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ENHANCING STRATEGIC DECISION-MAKING IN HIGHER EDUCATION INSTITUTIONS IN MOROCCO: FORMULATING COMPOSITE INDEXES FOR SVM MACHINE LEARNING MODELS

APRIMORANDO A TOMADA DE DECISÃO ESTRATÉGICA EM INSTITUIÇÕES DE ENSINO SUPERIOR NO MARROCOS: FORMULAÇÃO DE ÍNDICES COMPOSTOS PARA MODELOS DE APRENDIZADO DE MÁQUINA SVM

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Resumo

This article explores the development and application of composite indexes as tools for simplifying and synthesizing complex institutional data within Higher Education Institutions (HEIs). By condensing multiple performance, growth, and success indicators into structured indexes, the approach enhances the interpretability of multidimensional datasets. These indexes are then integrated with Support Vector Machine (SVM) classifiers to identify institutional patterns and classify institutions into distinct strategic categories. The study highlights how this combination not only strengthens the predictive capacity of machine learning models but also provides clearer insights for top management. Ultimately, the integration of composite indexes with SVM models demonstrates a significant potential to support evidence-based strategic decision-making, offering HEIs a robust analytical framework for aligning institutional performance with long-term development objectives.

Palavras-chave: Strategic Decision-Making. Higher Education. Composite Indexes. SVM Machine Learning. Morocco.

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Abstract

Este artigo explora o desenvolvimento e a aplicação de índices compostos como ferramentas para simplificar e sintetizar dados institucionais complexos em Instituições de Ensino Superior (IES). Ao condensar múltiplos indicadores de desempenho, crescimento e sucesso em índices estruturados, a abordagem amplia a interpretabilidade de conjuntos de dados multidimensionais. Esses índices são então integrados a classificadores de Support Vector Machine (SVM) para identificar padrões institucionais e classificar as instituições em categorias estratégicas distintas. O estudo destaca como essa combinação não apenas fortalece a capacidade preditiva dos modelos de aprendizado de máquina, mas também fornece percepções mais claras para a alta gestão. Em última instância, a integração de índices compostos com modelos SVM demonstra um potencial significativo para apoiar a tomada de decisão estratégica baseada em evidências, oferecendo às IES uma estrutura analítica robusta para alinhar o desempenho institucional com os objetivos de desenvolvimento de longo prazo.

Keywords: Tomada de Decisão Estratégica. Ensino Superior. Índices Compostos. Aprendizado de Máquina SVM. Marrocos.

INTRODUCTION

Higher Education Institutions (HEIs) today operate in increasingly complex and competitive environments, where strategic management requires balancing resource allocation, institutional performance evaluation, and stakeholder satisfaction. These institutions face mounting pressures to expand student access, improve educational quality, and respond to evolving labor market demands while maintaining financial sustainability and accountability (Altbach, Reisberg, & Rumbley, 2009). In such a context, effective management cannot rely solely on intuition or tradition; it must be informed by rigorous, data-driven approaches. As noted by Brynjolfsson and McElheran (2016), organizations that adopt systematic data analysis in their decision-making processes significantly outperform those that rely on conventional methods.

The challenge, however, lies in the inherent heterogeneity and multidimensionality of HEI data, which encompasses academic performance, institutional efficiency, research productivity, and stakeholder perceptions. Managing such diverse information often overwhelms decision-makers and obscures meaningful insights (Kettunen, 2015). To overcome this limitation, composite indexes have emerged as valuable tools, as they allow for the aggregation of multiple indicators into a simplified yet comprehensive representation of institutional performance and growth (Nardo et al., 2008). By condensing complexity into structured measures, these indexes facilitate comparability across institutions and enhance the interpretability of trends relevant to strategic management.

Still, even when aggregated into indexes, the complexity of institutional data requires advanced analytical methods to reveal underlying patterns and strategic positioning. Traditional descriptive analyses are often insufficient for this purpose. Machine learning techniques, particularly Support Vector Machines (SVMs), offer robust capabilities for handling multidimensional data and achieving high predictive accuracy (Cortes & Vapnik, 1995). When combined with composite indexes, SVM classifiers can provide decision-makers with a clearer mapping of institutional identities, enabling more precise categorization of HEIs and supporting long-term planning. This integration responds directly to the growing demand for evidence-based governance in higher education systems (Salmi, 2009).

The purpose of this study is to build on these developments by proposing a structured framework for formulating composite indexes tailored to HEIs, encompassing dimensions of academic success, institutional performance, and growth capacity. Furthermore, it aims to demonstrate how SVM classifiers can leverage these indexes

to generate reliable classifications that improve the clarity and robustness of strategic insights. By uniting the strengths of composite indexes and machine learning, this research seeks to contribute to more effective strategic management in HEIs, particularly in contexts where data complexity presents significant challenges.

LITERATURE REVIEW

Strategic Management in HEIs

Strategic management in Higher Education Institutions (HEIs) encompasses the systematic planning and coordination of academic, financial, and institutional activities to achieve long-term objectives. Academic planning is central to this process, as it ensures that teaching programs align with evolving labor market demands, research priorities, and broader societal needs. According to Shattock (2010), universities must continuously adapt their academic offerings to remain relevant while balancing pressures of quality assurance, accreditation standards, and international competitiveness. Financial management constitutes another critical pillar, particularly in an era where institutions face shrinking public resources and growing accountability requirements. Jongbloed (2015) highlights that financial strategies increasingly involve diversification of income sources, cost-efficiency measures, and transparent allocation of budgets to ensure sustainability. Beyond academics and finance, institutional positioning within ranking systems has become a key driver of strategic choices, with global rankings influencing not only student and faculty recruitment but also government funding and partnerships (Hazelkorn, 2015).

Yet the complexity of these domains is intensified by the nature of the data required to inform them. Decision-making in HEIs must often reconcile quantitative measures—such as enrollment statistics, graduation rates, and research output—with qualitative inputs, including student satisfaction, stakeholder perceptions, and institutional reputation. As Kettunen (2015) observes, the challenge lies in integrating such heterogeneous evidence into coherent management strategies without oversimplifying the underlying realities. This multidimensionality of higher education data underscores the need for frameworks that both respect its complexity and provide actionable insights for decision-makers.

Composite Indexes in Higher Education

To address these challenges, composite indexes have emerged as an important tool in higher education governance. A composite index combines multiple indicators into a single measure, thereby offering a simplified representation of complex realities. Perhaps the most visible examples are global university rankings, such as the *Times Higher Education World University Rankings* and the *QS World University Rankings*, which synthesize data on teaching, research, citations, internationalization, and reputation into aggregated scores (Docampo, 2013). These rankings, while contested, have become powerful benchmarks that shape institutional strategies worldwide, influencing governments, funders, and students alike (Hazelkorn, 2015). In addition to rankings, other indexes—such as student satisfaction indices—provide systematic measures of the learning environment and teaching quality, offering valuable feedback for both institutional leaders and policymakers (Richardson, Slater, & Wilson, 2007).

The benefits of composite indexes lie in their ability to distill diverse sets of information into a form that is accessible to a wide range of stakeholders. Nardo et al. (2008) argue that indexes improve transparency, enable comparability across institutions, and facilitate the monitoring of progress toward strategic goals. They function as communication tools that translate complex realities into clear, actionable benchmarks. However, they are not without limitations. Questions of methodological validity such as the choice of indicators, weighting schemes, and normalization techniques have long been debated in the literature (Saisana, d'Hombres, & Saltelli, 2011). Misinterpretations or over-reliance on these indexes can lead to unintended consequences, such as the prioritization of activities that improve rankings at the expense of other mission-critical functions. This tension highlights the need for careful design and contextual adaptation of composite indexes tailored to the unique realities of HEIs.

Machine Learning in HEIs

Parallel to these developments, machine learning techniques have increasingly been deployed to address the growing complexity of higher education data. Educational data mining and learning analytics have expanded rapidly as fields, offering new methods to extract actionable insights from large and heterogeneous datasets (Romero & Ventura, 2020). Applications include predicting student performance and dropout risk (Kotsiantis, Pierrakeas, & Pintelas, 2007), optimizing resource

allocation such as classroom scheduling and faculty deployment (Baker & Inventado, 2014), and identifying patterns in administrative operations. These tools not only allow for proactive interventions but also enhance institutional efficiency and accountability.

Among the wide range of machine learning models, Support Vector Machines (SVMs) stand out for their ability to handle high-dimensional and structured data with strong predictive performance. First introduced by Cortes and Vapnik (1995), SVMs work by contructing optimal hyperplanes that separate data into distinct categories. This makes them particularly effective for classification problems, where the goal is to categorize entities based on complex input features. In higher education, SVMs have been applied to tasks such as predicting student success, identifying at-risk learners, and classifying institutions based on multidimensional performance metrics (Delen, 2010). Their flexibility in managing both structured and partially unstructured data, combined with their robustness against overfitting, makes them especially suitable for addressing the challenges posed by HEI datasets.

