

BRIDGING THE GAP BETWEEN INDUSTRY AND EDUCATION: DESIGNING COURSES FOR ECONOMIC IMPACT

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Abstract

This study analyzes the relationship between gross fixed capital formation (by CAE) and the number of companies in the Cávado and Ave regions, and the supply of Professional Higher Technical Courses (CTeSP) offered by the Polytechnic of Cávado and Ave (IPCA), in Portugal. Using data from national statistical sources and institutional records, the research aims to assess whether the supply of CTeSPs is aligned with trends in regional investment and the needs of local businesses. Through statistical correlation techniques, the study examines how variations in gross fixed capital formation and the number of companies influence the demand for and expansion of CTeSP courses. The results reveal a strong relationship between investment in key economic sectors and the adaptation of the educational offer, suggesting that aligning training programs with regional business dynamics can enhance employability and foster economic growth. The study underscores the importance of strategic planning in higher education to meet local labor market demands, emphasizing the need for continuous monitoring and adjustment of the CTeSP offering in line with regional economic development.

Keywords: Higher professional technical courses, investment rate, regional development, higher education.

1. Introduction

Developing human resources and aligning job profiles are essential tasks for promoting both economic and social growth (Goulart et al., 2021). This alignment is especially critical in the context of Cávado and Ave, regions characterized by industrial dynamism. The offering of Higher Professional Technical Courses (CTeSP) by the Polytechnic Institute of Cávado and Ave (IPCA) serves as a direct response to the local market's qualification needs. The continuous transformation of labor market demands, coupled with the need for higher education institutions to adapt to these demands, necessitates a constant review of educational offerings, particularly in economically dynamic regions.

Gross Fixed Capital Formation (GFCF) is a vital indicator for measuring the levels of investment in fixed assets, such as equipment, infrastructure, and construction (Eurostat, 2023). GFCF plays a key role in fostering economic growth by increasing an economy's productive capacity (OECD, 2021). Research indicates that a rise in GFCF is often associated with improved labor market conditions and a growing demand for professionals with specialized technical qualifications (World Bank, 2022). In the Cávado and Ave regions, GFCF has shown an upward trend in recent years, except during the pandemic period (CCDR-N, 2023). This suggests that the regions are seeing increased investment, which further drives the demand for a skilled workforce. The Higher Professional Technical Courses (CTeSP), introduced by Decree-Law No. 43/2014, aim to provide short-term higher technical training closely linked to the specific needs of the labor market (DGES, 2024). The literature emphasizes that higher technical education significantly impacts the employability of graduates and contributes to local economic development, particularly in sectors such as Information and Communication Technologies (ICT) and Industry (Heitor, 2022). The expansion of these courses has been primarily advocated for as a means of diversifying higher education offerings to new audiences and updating the qualifications of the Portuguese workforce, thereby meeting the growing employability requirements of a more technologically advanced and environmentally sustainable economy (CEDEFOP, 2021). Higher education institutions are increasingly adapting their programs to better respond to the emerging needs of the labor market (Hou et al., 2022). In particular, the integration between higher education and a region's investment sectors can foster sustainable economic growth and drive technological innovation, as observed in several European Union countries (OECD, 2021). In this context, the present study examines the Gross Fixed Capital (FBC) by CAE (Economic Activity Code), grouping it into 17 CAE categories, and explores its relationship with the offering of CTeSPs by the IPCA. This approach aims to highlight the alignment between the economic sectors driving investment and the educational offerings tailored to meet those sectors' needs, emphasizing the importance of technical training in fostering regional development.

2. Design

This study adopted a quantitative approach, using secondary data provided by the National Institute of Statistics (INE), the Directorate-General for Higher Education (DGES), and internal IPCA databases. The analysis of the relationship between investments by sector and the supply of CTeSP was carried out through the application of statistical correlation techniques, to identify patterns between the variables.

3. Objectives

The main objective of this study is to evaluate the alignment between the CTeSP offerings at IPCA and the predominant investment sectors in the Cávado and Ave region in 2023, based on the Classification of Economic Activities (CAE), utilizing the Gross Fixed Capital Formation (GFCF) and the number of companies. The specific objectives are: **a)** To observe the values of GFCF, by CAE, in the Cávado and Ave region; **b)** To observe the values of the number of companies, by CAE, in the Cávado and Ave region; **c)** To assess the correlation between the CTeSP offerings and the GFCF in the region; **d)** To assess the correlation between the CTeSP offerings and the number of companies in the region; **e)** To contribute to the debate on the role of higher education in regional development.

