (Q3) with r = −0.306. However, the magnitude of correlations can be defined as weak [36]. The analysis of the linear regression, defining Preference for working region (Q5) as dependent variable and Place of Birth (Q1c) and Current Semester (Q2c) as independent variables, shows the following outcome (Table 11):

Table 11. Linear Regression analysis—Internationality.

Model	B	Std. Error	Beta	t	Sig.	VIF
(Constant)	2.237	0.057		39.589	0.000	
Q1c	−0.354	0.034	−0.366	−10.332	0.000	1.048
Q2c	−0.012	0.006	−0.072	−2.043	0.041	1.048

Notes: Preference for Working region (Q5) as dependent variable. R = 0.357 and R^2 = 0.128, defined as non-relevant; Durbin-Watson of 2.0, what excludes autocorrelation; VIF-Value < 10.

Based on the coefficient of determination R^2 = 0.128, we find that an only a small part of the variance in the data can be explained by the independent variables. Thus, Place of Birth (Q1c) and Current Semester (Q2c) poorly explain the interest for a workplace abroad in the future (Q5). An analysis by country of Current Semester (Q2c) and Preference for Working Region (Q5) shows that the current semester of students is not related to their interest of working abroad, neither in Brazil nor

in Germany. Place of Birth (Q1c), on the other hand, seems to be related to their interest in a job in a foreign country. The data shows that participating students from Brazil reveal a higher interest in working abroad in comparison to the German students.

Secondly, we analyze correlations between Place of Birth (Q1c) and Current Semester (Q2c) and the awareness of the topic digitalization/Industry 4.0 (Q9). Table 12 presents the results obtained for this analysis. The results indicate that the place of birth (Q1c) and the confidence with digitalization/Industry 4.0 (Q9) a highly significant correlation [36] with r = 0.463. On the other hand, the correlation between the awareness of digitalization/Industry 4.0 (Q9) and the current semester (Q2c) is weak, confirmed by the r = 0.142.

Table 12. Correlation analysis according to Bravis-Pearson-Digitalization.

Variables		**Q1c.**	**Q2c.**	**Q9.**
Q1c.	Pearson Correlation	1	−0.214 **	0.463 **
	Sig. (2-tailed)		0.000	0.000
	N	733	733	733
Q2c.	Pearson Correlation	−0.214 **	1	0.142 **
	Sig. (2-tailed)	0.000		0.000
	N	733	733	733
Q9.	Pearson Correlation	0.463 **	0.142 **	1
	Sig. (2-tailed)	0.000	0.000	
	N	733	733	733

Notes: **. Correlation is significant at the 0.01 level (2-tailed); Q1c = Place of Birth; Q2c = Current Semester; Q9 = Awareness of the topic Digitalization/Industry 4.0.

In this context, we also analyze the data by country. The result of the linear regression for the Brazilian analysis, using the awareness of digitalization/Industry 4.0 (Q9) as dependent variable and current semester (Q2c) as independent variable, is presented on Table 13.

Table 13. Linear Regression analysis—Brazil-Industry 4.0.

		Unstandardized Coefficients		**Standardized Coefficients**		
Model		B	Std. Error	Beta	T	Sig.
1	(Constant)	1.567	0.090		17.378	0.000
	Q2c.	0.058	0.017	0.150	3.426	0.001

Notes: Awareness of digitalization/Industry 4.0 (Q9) as dependent variable. R = 0.150 and R^2 = 0.022, defined therefore as non-relevant.

The outcome for Brazilian students shows that the semester (Q2c) does not explain the degree of knowledge of digitalization/Industry 4.0. Table 14 presents the results for the same analysis considering the surveyed German students.

Table 14. Linear Regression analysis—Germany-Industry 4.0.

		Unstandardized Coefficients		**Standardized Coefficients**		
Model		B	Std. Error	Beta	T	Sig.
1	(Constant)	2.137	0.110		19.413	0.000
	Q2c.	0.312	0.028	0.607	11.291	0.000

Notes: Awareness of digitalization/Industry 4.0 (Q9) as dependent variable. R = 0.607 and R2 = 0.368, defined therefore as relevant.