Gaps in Existing Research

While composite indexes and machine learning models have been widely discussed in the literature, their integration for strategic decision-making in HEIs remains underexplored. Composite indexes are primarily used for benchmarking and communication, whereas machine learning models are often applied to specific operational challenges such as student retention or resource allocation. Very few studies have systematically examined how composite indexes—when employed as structured inputs—can enhance the predictive accuracy and interpretability of machine learning models such as SVMs. As a result, there is a gap between the simplification of complex data through indexes and the analytical power of advanced modeling techniques.

This gap represents a promising direction for research. The integration of composite indexes with machine learning could offer HEIs a robust analytical framework capable of bridging complexity and decision-making. By combining the transparency and communicability of indexes with the predictive strength of SVMs, institutions may be better equipped to classify their strategic positioning, anticipate future challenges, and align management decisions with long-term objectives. Salmi (2009) emphasizes that data-informed strategies are essential for building world-class universities, and this integration could represent a practical step toward realizing that vision in diverse higher education contexts.

METHODOLOGY

Data Collection and Preprocessing

The data for this study is sourced exclusively from the official yearly statistics published by the Ministry of Higher Education, Scientific Research, and Innovation. The focus of this data collection effort is specifically on the higher education public sector, encompassing 13 universities along with 130 associated faculties and institutions. The data spans a comprehensive 10-year period, starting from 2012 and concluding in 2022.

The dataset is meticulously structured to include a range of essential statistical metrics pertinent to higher education institutions. These metrics consist of:

- New Registrations per Year: This metric tracks the number of newly enrolled students at each institution on an annual basis.

- Total Number of Students: This encompasses the overall student enrollment figures across all 13 universities and their affiliated faculties and institutions.

- Number of Graduates per Year: This metric captures the yearly count of students who successfully complete their respective academic programs and graduate from their institutions.

- Number of Pedagogical and Administrative Staff: This includes data on the total workforce within each institution, differentiating between pedagogical (Professors) and administrative roles (Administrators and technicians).

- Occupational Capacity: This metric assesses the capacity of each institution to accommodate students and staff, providing insights into infrastructure and resource utilization.

- Data preparation:

After the data collection process, data preparation incorporates a rigorous preprocessing methodology to ensure data integrity and reliability. This preprocessing includes three distinct steps:

- Filtering: Institutions displaying inconsistencies in their statistical reporting or experiencing operational disruptions are carefully filtered out from the dataset. This step results in a refined dataset focusing on 105 institutions with consistent and reliable data.

- Data Cleaning: The cleaning phase involves a meticulous review of the dataset to identify and rectify any anomalies or discrepancies. This ensures that the data is accurate and consistent across all entries, mitigating potential errors in

subsequent analysis.

- Data Coding: Once the dataset is refined and cleaned, a comprehensive data coding process is implemented. This step involves converting the raw data into a structured format suitable for analysis and inclusion in the scientific study. Each of the 105 institutions affiliated with the 13 universities is meticulously coded to facilitate meaningful analysis and interpretation of the collected data.

By adhering to these stringent data collection and preprocessing protocols, the resulting dataset is robust, reliable, and well-suited for conducting in-depth analyses and deriving meaningful insights into the higher education public sector's dynamics and trends over the specified 10-year timeframe.

Here are the recapitulative figures of the final form dataset:

NI	Year	1	2	3	4	5	6	7	8	9	10
A											
	A1	1 768	1 200	1 414	1 119	1 075	1 130	1 312	1 391	1 463	1 298
	A2	714	1 127	1 293	1 821	1 613	1 311	1 886	1 818	2 234	2 386
	A3	120	116	226	394	414	417	414	280	534	569
	A4	321	473	391	287	537	544	768	575	848	929
	A5	865	714	849	998	969	1 052	902	704	620	832
B											
	B1	3 334	3 205	2 973	3 129	3 018	3 215	3 694	4 296	5 548	3 318
	B2	3 420	2 778	3 585	2 358	2 416	2 316	2 393	3 102	4 180	3 821
	B3	3 371	2 498	2 807	2 856	2 086	2 747	2 340	2 299	2 564	2 576
	B4	517	512	523	542	560	576	822	665	669	671
	B5	4 453	4 751	3 792	5 241	5 163	5 360	4 685	5 167	6 709	5 204
	B6	3 422	3 188	2 896	3 892	4 345	3 987	4 007	5 197	6 892	6 263
	B7	676	570	494	475	637	678	702	813	785	842
	B8	175	159	185	156	150	149	151	185	189	171
	B9	75	97	145	115	155	117	169	217	187	221
C											
	C1	5 400	4 619	7 072	7 483	7 366	8140	8 845	11 527	10 325	13 609
	C2	2 173	1 917	1 719	1 995	2 301	3318	3 844	4 051	3 372	4 639
	C3	2 226	1 917	2 816	2 346	2 002	1727	2 070	2 017	2 573	2 431
	C4	537	476	482	451	507	484	555	611	574	651
	C5	184	476	166	167	179	185	178	182	190	209
	C6	474	511	567	458	505	617	790	678	344	716
	C7	4 380	4 049	3 382	2 621	3 277	3331	4 373	4 921	5 659	6 674
	C8	1 523	1 705	1 638	2 268	2 938	3664	2 235	2 942	2 336	3 379
	C9	1 530	1 477	1 879	1 257	1 327	1321	1 664	1 782	1 440	1 979
	C10	1 431	1 662	1 598	1 360	1 347	1364	1 557	1 885	2 014	2 530
	C11	4 571	3 868	3 277	2 346	2 493	2275	3 036	2 317	3 571	3 210
	C12	845	1 050	828	944	907	1106	1 375	1 326	1 048	1 369
	C13	100	235	324	149	169	165	208	262	236	351
	C14	384	331	362	366	329	490	497	490	536	507
	C15	127	156	144	157	22	89	87	127	135	73
D											
	D1	4 181	8 636	6 274	12 189	7 851	8 217	9 038	10 360	11 601	10 177
	D2	3 659	2 344	3 202	3 647	5 529	3 835	3 467	2 809	4 301	3 286
	D3	1 611	1 850	2 546	2 860	1 739	2 002	2 178	2 663	3 226	2 645
	D4	2 533	2 604	2 140	2 333	1 571	1 740	2 158	1 839	2 383	2 619
	D5	2 358	2 710	3 624	4 276	5 529	3 717	3 029	2 863	3 213	3 332
	D6	721	809	853	907	734	753	917	935	735	942
	D7	277	426	412	383	319	367	387	369	411	429
	D8	90	162	149	160	151	186	253	270	224	283
	D9	104	113	125	147	129	235	272	273	230	298
	D10	750	815	501	850	828	759	957	960	967	959
E											
	E1	8244	5902	6946	8885	10259	10770	12 140	12 189	11 132	13 758

RI	Year	1	2	3	4	5	6	7	8	9	10
A											
	A1	3694	4251	4743	4540	4554	4675	4614	4865	5 237	5 354
	A2	2568	3859	3705	4722	5056	6236	6946	7773	7 008	7 691
	A3	120	240	460	808	808	1248	1540	1612	2 021	2 472
	A4	1041	1133	1328	1272	1458	1666	2222	2172	2 673	2 665
	A5	2225	2580	3132	3516	3806	3685	3643	3810	4 050	3 652
B											
	B1	9091	9400	9931	11041	11697	11294	12906	13178	13 195	13 040
	B2	9849	10678	14288	14029	11489	10335	10393	10525	10 282	11 311
	B3	9732	9532	11925	11002	8345	10989	10475	10678	10 809	9 964
	B4	994	1030	1146	1187	1260	1406	1 645	1 818	1 195	1 726
	B5	10093	11522	13276	15958	11697	17877	17606	17558	17 645	17 116
	B6	7436	9120	9977	11377	13076	13209	13893	14469	13 786	14 636
	B7	4799	5456	5615	5785	6158	6500	5 611	6 797	7 315	6 789
	B8	748	830	998	1115	1058	1066	834	1 000	1 077	977
	B9	706	845	952	1063	1495	1940	1 988	2 130	2 377	2 189
C											
	C1	16800	19014	20428	22827	24213	25016	26641	28197	29 078	35 151
	C2	5448	6149	6551	8029	8647	9518	10420	11001	10 493	12 186
	C3	6633	7451	7457	8204	8148	7578	7228	7286	7 877	8 178
	C4	4789	4106	4958	4063	4667	4260	4058	4318	4 689	5 817
	C5	714	769	829	902	863	880	850	794	950	954
	C6	851	998	1058	1230	1160	1306	1520	1575	1 504	1 420
	C7	12830	14922	17650	16492	17422	18836	20957	23170	26 373	29 373
	C8	4469	5098	4974	6054	7352	9885	9628	10187	9 629	10 062
	C9	4124	4767	5171	5375	5255	5124	5145	5125	4 696	5 458
	C10	3859	4345	4372	4633	4470	4489	5118	6406	7 175	6 927
	C11	9964	10283	10207	11342	10788	11952	12346	10046	11 052	9 263
	C12	2902	3061	3301	3526	3734	3670	4311	4010	4 269	4 321
	C13	212	335	549	713	828	871	1041	1088	1 181	1 309
	C14	1779	2020	2365	2484	2495	2831	3061	3105	3 050	3 136
	C15	583	552	678	736	774	710	872	833	963	990
D											
	D1	19580	22318	24257	28426	32289	29048	31220	33392	40 458	35 302
	D2	15087	14958	14748	14944	13531	12912	11829	10340	12 003	13 017
	D3	9082	9665	9685	11937	8474	8193	8033	8481	9 255	9 393
	D4	9486	10260	12047	11044	9147	8518	9121	8333	8 544	9 115
	D5	10674	11010	13135	13424	11392	10899	10082	10363	11 294	12 247
	D6	3444	3732	3671	4055	3924	3934	3947	4093	3 883	3 929
	D7	1789	2445	2882	2800	2717	3497	3323	3763	3 507	3 575
	D8	626	711	771	833	902	999	1115	1206	1 230	1 327
	D9	504	537	688	780	869	1029	1179	1378	1 514	1 581
	D10	1560	1647	1567	1687	1821	1842	1909	2052	1 043	1 920
E											
	E1	15402	17252	20263	23560	27266	29618	31600	34580	34 630	39 130