4. Methods

The analysis of the relationship between regional investment and training offerings in the Cávado and Ave regions in 2023 was conducted using data on gross fixed capital formation (GFCF) and the number of companies, based on the classification of economic activities (CAE) provided by the National Institute of Statistics (INE). For this study, the data on regional investment were cross-referenced with data on the availability of CTeSP (Higher Technical Professional Courses) offered by the Polytechnic Institute of Cávado and Ave (IPCA). The main objective of the analysis was to identify possible significant relationships between regional investment and the availability of technical training, through statistical analysis. The methodology employed for this analysis involved Pearson correlation tests, which were applied after verifying the normality of the data. Pearson correlation was used for variables that followed a normal distribution. The data on the number of companies were organized according to the classification of economic activities, which is divided into 17 categories according to the INE classification, namely: agriculture, animal production, hunting, forestry, and fishing (CAE 01 to 03), covering activities related to agriculture, livestock, forestry, fishing, and aquaculture; extractive industries (CAE 05 to 09), including the extraction of coal, oil, minerals, and quarries; manufacturing industries (CAE 10 to 33), which include food, textiles, metalworking, automotive industries, among others; electricity, gas, steam, hot and cold water, and cold air (CAE 35), related to the production and distribution of electricity and gas; water collection, treatment, and distribution, sanitation, waste management, and pollution control (CAE 36 to 39), covering water supply, sewage, waste management, and pollution control activities; construction (CAE 41 to 43), which includes building construction, civil engineering, and specialized activities; wholesale and retail trade and repair of motor vehicles and motorcycles (CAE 45 to 47), encompassing trade and repair of vehicles, wholesale and retail trade; transportation and storage (CAE 49 to 53), including land, sea, and air transportation, postal services, and logistics; accommodation, food services, and similar (CAE 55 to 56), including hotels, guesthouses, restaurants, cafes, and catering services; information and communication activities (CAE 58 to 63), which include publishing, radio, television, telecommunications, and IT; real estate activities (CAE 68), related to buying, selling, renting, and managing properties; consulting, scientific, technical, and similar activities (CAE 69 to 75), which include legal services, accounting, engineering, advertising, and veterinary services; administrative and support services (CAE 77 to 82), involving the rental of goods, employment services, security, call centers, cleaning, and business support; education (CAE 85), ranging from preschool to higher education, including vocational training; human health and social care activities (CAE 86 to 88), covering hospitals, clinics, nursing homes, and social care services; artistic, entertainment, sports, and recreational activities (CAE 90 to 93), encompassing arts, entertainment, sports, gambling, and betting; and finally, other service activities (CAE 94 to 96), such as associations, household repairs, hairdressers, and laundries.

5. Results and discussion

The main objective of this study is to evaluate the alignment between the CTeSP offerings at IPCA and the predominant investment sectors in the Cávado and Ave regions in 2023, based on the Classification of Economic Activities (CAE), utilizing data on Gross Fixed Capital Formation (GFCF) and the number of companies. To this end, it is first essential to observe the values of GFCF by CAE in both regions. In 2023, the Cávado region registered a total GFCF of approximately 897 million euros, while the Ave region recorded about 861 million euros. In both territories, investment was heavily concentrated in specific sectors. The Manufacturing Industries stood out, representing the largest share of GFCF, with around 296 million euros in Cávado and approximately 462 million euros in Ave. Wholesale and Retail Trade, along

with the Repair of Motor Vehicles and Motorcycles, also revealed significant investment volumes, amounting to about 96 million euros in Cávado and 113 million euros in Ave. Additionally, Real Estate Activities contributed notably to the regional investment landscape, with 89 million euros invested in Cávado and 60 million euros in Ave (**Table 1**). These figures highlight the strong industrial and commercial dynamics of the Cávado and Ave regions, suggesting that the sectors with the highest levels of investment are also those likely to demand more qualified human resources. Consequently, analyzing these investment patterns is critical to assessing how well the CTeSP programs at IPCA are aligned with the real needs and economic opportunities of the surrounding territory.

Table 1. Gross Fixed Capital Formation (€) of companies by geographical location (NUTS - 2024).