The analysis of the coefficient of determination R^2 = 0.368 shows that the variance of data over the current semester (Q2c) can be better explained by the considered independent variable. In other words,

the results demonstrate that the German participants from later semesters perceive a better knowledge of digitalization/Industry 4.0 compared to their fellow students from first semesters. Such relationship could not be found in the analysis for Brazilian students.

4. Discussion

Based on the above-presented results, we can infer the following acknowledgement regarding the hypothesis:

Hypothesis H1a could not be falsified due to the fact that surveyed students from technological and natural sciences in Brazil and Germany exhibit significant differences regarding the awareness about the Internationality and digitalization of the industry/Industry 4.0. The expectations from participating students regarding career (Q3) and personal skills in an international context (Q4) are found to be similar in both countries. However, Brazilian students are more internationally oriented in comparison with German students (Q5). Regarding desired countries in which students would be most prone to work (Q6), Brazilian participants choose Germany and the USA as main destinations. Most of the surveyed German students considered are more willing to work inland. Internationally, these students see the USA as an attractive country. When considering the reasons for working abroad (Q7), we find several differences: surveyed Brazilians see that as a part of career plan and expect a good introduction into a new culture, while Germans are motivated to go abroad mainly by higher wages. On the other hand, the main reasons weighing against working abroad are similar between students from both countries: family and significant others are the main reasons weighing against a job abroad. The survey also shows that participating German students are more aware about the term "Industry 4.0" (Q9). Although that is an expected result, due to the fact that the term has been created and strongly advertised in Germany, by assessing the students' skill in several related technology and processes we find that Brazilian students participating in the survey are, in fact, less aware of the technologies involved in the digitalization of industry (Q10). The analysis of the students' expectations for workplace development in the coming years (Q11) leads to no significant differences as well as the analysis of the students' perspectives regarding different technologies up to 2025 (Q12). We analyze if the place of birth of a student has a significant influence for his or her professional understandings of internationalization and digitalization of Industry. As result, we find that the students from Brazil have different motivations on internationalization and digitalization in comparison to the surveyed German students. The interest for an international career is, in Brazil, more disseminated than in Germany; however, the awareness of the term "Industry 4.0" and the related technologies and processes is stronger in German students than in Brazilian ones.

Hypothesis H1b aims to analyze the influence of a student's academic experience on the awareness of the term "Industry 4.0" and its related technologies and processes. We find that no significant influence is found in the analysis of the answers from Brazilian participants. However, German students from later academic semesters declared a higher awareness regarding the topic in comparison with German students from the first semesters of the degree program.

5. Conclusions

Thus, we find that Brazilian and German surveyed students have bold differences in knowledge perception and perspectives of the topics internationalization and "Industry 4.0" as professional factors. Based on these findings, we define the following implications: (1) German students demonstrate, in comparison to Brazilian surveyed students, a stronger interest in working inland and, therefore, it demands motivating German students into a more international environment (see benefits of international career in the literature review). (2) Brazilian surveyed students, on the other hand, show an increased international open-mindedness. Such characteristics can lead into positive personal and professional outcomes, such as improved personal development, more international partnerships and networking development, among others. (3) German students perceive a better knowledge of industrial digitalization/Industry 4.0. Therefore, there is a knowledge demand from Brazilian surveyed students

in these topics. (4) German students from later semesters participating in the survey have declared a deeper understanding of the technologies and processes involved in the industrial digitalization. Even though, based on the low share of students that have worked with such technologies, universities, government and companies may not have been addressing the industrial challenges in a proper way and should, therefore, work together to develop awareness on their future professionals, aiming the reach of a better economic and industrial situation in both countries.

The limitations of the research were the unbalanced number of participants from Brazil and Germany, the fact that "Industry 4.0" has been advertised in the German media in comparison to Brazil and the disadvantages of a self-evaluated survey, in which characteristics such as confidence and self-esteem play an important role in their own assessment of personal skills.