	E2	5075	5180	6420	6448	4455	4465	5 241	5 072	5 641	6 306
	E3	5075	4415	3922	4230	3241	3233	4 041	4 020	4 230	4 109
	E4	3952	3223	2298	2713	2468	2447	3 753	3 539	3 663	5 174
	E5	744	1014	744	1018	754	962	1 276	858	917	1 018
	E6	324	269	353	310	354	330	379	371	408	409
	E7	144	277	211	186	168	157	281	357	255	302
	E8	122	302	153	183	109	242	194	192	181	190
	E9	153	155	144	168	174	220	268	249	305	308
	E10	249	237	263	243	259	466	411	488	459	542
	E11	183	137	236	177	308	440	288	266	425	425
F											
	F1	3259	3240	3303	3940	3508	3 583	3 864	4 363	4 793	6355
	F2	2172	3132	2983	3028	3182	3 233	2 593	1 679	2 702	2 140
	F3	837	766	666	639	650	956	844	983	751	1 332
	F4	40	77	64	70	89	185	185	282	155	619
	F5	1766	1546	1257	1838	1 475	1 045	1 464	1 619	1 826	989
	F6	152	165	159	145	149	170	245	287	263	237
G											
	G1	4 143	3 775	4 646	6 270	5 184	5 765	5 765	6 375	6 330	6 673
	G2	3 273	2 169	2 742	3 422	2 685	2 700	2 700	3 225	2 585	3 203
	G3	1 965	2 148	1 689	2 136	1 487	1 420	1 420	3 225	1 795	3 203
	G4	2 832	2 435	3 218	4 202	3 451	4 550	4 550	4 957	5 136	5 713
	G5	228	276	295	305	330	326	326	348	355	326
	G6	160	110	215	151	162	152	152	279	308	285
	G7	181	126	118	137	135	174	174	240	240	236
	G8	511	546	331	554	539	604	604	1 081	862	818
H											
	H1	3752	4722	6274	5085	6355	6 390	7 537	9 009	8 308	8 303
	H2	2410	2635	3668	3112	3402	3 375	3 472	3 185	2 633	3 237
	H3	1521	1835	1972	1854	1417	1 433	1 855	2 207	2 234	2 436
	H4	3094	3477	4816	4568	6399	7 207	9 213	8 521	7 329	7 662
	H5	833	896	771	731	1596	1 351	1 525	1 510	4 078	1 490
	H6	835	869	1129	955	1033	1 128	1 435	1 278	959	1 236
	H7	240	347	120	192	183	237	289	307	356	349
	H8	182	226	271	191	192	223	280	347	259	235
	H9	248	193	230	165	173	210	262	306	281	237
	H10	309	307	340	314	312	385	446	491	474	482
	H11	162	138	121	112	137	142	241	219	221	290
I											
	I1	5 762	4 960	4 813	6 297	5 631	6 782	7 126	6 843	7 530	7 966
	I2	6 432	5 658	3 953	4 120	2 386	2 137	2 946	2 743	3 631	3 313
	I3	2 468	1 986	3 541	2 110	1 396	1 372	1 610	1 370	1 897	1 489
	I4	1 504	1 659	2 446	3 060	3 330	3 382	4 636	4 324	5 000	4 935
	I5	722	730	936	932	955	926	1 002	918	684	1 195
	I6	261	321	318	235	310	291	433	414	372	476
	I7	1 038	788	859	865	842	762	895	956	930	923
J											
	J1	1936	1534	1514	2203	2202	2115	2 483	2 810	2 155	2 716
	J2	2555	2424	2066	2584	1847	1891	1 948	2 660	2 155	2 644
	J3	477	451	527	740	922	1089	1 220	1 427	3 960	2 419
	J4	81	118	89	100	104	165	191	243	189	223
	J5	147	127	141	153	160	212	237	259	235	251
K											
	K1	1 253	1 475	1 655	2 122	2 326	4 359	4 876	5 542	7 303	10161
	K2	6 173	6 330	5 363	5 034	6 376	3 559	4 387	4 939	5398	7217
	K3	3 760	4 509	1 868	2 227	2 204	1 145	1 559	1 315	1 914	2 379
	K4	158	183	172	177	208	217	260	278	262	280
	K5	225	227	223	212	205	266	342	392	400	385
L											
	L1	3716	3792	3872	5260	5040	5398	7 713	9 263	7477	7815
	L2	802	908	972	878	862	958	1 277	1 081	972	1 181
	L3	282	285	302	231	280	430	388	479	527	484
	L4	133	211	187	152	173	178	179	160	180	93
M											
	M1	11 437	9 214	11 124	11 164	8 201	8 430	8 233	10 195	8 670	11 755
	M2	7 048	6 081	8 894	7 783	6 659	3 884	4 380	4 806	4 984	5 249
	M3	5 054	5 367	6 059	5 580	3 516	2 279	2 774	2 666	3 503	2 774
	M4	796	762	983	989	314	384	911	1 064	2 062	829
	M5	783	802	591	656	414	627	1 377	1 286	1 244	1 183
	M6	78	181	187	159	166	211	267	288	230	317
	M7	302	300	320	318	305	311	468	443	230	440
	M8	417	549	502	507	454	620	835	753	600	770
	M9	158	169	205	171	218	133	363	273	271	366

	E2	13730	16067	17995	21224	19016	17412	17975	18177	18 535	19 474
	E3	9718	11221	11601	13841	10497	11117	10618	11681	11 527	10 849
	E4	6989	6644	6413	6908	7554	7051	7170	8401	9 732	12 119
	E5	2504	2818	2332	2296	2646	2463	2660	2956	3 683	3 467
	E6	2317	2318	2745	2745	3038	3340	3615	3850	4 168	4 244
	E7	515	680	794	851	907	969	1051	1197	1 257	1 354
	E8	701	744	788	767	699	737	743	834	905	957
	E9	725	716	780	880	966	1023	1127	1267	1 414	1 526
	E10	517	479	563	582	603	1068	905	1051	1 116	1 161
	E11	339	366	410	526	674	1029	793	817	1 013	1 113
F											
	F1	7455	8539	9517	11302	12 508	12 677	13101	14332	17681	17 169
	F2	4830	6650	6682	8339	8621	9106	9291	4757	9 231	7 531
	F3	2560	2765	1940	2154	3254	3652	3884	3937	4 380	4 663
	F4	40	111	153	140	196	341	457	582	638	952
	F5	4115	3595	3487	3702	3846	3057	3594	4033	5 343	5 882
	F6	615	739	794	806	820	806	904	1020	1 107	1 194
G											
	G1	12405	13726	15427	18693	18856	21619	25242	26641	26 746	28 132
	G2	8357	9085	13903	10970	11300	13148	13805	14040	13 643	14 170
	G3	6408	7560	6532	7016	6921	6973	6665	6865	6 315	6 641
	G4	8482	8687	10867	13035	13848	17398	19793	22030	23 028	27 785
	E6	1071	1345	1482	1736	1847	2252	2503	2562	2 729	2 376
	G6	809	921	930	933	950	948	1046	1070	1 079	1 176
	G7	672	709	716	719	636	772	839	926	1 033	1 101
	G8	1193	1055	909	989	1136	1371	1896	2136	2 401	2 277
H											
	H1	14038	16298	18808	23281	21627	28985	32064	32972	35 356	37 828
	H2	7861	8980	10758	13211	14491	14471	16719	15839	16 292	17 231
	H3	5937	7681	7734	8654	8667	8719	8074	8484	8 622	9 741
	H4	7124	9705	11970	14827	22638	21132	25393	28370	30 295	28 933
	H5	2010	3052	2842	3041	4262	5859	6060	6839	7 385	7 688
	H6	3350	3639	4478	4693	4783	5222	5705	5765	6 065	5 800
	H7	240	351	370	449	528	685	839	104	1 305	1 475
	H8	677	1052	1086	1122	1164	1219	1347	1426	1 468	1 678
	H9	306	351	329	858	1021	1100	1111	1072	1 173	1 327
	H10	1215	1385	1477	1563	1673	1816	2014	2308	2 448	2 555
	H11	681	717	753	747	743	823	943	942	1 022	1 162
I											
	I1	12628	14131	18028	13617	19328	21877	24 562	24 802	28 315	26 461
	I2	12005	13250	14096	14997	13857	12758	11 813	10 843	12 077	13 810
	I3	8123	5866	9086	6833	6376	6440	6 439	5 625	5 983	5 706
	I4	4720	4297	6003	7540	11312	15286	17 865	20 115	23 224	25 002
	I5	2522	2956	3274	3323	3530	3864	4130	4131	3 806	4 132
	I6	1194	1358	1469	1533	1607	1663	1739	1796	1 902	2 072
	I7	1925	1730	1818	1773	2037	1908	1884	2028	2 032	2 041
J											
	J1	4443	5294	4863	5679	6218	6623	6878	7524	6 828	7 634
	J2	6042	6533	6108	6335	6449	6626	6330	7048	6 476	7 184
	J3	1370	1356	1773	2122	2412	3248	3859	4568	7 392	8 855
	J4	266	349	408	441	476	557	661	786	874	928
	J5	528	511	643	665	799	918	1067	1222	1 353	1 455
K											
	K1	3 529	4 369	5 511	6 655	8436	11116	13577	17169	23438	30733
	K2	13914	16721	20922	24888	25372	21961	21004	22303	25739	33622
	K3	9074	10371	10548	8303	9683	3963	8505	8419	9 090	10 291
	K4	612	779	889	1001	1046	1126	1216	1333	1 377	1 661
	K5	923	1122	1345	1463	1587	1760	2037	2357	2 436	2 740
L											
	L1	8443	10486	12374	16815	20338	23889	28 922	34 393	36029	40464
	L2	3687	3899	4569	4547	4396	4309	5085	4822	4 311	4 314
	L3	1277	1532	1501	1657	1761	1950	2039	2258	2 768	2 692
	L4	377	389	402	354	430	442	491	416	534	476
M											
	M1	25267	30311	33794	42625	39320	33431	33724	37219	38 436	42 964
	M2	23422	26103	28306	31825	29523	28705	27201	21579	21 630	22 777
	M3	13217	15472	16144	18243	15127	11835	10498	3556	10 586	10 133
	M4	1539	2007	2350	2674	2983	2830	2830	2965	3 559	3 342
	M5	2018	2395	2353	2308	2227	2388	3186	3233	3 603	3 788
	M6	743	930	1004	1078	1174	1265	1343	1500	1 570	1 647
	M7	1725	1870	1608	1782	1838	2113	2403	2414	2 598	2 666
	M8	1062	1020	1132	1119	1143	1288	1606	1503	1 359	1 309
	M9	279	325	100	343	401	388	684	802	767	724