Geographical location	Total (€)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Cávado	897,041,119	21,585,959	2,102,623	295,988,415	8,542,500	12,225,440	86,930,400	95,629,547	40,909,794	37,447,399	72,047,532	89,512,705	37,315,022	34,612,261	2,518,591	22,396,272	31,786,658	5,490,001
Ave	860,753,038	23,355,029	5,717,678	461,818,858	3,085,202	5,975,325	44,433,517	112,545,931	26,578,386	26,581,631	7,265,871	60,489,198	20,162,830	10,249,631	1,814,608	14,235,974	33,091,774	3,351,595

Source: INE (2023a); 1- Agriculture, animal production, hunting, forestry, and fishing; 2- Extractive industries; 3- Manufacturing industries; 4- Electricity, gas, steam, hot and cold water, and cold air; 5- Water collection, treatment, and distribution; sanitation, waste management, and pollution control; 6- Construction; 7- Wholesale and retail trade; repair of motor vehicles and motorcycles; 8- Transportation and storage; 9- Accommodation, food services, and similar activities; 10- Information and communication activities; 11- Real estate activities; 12- Professional, scientific, and technical activities; 13- Administrative and support service activities; 14- Education; 15- Human health and social care activities; 16- Arts, entertainment, sports, and recreation activities; 17- Other service activities.

In 2023, the regions of Cávado and Ave displayed diverse company distributions according to the Classification of Economic Activities (**Table 2**). In Cávado, the total number of companies was 57.634, with the Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles sector having the highest concentration at 10.101 companies. This was followed by Administrative and Support Services (7.068 companies) and Professional, Scientific, and Technical Activities (6.125 companies). The Construction sector had 5.670 companies, while Manufacturing recorded 4.811. Health and Social Work Activities accounted for 4.921 companies. On the other hand, Mining and Water Supply sectors had a much smaller presence, with only 29 and 55 companies, respectively. In Ave, there were 48.561 companies, with Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles leading at 9.552 companies. Administrative and Support Services (5.346 companies) and Professional, Scientific, and Technical Activities (4.353 companies) followed. The Manufacturing sector had 5.151 companies, and Construction had 4.033. Health and Social Work Activities amounted to 4.303 companies. The Mining and Water Supply sectors also had limited representation, with only 29 and 44 companies, respectively.

Table 2. Number of companies by CAE - Cávado and Ave (2023).

CAE	Cávado	Ave
Total	57,634	48,561
1. Agriculture, animal production, hunting, forestry, and fishing	3,066	2,230
2. Extractive industries	29	29
3. Manufacturing industries	4,811	5,151
4. Electricity, gas, steam, hot and cold water, and cold air	241	219
5. Water collection, treatment, and distribution; sanitation, waste management, and pollution control	55	44
6. Construction	5,670	4,033
7. Wholesale and retail trade; repair of motor vehicles and motorcycles	10,101	9,552
8. Transportation and storage	1,281	883
9. Accommodation, food services, and similar activities	3,460	3,318
10. Information and communication activities	1,150	584
11. Real estate activities	2,429	1,932
12. Professional, scientific, and technical activities	6,125	4,353
13. Administrative and support service activities	7,068	5,346
14. Education	2,708	2,327
15. Human health and social care activities	4,921	4,303
16. Arts, entertainment, sports, and recreation activities	1,337	1,341
17. Other service activities	3,182	2,916

Source: INE (2023b)