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

Appendix A

Table A1. Overview of the Questions.

Item	Description	Scale	Objective	Source
Part A	**General Information:**			
1.	(a) How old are you?	Age		
	(b) Sex	m/f	Collection of personal data	[37]
	(c) Place of Birth	Country		
2.	(a) University	Name		
	(b) Degree Program	Name	Collection of academic data	[37]
	(c) Current Semester	Number		
Part B	**Globalization:**			
3.	How do you evaluate your professional perspectives?	1–3	Self-Evaluation	[34]
4.	How do you evaluate your personal skills in comparison to national and international students?	1–3	Self-Evaluation	[34]
5.	In which regions would you like to work in the future? Choices: (a) In the region where I currently live (b) In certain regions of Germany/ Brazil (c) Everywhere in Germany/Brazil; (d) In certain regions worldwide	1	Preference – Inland or abroad	[34]
6.	In which countries would you like to work? Choices: (a) 1. Choice; (b) 2. Choice; (c) 3. Choice	Name	Preference for countries to work	[34]
7.	Why would you take a job abroad? Choice: (a) Over average wages; (b) Different Workload; (c) Interesting Work topic; (d) Nice preparation/introduction to the culture (e) Lack of jobs inland; (f) Better CV; (g) As a part of a career plan; (h) Other reasons	1	Reasons for working abroad	[34]
8.	What would weigh against working abroad? Choice: (a) Family/Relationship; (b) Friends/Acquaintances; (c) Preconceptions against countries; (d) Other reasons	1	Reason against working abroad	[34]
Part C	**Digitalization**			
9.	In which degree do you know the topic „Industry 4.0"? Choice: (a) I did not know the term „Industry 4.0" before this survey; (b) I have already heard about „Industry 4.0", but I do not understand its applications; (c)I know the topic „Industry 4.0" in general and have an idea of possible applications; (d) I know the topic, but I have not had any kind of related preparation during my academic studies; (e) I know the topic and I have already worked with it.	1	Knowledge about the topic Digitalization/Industry 4.0	[38]
10.	Do you know these technologies or processes related to Digitalization/Industry 4.0? Choices: (a) Big-Data-Driven Quality Control; (b) Robot-Assisted Production; (c) Self-Driving Logistics Vehicles; (d) Production Line Simulation; (e) Smart Supply Network;(f)Predictive Maintenance; (g) Machines as a service; (h) Self-Organizing Production; (i) Additive Manufacturing of Complex Parts; (j) Augmented Work, Maintenance and Service	1–5	Knowledge about the topic Digitalization/Industry 4.0 in detail	[39]

Table A1. *Cont.*

Item	Description	Scale	Objective	Source
11.	In which extend do you agree with the following sentences? Choices:(a) Academic jobs will be automated and substituted by machines (b) Business jobs will be automated (c) Research and Development will be more important (d) The cooperation between Universities and Companies will be intensified (e) There will be different jobs and career in comparison to current jobs (f)There will be new products on the market and companies will require new knowledge for product development (g) New technologies and processes will drastically change the production line (h) The cooperation between teams will be more important (i) The institutional borders between companies will become less strict (eg.: more interinstitutional projects) (h) The cooperation between teams will be more relevant.	1–5	Expectations about the influence of Digitalization/Industry 4.0 on the workplace	[40]
12.	Under Industry 4.0/Digitalization there are discussions about different technologies and scenarios. When do you expect that the following technologies will achieve industrial relevance? Choice: (a) Web 2.0/Mobile Gadgets; (b) Cyber-Physical-Systems/Internet of Things (Connectivity between machines and processes); (c) Additive manufacturing (= Laser-Sintering, 3D-Druck etc.); (d) Wearables, such as "Intelligent Gloves" or Virtual Reality gadgets.	1–3	Evaluation of the relevance of technologies connected to Digitalization/Industry 4.0	[38]

Notes: Questions, which were used for the survey.

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