Figures 1, 2 & 3: Representing the number of newly registered students and total number of current students per year for 105 institutions over 13 universities from 2012 to 2022.

LAU											
A											
	A1	292	641	925	1 080	952	979	892	845	942	1 029
	A2	585	494	629	623	798	995	956	1 003	1 093	1 205
	A3	0	0	29	76	90	93	149	153	183	248
	A4	172	161	205	229	291	286	310	340	421	359
	A5	251	233	253	331	368	501	497	436	501	488
B											
	B1	1 025	747	1 274	1 569	1594	1651	1 438	1 625	1 963	1 622
	B2	1 046	978	1 428	1 710	1802	1932	1 727	1 818	1 624	1 395
	B3	803	1 145	1 169	1 064	981	1299	1 686	1 459	1 556	1 079
	B4	398	431	516	562	605	712	792	432	1 154	939
	B5	1 057	1 437	1 769	2 016	2280	2668	2 727	2 919	3 000	2 853
	B6	1 069	1 114	1 307	1 220	1627	2187	2 249	2 008	2 013	1 718
	B7	439	684	742	687	659	656	621	412	785	990
	B8	86	109	108	177	164	207	214	173	228	197
	B9	326	292	262	232	292	691	604	622	1 042	823
C											
	C1	1 370	1 843	2 345	2 314	3263	2367	4 273	4 837	5 309	5 602
	C2	651	888	1 007	1 173	1257	1365	1 400	1 480	1 750	1 622
	C3	935	665	1 075	1 408	1548	1601	1 408	1 418	1 374	1 422
	C4	240	227	571	111	358	498	524	277	843	629
	C5	112	71	109	145	167	165	167	124	154	149
	C6	370	433	514	574	674	513	514	742	703	655
	C7	1 391	979	1 717	1 780	1897	1901	2 058	2 219	3 083	3 660
	C8	640	726	952	1 058	1368	1710	2 049	2 634	2 422	2 374
	C9	677	763	857	753	856	965	943	800	882	777
	C10	670	596	645	696	785	809	773	827	1 001	881
	C11	1 000	1 236	1 475	1 408	1447	1437	1 460	1 428	1 359	1 404
	C12	481	584	624	299	742	738	771	994	971	894
	C13	0	0	0	102	134	145	188	179	183	190
	C14	299	313	454	584	544	592	640	755	661	654
	C15	358	240	308	215	330	289	363	241	307	383
D											
	D1	1 579	1 323	1 932	2 200	2474	2330	2 695	2 823	3 789	2 956
	D2	1 171	2 127	2 181	1 698	1702	2144	1 738	1 320	1 468	1 463
	D3	1 048	1 135	1 035	769	1003	1137	1 246	1 194	1 315	1 214
	D4	725	1 002	1 396	1 445	1626	1351	1 237	1 561	1 449	1 236
	D5	381	1 253	1 217	1 351	1028	1344	1 523	1 476	1 407	1 295
	D6	598	885	871	868	869	821	780	824	927	845
	D7	48	94	310	298	380	341	375	337	510	478
	D8	108	131	159	140	175	195	239	217	217	221
	D9	82	79	89	153	167	167	277	228	264	253
	D10	615	655	676	772	1097	860	792	914	983	851
E											
	E1	1 098	1 667	1 501	2 959	3476	3621	3 597	4 110	4 546	6 430

ENPED											
A											
	A1	35	45	44	48	52	55	57	55	58	58
	A2	31	33	33	12	44	44	45	44	49	52
	A3	8	10	10	39	16	18	21	25	28	29
	A4	35	35	38	41	42	41	48	44	45	48
	A5	27	21	25	30	33	33	32	33	31	34
B											
	B1	136	128	132	122	125	137	130	122	130	130
	B2	241	229	229	235	235	249	240	244	238	239
	B3	396	413	418	430	423	428	409	427	423	425
	B4	76	79	82	80	116	91	36	38	39	106
	B5	122	132	128	136	142	151	157	154	159	168
	B6	84	84	86	87	89	89	89	96	101	102
	B7	676	617	623	603	601	563	558	628	599	609
	B8	56	41	41	43	66	68	70	74	81	86
	B9	58	49	55	57	59	60	63	81	83	87
C											
	C1	201	202	202	205	204	207	194	191	182	179
	C2	131	149	140	136	136	135	134	125	124	125
	C3	224	244	253	252	258	252	246	235	219	223
	C4	298	274	274	256	259	260	258	230	315	331
	C5	52	55	55	58	60	62	62	64	66	69
	C6	80	80	80	86	88	85	89	93	93	95
	C7	89	100	100	106	113	113	117	112	116	115
	C8	36	38	43	45	53	59	65	66	75	81
	C9	118	130	130	134	133	124	123	123	126	123
	C10	132	118	121	126	127	118	120	115	114	116
	C11	258	268	271	274	285	275	275	283	269	289
	C12	162	167	173	172	177	181	185	191	197	197
	C13	17	21	21	32	37	39	45	50	50	60
	C14	27	41	41	42	52	53	61	61	70	73
	C15	78	75	75	76	72	67	68	63	59	68
D											
	D1	117	131	141	146	158	162	161	168	176	199
	D2	169	178	195	191	191	185	181	170	161	160
	D3	111	118	122	130	138	137	138	141	143	143
	D4	295	300	318	311	313	298	294	290	282	287
	D5	95	103	111	115	129	137	148	142	149	146
	D6	173	176	182	191	192	193	197	207	203	200
	D7	161	170	181	197	211	230	230	252	260	262
	D8	21	27	29	32	34	37	42	58	64	47
	D9	17	18	21	22	28	30	37	37	39	67
	D10	93	89	89	92	94	92	98	96	67	103
E											
	E1	158	165	173	176	182	185	179	181	173	178