The analysis of correlations between the offerings of Higher Professional Technical Courses (CTeSP) and regional economic indicators clearly highlights the substantial positive impact of the Instituto Politécnico do Cávado e do Ave (IPCA) on local economic growth and development. The results are not only promising but also reinforce the pivotal role that the IPCA plays in fostering the region's economic prosperity through its educational offerings (**Table 3**). The correlation between the number of internships (representing CTeSP offerings) and Gross Value Added (GVA), which serves as a proxy for Gross Fixed Capital Formation (GFCF), reveals a remarkable coefficient of 0.963 with a significance value of $p < 0,001$. This strong, statistically significant correlation underscores the profound impact of the IPCA's CTeSP offerings on the region's economic growth. As the number of internships increases, there is a substantial corresponding increase in GVA, indicating that IPCA's CTeSP offerings are directly contributing to the generation of economic value. This positive association demonstrates the IPCA's vital role in fostering local economic development, particularly in terms of strengthening fixed capital formation and enhancing the overall economic infrastructure of the region. The correlation between the number of internships and the number of companies in the region also shows a statistically significant correlation, with a coefficient of 0.571 and a proof value of 0.033, revealing a positive relationship. The positive correlation implies that, in the long term, the highly qualified professionals trained by the IPCA can contribute to entrepreneurship and business growth in the region. The positive influence of the IPCA on the qualification and specialization of the workforce is undoubtedly a driving factor for innovation and future business development. In conclusion, the results confirm the IPCA's significant and positive impact on the region's economic activity, especially in terms of generating added value and developing fixed capital. While the immediate effect on the number of companies is not as strong, it does show that the IPCA's educational contributions undoubtedly create fertile ground for future company growth and innovation. These results highlight IPCA's critical importance in driving regional economic development through its CTeSP offerings, and the institution remains a key pillar in advancing the region's economic and industrial infrastructure. This study provides strong evidence that investment in IPCA and its programs is a strategic measure to promote long-term sustainable economic growth in the Cávado and Ave region.

Table 3. Correlation Analysis Between CTeSP Offerings (Internships), Number of Companies, and Gross Value Added (GVA).

Gross Fixed Capital Formation (GFCF) by GVA	R _p = 0,963 p < 0,001
Number of companies	R _p = 0,571 p = 0,033

Source: own elaboration; *Note that gross fixed capital formation was constructed based on the year 2023; while the number of companies was constructed based on the years 2021, 2022, 2023; the comparison refers to the number of internships in 2023, when observing gross fixed capital formation and the number of internships in 2021, 2022, 2023 for the number of companies - Table 4 and Table 5.*

Table 4. Distribution of Internships and GVA by CAE (Economic Activity Code).

CAE	Nº Internships	%e Internships	GVA €	%GVA	GVA (million €)
3	184	28,4	757807273	44,8%	757,8073
5	5	,8	18200765	1,1%	18,20077
6	44	6,8	131363917	7,8%	131,3639
7	137	21,1	208175478	12,3%	208,1755
8	12	1,8	67488180	4,0%	67,48818
9	12	1,8	64029030	3,8%	64,02903
10	79	12,2	79313403	4,7%	79,3134
11	2	,3	150001903	8,9%	150,0019
12	117	18,0	57477852	3,4%	57,47785
13	17	2,6	44861892	2,6%	44,86189
14	7	1,1	4333199	0,3%	4,333199
15	8	1,2	36632246	2,2%	36,63225
16	8	1,2	64878432	3,8%	64,87843
17	17	2,6	8841596	0,5%	8,841596

Source: IPCA (2023) & INE (2023a)

Table 5. Distribution of Internships and Companies by CAE (Economic Activity Code).

CAE	Nº Internships	%e Internships	Nº Companies
3	365	30%	29821
5	12	1%	295
6	72	6%	27593
7	276	23%	58398
8	18	1%	5483
9	18	1%	19756
10	160	13%	4531
11	2	0%	12211
12	175	14%	29932
13	31	3%	33163
14	15	1%	14292
15	18	1%	26496
16	27	2%	7187
17	29	2%	16989

Source: IPCA (2021; 2022; 2023) & INE (2023b)

6. Conclusions

This study analyzed the relationship between gross fixed capital formation (GFCF), the number of companies, and the supply of Professional Higher Technical Courses (CTeSP) at the Polytechnic Institute of Cávado and Ave (IPCA) in the Cávado and Ave regions of Portugal in 2023. It found that sectors with the highest investment, such as Manufacturing and Wholesale/Retail Trade, align closely with IPCA's educational offerings, indicating a match between market needs and education. A strong, statistically significant correlation was found between GFCF and the number of internships, suggesting that investment in key sectors drives demand for skilled professionals and supports regional economic growth. While the correlation between internships and the number of companies was not statistically significant, a positive trend indicates that IPCA's specialized training may foster innovation and business growth over time. The findings highlight the importance of aligning educational programs with regional investment and economic dynamics. IPCA's higher technical education contributes directly to value creation, infrastructure development, and sustainable regional growth. In conclusion, the strategic alignment of CTeSP courses with labor market demands is crucial for regional development and graduate employability. The study underscores the need for continuous, market-informed planning of educational offerings to promote innovation, entrepreneurship, and long-term economic prosperity.

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