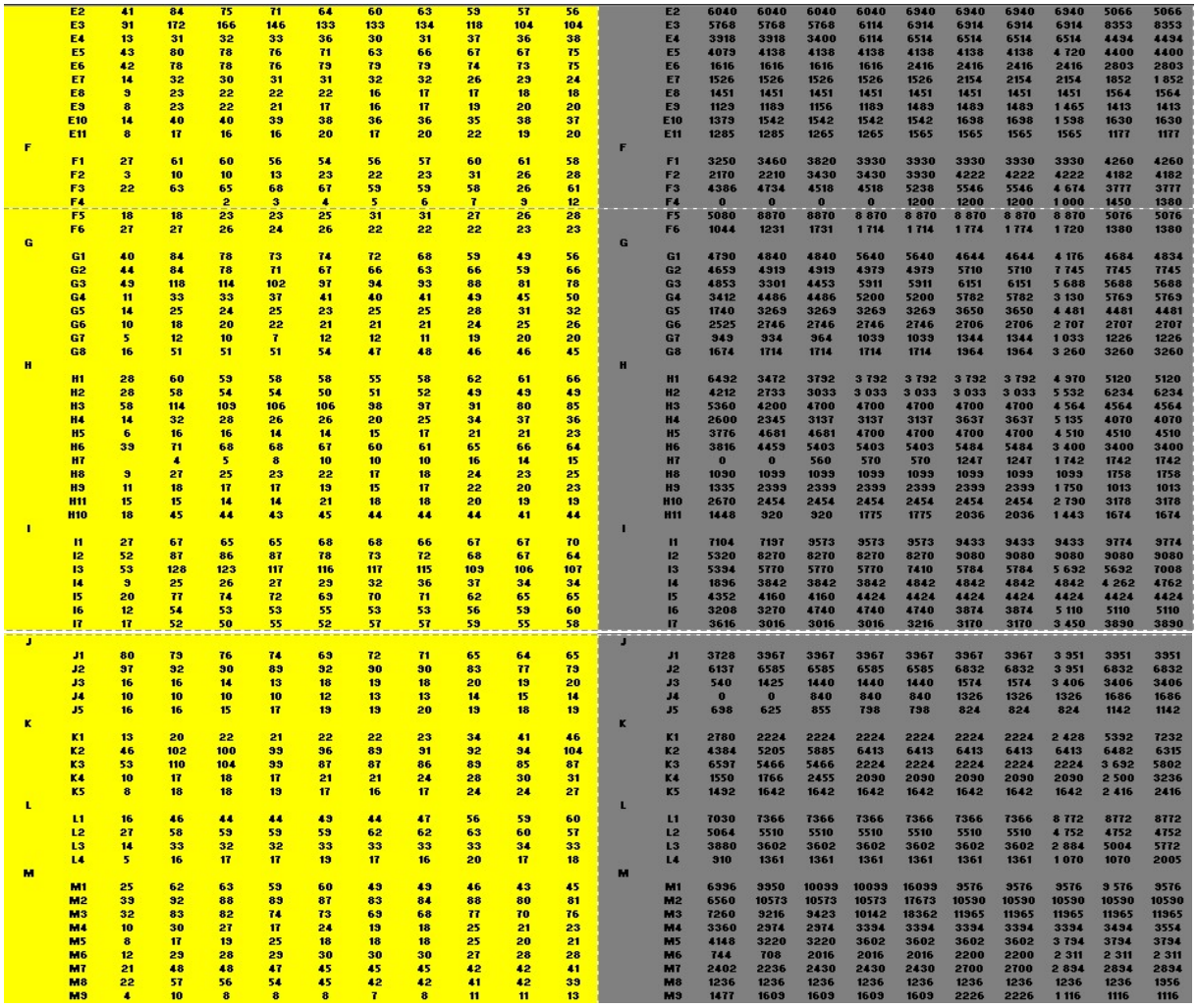
	E2	974	1 662	2 056	2 627	2876	2579	2 809	2 611	2 698	2 625
	E3	827	1 076	1 115	1 554	1421	1581	1 473	1 474	1 532	1 670
	E4	571	592	598	760	828	798	728	882	838	921
	E5	387	509	641	574	604	627	539	574	748	760
	E6	138	169	201	196	289	343	366	361	390	473
	E7	81	90	99	91	123	137	154	161	165	181
	E8	139	113	159	142	135	160	141	138	143	153
	E9	89	91	129	173	200	202	211	185	206	234
	E10	235	242	234	269	454	345	427	156	568	536
	E11	134	116	210	319	286	448	473	470	514	612
F											
	F1	880	1 102	1 175	1 459	1 464	1 612	1 789	2 090	2 159	2 124
	F2	403	398	862	1 223	1386	1351	1 705	1 873	2 166	1 869
	F3	316	359	339	538	784	603	679	690	920	732
	F4	0	27	65	62	63	146	203	247	293	271
	F5	388	448	528	393	523	549	493	530	521	557
	F6	53	121	126	123	166	155	142	152	153	186
G											
	G1	1 126	1 262	1 103	1 347	1439	1441	1 405	1 733	2 156	1 819
	G2	1 007	1 088	1 289	1 108	1320	1239	1 424	1 587	1 642	1 377
	G3	825	902	817	912	1153	1265	1 171	1 085	1 180	1 111
	G4	564	558	759	730	906	960	868	1 316	1 540	1 552
	G5	0	0	0	121	194	164	255	188	330	321
	G6	140	171	174	175	178	195	179	174	182	130
	G7	99	126	124	131	145	152	119	126	157	153
	G8	555	427	374	411	495	501	523	1 082	1 174	1 046
H											
	H1	1 290	1 949	3 546	3 834	2612	3476	3 718	3 449	4 294	4 175
	H2	1 123	1 319	1 310	3 834	1246	1638	1 802	1 547	1 907	1 838
	H3	1 175	1 213	1 208	3 834	1201	1399	1 427	1 334	1 377	1 265
	H4	317	1 184	2 280	2 743	3340	3615	3 695	3 915	5 373	4 905
	H5	178	334	343	422	415	530	658	732	926	728
	H6	785	860	1 611	1 090	830	970	937	1 010	1 214	1 140
	H7	0	0	86	120	104	141	206	236	303	342
	H8	108	206	168	182	141	216	295	243	301	230
	H9	99	141	148	192	167	218	223	164	162	203
	H10	130	188	231	223	263	294	324	278	332	429
	H11	0	0	100	131	139	159	166	204	139	171
I											
	I1	314	842	1 567	2 059	2063	2609	2 863	3 263	3 713	3 766
	I2	1 412	935	1 355	1 431	1409	1722	1 839	1 496	1 483	1 567
	I3	557	721	581	519	536	683	863	819	909	627
	I4	475	533	623	769	762	1137	1 276	1 647	1 867	2 125
	I5	219	319	443	500	403	541	640	824	812	695
	I6	188	173	173	243	222	288	280	174	254	163
	I7	855	824	174	950	993	986	859	314	216	932
J											
	J1	715	561	521	677	735	744	956	1 000	1 078	816
	J2	486	782	730	939	851	731	1 033	899	889	737
	J3	445	294	510	664	445	724	850	1 105	1 223	1 036
	J4	29	28	52	63	73	85	85	85	119	120
	J5	69	82	91	97	190	164	176	226	198	250
K											
	K1	688	545	650	511	546	752	928	1565	2160	2325
	K2	1 132	1 426	2 039	2 284	2198	2834	2 633	2911	2555	3072
	K3	860	914	1 028	1 048	1219	1267	1 251	1 782	1 317	1 435
	K4	54	116	130	181	182	233	165	213	189	212
	K5	123	248	228	314	385	394	473	508	616	610
L											
	L1	442	1 029	1 763	757	1592	2262	3 350	3421	4129	4332
	L2	674	914	983	1 020	928	1039	874	888	972	953
	L3	284	295	253	267	258	338	333	364	284	416
	L4	176	176	180	172	246	0	232	155	141	155
M											
	M1	2 110	2 390	2 687	3 423	3838	3615	3 520	4 395	5 222	4 349
	M2	4 300	3 414	3 456	3 824	4 071	3 861	3 478	2 990	3 006	2 784
	M3	1 224	1 435	1 598	1 590	1845	1893	1 710	1 400	1 376	934
	M4	184	252	410	532	452	395	522	482	519	638
	M5	164	379	582	460	381	323	328	351	568	546
	M6	162	227	191	198	244	227	219	223	287	247
	M7	297	233	474	371	432	463	500	501	545	386
	M8	495	451	539	476	589	580	618	594	687	101
	M9	0	0	387	136	144	197	282	444	472	303

	E2	163	165	168	192	190	185	185	176	182	181
	E3	407	431	429	419	415	399	399	387	356	347
	E4	80	94	100	97	107	105	115	117	124	127
	E5	179	188	185	193	201	195	197	199	203	194
	E6	143	157	176	177	196	214	219	238	251	256
	E7	36	42	42	41	44	44	45	51	53	58
	E8	26	25	27	36	44	47	48	50	49	55
	E9	20	22	23	23	27	29	30	35	40	39
	E10	30	31	31	35	39	39	40	43	46	45
	E11	15	15	21	26	32	33	42	38	40	42
F											
	F1	93	103	103	107	115	114	119	117	120	122
	F2	36	40	40	73	85	84	97	78	98	116
	F3	158	160	167	170	179	180	189	188	183	186
	F4	0	6	6	4	9	13	18	28	32	31
	F5	51	54	65	66	75	76	84	84	89	91
	F6	22	27	36	40	46	47	51	49	54	57
G											
	G1	85	90	92	94	98	103	109	114	115	126
	G2	146	149	152	152	151	152	154	159	155	160
	G3	253	266	265	262	267	272	272	270	278	285
	G4	75	85	88	93	103	103	118	124	156	157
	G5	62	63	81	81	85	83	82	97	101	102
	G6	51	58	62	63	65	68	72	66	69	66
	G7	12	15	17	20	26	26	28	29	31	34
	G8	53	57	62	61	64	69	69	68	69	70
H											
	H1	75	79	91	90	98	101	111	103	112	117
	H2	125	129	134	138	139	128	132	135	134	136
	H3	196	189	194	202	206	204	205	208	204	203
	H4	31	38	47	51	55	62	71	68	76	84
	H5	23	24	30	33	39	40	40	54	61	69
	H6	158	162	162	167	173	173	186	192	189	194
	H7	3	7	16	21	27	28	34	36	39	43
	H8	36	41	41	47	53	56	61	64	65	66
	H9	24	26	32	41	42	48	55	57	61	62
	H10	43	44	48	50	53	54	57	60	62	62
	H11	23	32	32	36	41	36	48	42	50	48
I											
	I1	90	94	101	106	108	110	115	110	111	120
	I2	145	164	171	168	170	164	159	160	155	156
	I3	278	284	288	289	293	298	298	301	287	288
	I4	42	46	52	56	68	67	82	87	98	105
	I5	112	118	114	117	127	129	139	145	148	149
	I6	66	74	75	77	81	88	95	102	109	113
	I7	50	56	56	57	67	66	71	79	89	98
J											
	J1	158	151	154	157	161	159	167	166	167	173
	J2	293	291	299	300	310	311	319	318	321	319
	J3	18	20	28	32	42	41	41	46	49	63
	J4	11	11	22	31	36	39	45	49	53	53
	J5	10	14	20	22	32	36	41	41	45	45
K											
	K1	32	39	38	44	49	54	62	74	79	88
	K2	135	146	147	151	149	167	170	173	173	171
	K3	265	264	283	282	289	295	293	290	281	270
	K4	18	28	35	37	43	45	51	54	54	56
	K5	20	24	29	33	37	39	41	47	50	50
L											
	L1	74	84	90	96	101	103	109	111	115	121
	L2	140	140	148	154	161	163	169	178	177	181
	L3	33	34	41	42	46	44	47	52	58	60
	L4	18	21	24	28	32	32	35	40	44	45
M											
	M1	95	105	115	120	147	130	136	127	130	133
	M2	209	215	215	223	255	227	234	234	224	220
	M3	240	250	256	269	305	283	307	307	299	300
	M4	32	34	36	47	53	52	48	57	61	65
	M5	34	42	42	47	43	48	54	58	58	62
	M6	42	51	52	55	57	58	63	62	64	64
	M7	51	50	56	56	56	57	57	60	60	60
	M8	45	49	51	48	53	54	60	56	59	58
	M9	12	15	15	17	21	24	27	27	29	28

Figures 4, 5 & 6: Representing the ***Number of Graduates and the number of pedagogical staff Per Year*** *for 105 institutions over 13 universities from 2012 to 2022.*

ENAD											
A											
	A1	51	50	46	50	48	50	50	48	43	44
	A2	40	39	42	39	36	36	35	30	30	34
	A3	3	3	8	5	9	8	8	8	9	10
	A4	55	55	56	55	55	54	53	45	43	47
	A5	26	31	29	27	30	26	29	33	32	30
B											
	B1	134	125	118	111	101	100	100	89	91	90
	B2	133	121	121	98	94	89	89	81	77	82
	B3	209	206	194	176	165	145	143	136	120	118
	B4	104	98	96	98	96	97	97	88	84	86
	B5	100	92	88	94	78	75	74	65	67	67
	B6	86	83	81	78	79	71	72	62	64	70
	B7	156	150	142	123	115	115	113	99	85	83
	B8	55	52	49	48	45	45	44	44	40	42
	B9	58	63	62	52	48	43	44	44	45	45
C											
	C1	51	106	96	87	96	87	88	80	74	78
	C2	37	71	68	61	57	56	54	53	49	51
	C3	36	79	80	81	78	72	72	76	70	69
	C4	85	124	120	116	101	100	104	91	80	83
	C5	19	36	33	34	31	29	30	35	36	35
	C6	33	82	79	69	67	64	63	64	64	65
	C7	28	56	56	50	56	59	59	57	58	56
	C8	12	21	23	25	19	20	21	26	31	33
	C9	24	53	50	49	43	40	40	43	43	45
	C10	36	61	61	60	54	57	58	53	52	53
	C11	49	86	85	80	81	75	75	75	82	67
	C12	24	61	61	59	58	62	62	60	57	61
	C13	4	10	10	15	18	19	19	24	23	26
	C14	9	18	16	16	24	25	25	26	25	27
	C15	11	23	20	20	20	18	19	24	21	22
D											
	D1	48	86	81	79	77	72	72	77	70	72
	D2	58	99	94	88	75	72	71	60	56	55
	D3	19	54	49	48	50	47	48	46	44	44
	D4	63	132	123	106	104	99	99	90	74	76
	D5	14	42	43	41	47	43	44	49	49	49
	D6	28	65	64	62	61	57	57	56	54	53
	D7	46	100	102	102	103	110	110	97	96	98
	D8	6	14	14	16	17	15	16	22	22	23
	D9	5	13	13	16	14	14	15	20	23	23
	D10	20	62	59	56	56	54	53	58	55	58
E											
	E1	45	108	104	100	92	91	88	90	77	77

CAPACC											
A											
	A1	1770	1955	2280	2280	2280	2160	2 160	2 160	3852	3852
	A2	2930	2280	1955	1955	1955	1965	1 365	1 365	2 765	2 765
	A3	133	250	250	410	410	410	410	410	410	1860
	A4	1117	1110	1115	1568	1568	1568	1 568	1 568	2025	2025
	A5	1520	1502	1502	1502	1502	1502	1 502	1 502	1 932	1 932
B											
	B1	7791	7791	7791	7791	7791	7791	7791	5 193	5193	5193
	B2	4680	4680	4680	5758	5758	5908	5908	6 208	6513	6513
	B3	5595	5595	5595	6353	6353	6541	6541	7 273	7874	7874
	B4	2025	2025	2025	2025	2025	2352	2352	2 669	2689	2689
	B5	4834	4834	4834	5955	5955	5955	5955	5955	5338	5338
	B6	7392	7392	7392	7859	7859	7859	7859	7859	8126	8126
	B7	4643	4643	4643	4643	4643	4643	4643	4643	3614	3614
	B8	830	830	830	1018	1018	1491	1491	1491	1420	1420
	B9	1226	1226	1226	1226	1226	1400	1400	1400	1400	1400
C											
	C1	10880	10880	10880	10880	10880	12008	12008	12008	8720	8720
	C2	6342	6342	6342	6342	6342	6342	6342	6342	3120	3120
	C3	6656	6656	6656	6718	6718	7806	7806	7806	6624	6624
	C4	3720	3720	3720	3720	3720	4361	4361	5 015	5030	5030
	C5	894	894	894	1125	1125	1125	1125	1125	983	983
	C6	1906	1906	1906	1906	1906	2727	2727	2727	3238	3238
	C7	7120	7120	7120	7120	7120	7120	7120	7120	3512	3512
	C8	4402	4402	4402	4402	4402	4595	4595	5 530	5650	5650
	C9	4483	4483	4483	4483	4483	4483	4483	4483	4396	4396
	C10	3032	3032	3032	3032	3032	4956	4956	4956	2777	2777
	C11	4238	4238	4238	4653	4653	5573	5573	5573	6337	6337
	C12	4584	4584	4584	4000	4000	4444	4444	4444	4474	4474
	C13	2056	2056	2056	2056	2056	2056	2056	2056	1804	1804
	C14	1020	1020	1020	1020	1020	1800	1800	1800	2396	2396
	C15	1630	1630	1630	1630	1630	1630	1630	1630	2164	2164
D											
	D1	10784	9397	10071	10071	10838	12368	12368	12368	3876	3876
	D2	6260	5230	4805	4805	5571	6835	6835	6835	8348	8348
	D3	3745	3745	5062	5041	5041	6223	6223	6223	6442	6442
	D4	6424	7762	7762	8033	8806	9230	9230	9230	3310	3310
	D5	3704	4730	5034	5034	5034	5634	5634	6 120	6252	6252
	D6	4307	3716	4430	4430	4430	4414	4414	4414	4832	4832
	D7	3032	3930	3930	3438	3438	3438	3438	3438	4033	4233
	D8	862	750	750	862	862	2362	2362	2362	1753	1753
	D9	246	440	440	430	430	2015	2015	2015	1644	1644
	D10	1680	1680	1825	1825	1825	2953	2953	2953	2845	2927
E											
	E1	7936	7936	7936	7936	8796	8796	8796	9 559	9607	9607



	E2	41	84	75	71	64	60	63	59	57	56
	E3	91	172	166	146	133	133	134	118	104	104
	E4	13	31	32	33	36	30	31	37	36	38
	E5	43	80	78	76	71	63	66	67	67	75
	E6	42	78	78	76	79	79	79	74	73	75
	E7	14	32	30	31	31	32	32	26	29	24
	E8	9	23	22	22	22	16	17	17	18	18
	E9	8	23	22	21	17	16	17	19	20	20
	E10	14	40	40	39	38	36	36	35	38	37
	E11	8	17	16	16	20	17	20	22	19	20
F											
	F1	27	61	60	56	54	56	57	60	61	58
	F2	3	10	10	13	23	22	23	31	26	28
	F3	22	63	65	68	67	59	59	58	26	61
	F4			2	3	4	5	6	7	9	12
	F5	18	18	23	23	25	31	31	27	26	28
	F6	27	27	26	24	26	22	22	22	23	23
G											
	G1	40	84	78	73	74	72	68	59	49	56
	G2	44	84	78	71	67	66	63	66	59	66
	G3	49	118	114	102	97	94	93	88	81	78
	G4	11	33	33	37	41	40	41	49	45	50
	G5	14	25	24	25	23	25	25	28	31	32
	G6	10	18	20	22	21	21	21	24	25	26
	G7	5	12	10	7	12	12	11	19	20	20
	G8	16	51	51	51	54	47	48	46	46	45
H											
	H1	28	60	59	58	58	55	58	62	61	66
	H2	28	58	54	54	50	51	52	49	49	49
	H3	58	114	109	106	106	98	97	91	80	85
	H4	14	32	28	26	26	20	25	34	37	36
	H5	6	16	16	14	14	15	17	21	21	23
	H6	39	71	68	68	67	60	61	65	66	64
	H7		4	5	8	10	10	10	16	14	15
	H8	9	27	25	23	22	17	18	24	23	25
	H9	11	18	17	17	19	15	17	22	20	23
	H11	15	15	14	14	21	18	18	20	19	19
	H10	18	45	44	43	45	44	44	44	41	44
I											
	I1	27	67	65	65	68	68	66	67	67	70
	I2	52	87	86	87	78	73	72	68	67	64
	I3	53	128	123	117	116	117	115	103	106	107
	I4	9	25	26	27	29	32	36	37	34	34
	I5	20	77	74	72	69	70	71	62	65	65
	I6	12	54	53	53	55	53	53	56	59	60
	I7	17	52	50	55	52	57	57	59	55	58
J											
	J1	80	79	76	74	69	72	71	65	64	65
	J2	37	32	90	89	92	90	90	83	77	79
	J3	16	16	14	13	18	19	18	20	19	20
	J4	10	10	10	10	12	13	13	14	15	14
	J5	16	16	15	17	19	19	20	19	18	19
K											
	K1	13	20	22	21	22	22	23	34	41	46
	K2	46	102	100	99	96	89	91	92	94	104
	K3	53	110	104	99	87	87	86	89	85	87
	K4	10	17	18	17	21	21	24	28	30	31
	K5	8	18	18	19	17	16	17	24	24	27
L											
	L1	16	46	44	44	49	44	47	56	59	60
	L2	27	58	59	59	59	62	62	63	60	57
	L3	14	33	32	32	33	33	33	33	34	33
	L4	5	16	17	17	19	17	16	20	17	18
M											
	M1	25	62	63	59	60	49	49	46	43	45
	M2	39	92	88	89	87	83	84	88	80	81
	M3	32	83	82	74	73	69	68	77	70	76
	M4	10	30	27	17	24	19	18	25	21	23
	M5	8	17	19	25	18	18	18	25	20	21
	M6	12	29	28	29	30	30	30	27	28	28
	M7	21	48	48	47	45	45	45	42	42	41
	M8	22	57	56	54	45	42	42	41	42	39
	M9	4	10	8	8	8	7	8	11	11	13

	E2	6040	6040	6040	6040	6940	6940	6940	6940	5066	5066
	E3	5768	5768	5768	6114	6914	6914	6914	6914	8353	8353
	E4	3918	3918	3400	6114	6514	6514	6514	6514	4494	4494
	E5	4079	4138	4138	4138	4138	4138	4138	4 720	4400	4400
	E6	1616	1616	1616	1616	2416	2416	2416	2416	2803	2803
	E7	1526	1526	1526	1526	1526	2154	2154	2154	1852	1 852
	E8	1451	1451	1451	1451	1451	1451	1451	1451	1564	1564
	E9	1129	1189	1156	1189	1489	1489	1489	1 465	1413	1413
	E10	1379	1542	1542	1542	1542	1698	1698	1 598	1630	1630
	E11	1285	1285	1265	1265	1565	1565	1565	1565	1177	1177
F											
	F1	3250	3460	3820	3930	3930	3930	3930	3930	4260	4260
	F2	2170	2210	3430	3430	3930	4222	4222	4222	4182	4182
	F3	4386	4734	4518	4518	5238	5546	5546	4 674	3777	3777
	F4	0	0	0	0	1200	1200	1200	1 000	1450	1380
	F5	5080	8870	8870	8 870	8 870	8 870	8 870	8 870	5076	5076
	F6	1044	1231	1731	1 714	1 714	1 774	1 774	1 774	1 720	1380
G											
	G1	4790	4840	4840	5640	5640	4644	4644	4 176	4684	4834
	G2	4659	4919	4919	4979	4979	5710	5710	7 745	7745	7745
	G3	4853	3301	4453	5911	5911	6151	6151	5 688	5688	5688
	G4	3412	4486	4486	5200	5200	5782	5782	3 130	5769	5769
	G5	1740	3269	3269	3269	3269	3650	3650	4 481	4481	4481
	G6	2525	2746	2746	2746	2746	2706	2706	2 707	2707	2707
	G7	949	934	964	1039	1039	1344	1344	1 033	1226	1226
	G8	1674	1714	1714	1714	1714	1964	1964	3 260	3260	3260
H											
	H1	6432	3472	3792	3 792	3 792	3 792	3 792	4 970	5120	5120
	H2	4212	2733	3033	3 033	3 033	3 033	3 033	5 532	6234	6234
	H3	5360	4200	4700	4700	4700	4700	4700	4 564	4564	4564
	H4	2600	2345	3137	3137	3137	3637	3637	5 135	4070	4070
	H5	3776	4681	4681	4700	4700	4700	4700	4 510	4510	4510
	H6	3816	4459	5403	5403	5403	5484	5484	3 400	3400	3400
	H7	0	0	560	570	570	1247	1247	1 742	1742	1742
	H8	1030	1039	1039	1039	1039	1039	1039	1039	1758	1758
	H9	1335	2339	2339	2339	2339	2339	2339	1 750	1013	1013
	H11	2670	2454	2454	2454	2454	2454	2454	2 730	3178	3178
	H10	1448	320	920	1775	1775	2036	2036	1 443	1674	1674
I											
	I1	7104	7197	3573	3573	3573	3433	3433	3433	3774	3774
	I2	5320	8270	8270	8270	8270	3080	3080	3080	3080	3080
	I3	5334	5770	5770	5770	7410	5784	5784	5 632	5632	7008
	I4	1836	3842	3842	3842	4842	4842	4842	4842	4 262	4762
	I5	4352	4160	4160	4424	4424	4424	4424	4424	4424	4424
	I6	3208	3270	4740	4740	4740	3874	3874	5 110	5110	5110
	I7	3616	3016	3016	3016	3216	3170	3170	3 450	3890	3890
J											
	J1	3728	3967	3967	3967	3967	3967	3967	3 951	3951	3951
	J2	6137	6585	6585	6585	6585	6832	6832	3 951	6832	6832
	J3	540	1425	1440	1440	1440	1574	1574	3 406	3406	3406
	J4	0	0	840	840	840	1326	1326	1326	1686	1686
	J5	698	625	855	798	798	824	824	824	1142	1142
K											
	K1	2780	2224	2224	2224	2224	2224	2224	2 428	5392	7232
	K2	4384	5205	5885	6413	6413	6413	6413	6413	6482	6315
	K3	6597	5466	5466	2224	2224	2224	2224	2224	3 692	5802
	K4	1550	1766	2455	2030	2030	2030	2030	2030	2 500	3236
	K5	1492	1642	1642	1642	1642	1642	1642	1642	2 416	2416
L											
	L1	7030	7366	7366	7366	7366	7366	7366	8 772	8772	8772
	L2	5064	5510	5510	5510	5510	5510	5510	4 752	4752	4752
	L3	3880	3602	3602	3602	3602	3602	3602	2 884	5004	5772
	L4	910	1361	1361	1361	1361	1361	1361	1 070	1070	2005
M											
	M1	6996	9950	10039	10039	16039	9576	9576	9576	9 576	9576
	M2	6560	10573	10573	10573	17673	10590	10590	10590	10590	10590
	M3	7260	9216	9423	10142	18362	11965	11965	11965	11965	11965
	M4	3360	2974	2974	3394	3394	3394	3394	3394	3494	3554
	M5	4148	3220	3220	3602	3602	3602	3602	3 794	3794	3794
	M6	744	708	2016	2016	2016	2200	2200	2 311	2 311	2 311
	M7	2402	2236	2430	2430	2430	2700	2700	2 894	2894	2894
	M8	1236	1236	1236	1236	1236	1236	1236	1236	1236	1956
	M9	1477	1609	1609	1609	1609	2226	2226	1 116	1116	1116

Figures 7, 8 & 9: Representing the ***number of administrative staff and the occupational capacity Per Year*** *for 105 institutions over 13 universities from 2012 to 2022.*

Formulating Composite Indexes for HEIs

Identifying Key Variables

In the strategic management of Moroccan public higher education institutions (HEIs), the construction of composite indexes requires the careful identification of variables that capture institutional effectiveness, efficiency, and adaptability. For this purpose, three core indexes were developed: the Success Index (S), the Performance Index (P), and the Growth Index (G).

The **Success Index (S)** evaluates student achievement outcomes by measuring the proportion of graduates relative to total student enrollments over a given period. Its formula is expressed as:

S=Number of Graduates/Total Number of Students

This index serves as a fundamental variable for institutional evaluation, highlighting the ability of HEIs to guide students to program completion.

The **Performance Index (P)** integrates multiple variables that represent institutional efficiency, combining academic outcomes with staff–student coverage. The components include the student success rate, the pedagogical coverage rate (faculty-to-student ratio), and the administrative coverage rate (administrative staff-to-student ratio). Its weighted formula is given by:

$$\mathbf{P = (SR \times 0.5) + (PCR \times 0.25) + (ACR \times 0.25)}$$

Where SR is the success rate, PCR is the pedagogical coverage rate, and ACR is the administrative coverage rate.

Finally, the **Growth Index (G)** measures institutional capacity to scale and accommodate increasing student populations, expressed as:

$$\mathbf{G = (New\ Enrollments/Total\ Enrollments) \times (Total\ Enrollments/Occupancy\ Capacity) \times 100}$$

This variable highlights institutional scalability and resource management efficiency. Together, these three indexes encapsulate the critical dimensions of success, operational performance, and growth, making them highly relevant inputs for machine learning models.

Weighting and Aggregation Method:

The development of composite indexes requires explicit weighting and aggregation methods to ensure that the importance of each variable is accurately represented. Weighting involves assigning relative importance to indicators, while aggregation specifies how weighted values are combined.

For this study, the **Performance Index** provides a clear example of weighted aggregation. The success rate receives a weight of 0.5, emphasizing its centrality to institutional outcomes, while pedagogical and administrative coverage rates are each weighted at 0.25. The choice of weights follows a **normative approach**, prioritizing academic outcomes while still recognizing the operational role of staffing. In alternative contexts, weighting could also be determined using **Principal Component Analysis (PCA)**, which derives weights from statistical variance, or **entropy-based methods**, which assign higher weights to variables with greater informational content (Nardo et al., 2008).

The aggregation method adopted is the **weighted sum model**, one of the most transparent and widely used approaches in composite index construction:

$$CI = \sum_{i=1}^{n} w_i \cdot x_i$$

Where wi represents the weight of indicator i, and xi its normalized value. This linear method ensures interpretability, as each variable's contribution to the composite score is proportional to its weight. In contexts where interactions among variables are nonlinear, alternative aggregation techniques such as the **geometric mean** may be applied:

$$CI = \prod_{i=1}^{n} x_i^{w_i}$$

This method penalizes unbalanced performance across indicators, making it useful when institutional balance across dimensions is as important as overall strength.

Normalization of Composite Indexes:

Normalization is a crucial step to ensure comparability of variables expressed in different units or scales. Without normalization, variables with larger numerical ranges such as total enrollments would dominate the composite index, overshadowing smaller-scale ratios like staff coverage rates. Normalization ensures methodological rigor and comparability across institutions and time periods.

Two primary normalization techniques are applied in composite index construction:

1. **Min–Max Normalization:**
   This method scales variables to a fixed range, typically [0, 1], ensuring that all indicators contribute proportionally to the index. The formula is:

$$x_i^{norm} = \frac{x_i - \min(x)}{\max(x) - \min(x)}$$

Where xi norm is the normalized value of indicator xi, and min(x),max(x) are the minimum and maximum values observed in the dataset.

2. **Z-Score Standardization:**
   This technique centers the variable around its mean and scales it by its standard deviation, making it suitable for normally distributed variables:

$$x_i^{norm} = \frac{x_i - \mu}{\sigma}$$

Where μ is the mean of the indicator and σ is its standard deviation.

Normalization guarantees consistency across Moroccan HEIs within the 10-year dataset used in this study. It also enhances the predictive performance of Support Vector Machine (SVM) models by ensuring that all input features (S, P, G) contribute equitably to classification and regression tasks. Without this step, disparities in scales could bias the model, leading to inaccurate decision boundaries and weaker institutional classifications.

SR	Year	1	2	3	4	5	6	7	8	9	10
A											
	A1	0,079	0,1508	0,195	0,2379	0,209	0,2094	0,1933	0,1737	0,1778	0,1922
	A2	0,2278	0,128	0,1698	0,1319	0,1578	0,1596	0,1376	0,129	0,156	0,1567
	A3	0	0	0,063	0,0941	0,1114	0,0745	0,0968	0,0949	0,0905	0,1003
	A4	0,1652	0,1421	0,1544	0,18	0,1936	0,1717	0,1395	0,1565	0,1575	0,1347
	A5	0,1128	0,0903	0,0808	0,0941	0,0967	0,136	0,1364	0,1144	0,1237	0,1336
B											
	B1	0,1127	0,0795	0,1275	0,1421	0,1363	0,1462	0,1114	0,1233	0,1488	0,1244
	B2	0,1062	0,0916	0,0939	0,1219	0,1568	0,1869	0,1662	0,1727	0,1579	0,1233
	B3	0,0825	0,1201	0,098	0,0967	0,1176	0,1182	0,161	0,1366	0,144	0,1083
	B4	0,4004	0,4184	0,4503	0,4735	0,4802	0,5064	0,4815	0,2376	0,3657	0,544
	B5	0,1047	0,1247	0,1332	0,1263	0,1949	0,1492	0,1549	0,1662	0,17	0,1667
	B6	0,1438	0,1221	0,131	0,1072	0,1244	0,1656	0,1619	0,1388	0,146	0,1174
	B7	0,0915	0,1254	0,1321	0,1188	0,107	0,1009	0,1107	0,0606	0,0992	0,1458
	B8	0,115	0,1313	0,1082	0,1587	0,155	0,1942	0,2566	0,173	0,2117	0,2016
	B9	0,4618	0,3456	0,2752	0,2747	0,1953	0,3562	0,3038	0,292	0,4384	0,376
C											
	C1	0,1173	0,0969	0,1148	0,1277	0,1348	0,0946	0,1604	0,1715	0,1826	0,1594
	C2	0,1195	0,1444	0,1537	0,1461	0,1454	0,1434	0,1344	0,1345	0,1668	0,1331
	C3	0,141	0,0892	0,1442	0,1716	0,19	0,2113	0,1948	0,1946	0,1744	0,1739
	C4	0,0501	0,0553	0,1152	0,0273	0,0767	0,1169	0,1291	0,0642	0,1798	0,1081
	C5	0,1569	0,0923	0,1315	0,1608	0,1935	0,1875	0,1965	0,1562	0,1621	0,1562
	C6	0,4348	0,4339	0,4858	0,4667	0,581	0,3928	0,3382	0,4711	0,4674	0,4613
	C7	0,1084	0,0656	0,0973	0,1079	0,1089	0,1009	0,0982	0,0958	0,1169	0,1246
	C8	0,1432	0,1424	0,1914	0,1748	0,1861	0,173	0,2128	0,2586	0,2515	0,2359
	C9	0,1642	0,1601	0,1657	0,1401	0,1629	0,1883	0,1833	0,1561	0,1878	0,1424
	C10	0,1736	0,1372	0,1475	0,1502	0,1756	0,1802	0,151	0,1291	0,1395	0,1272
	C11	0,1004	0,1202	0,1445	0,1241	0,1341	0,1202	0,1183	0,1421	0,123	0,1516
	C12	0,1657	0,1908	0,189	0,0848	0,1987	0,2011	0,1788	0,2479	0,2275	0,2069
	C13	0	0	0	0,1431	0,1618	0,1665	0,1806	0,1645	0,155	0,1451
	C14	0,1681	0,155	0,192	0,2351	0,218	0,2031	0,2031	0,2432	0,2167	0,2085
	C15	0,6141	0,4348	0,4543	0,2921	0,4264	0,407	0,4163	0,2893	0,3188	0,3869
D											
	D1	0,0806	0,0593	0,0796	0,0774	0,0766	0,0802	0,0863	0,0845	0,0937	0,0823
	D2	0,0776	0,1422	0,1479	0,1136	0,1258	0,166	0,1469	0,1277	0,1223	0,1124
	D3	0,1154	0,1174	0,1069	0,0644	0,1184	0,1388	0,1551	0,1408	0,1421	0,1292
	D4	0,0764	0,0977	0,1159	0,1308	0,1778	0,1586	0,1356	0,1873	0,1696	0,1356
	D5	0,0919	0,1138	0,0927	0,1006	0,0902	0,1233	0,1511	0,1424	0,1246	0,1057
	D6	0,1736	0,2371	0,2373	0,2141	0,2215	0,2087	0,1976	0,2013	0,2387	0,2151
	D7	0,0268	0,0384	0,1076	0,1064	0,1399	0,0975	0,1128	0,0894	0,1454	0,1337
	D8	0,1725	0,1842	0,2062	0,1681	0,194	0,1952	0,2143	0,1799	0,1764	0,1665
	D9	0,1627	0,1323	0,1294	0,1962	0,1922	0,1623	0,2349	0,1655	0,1744	0,16
	D10	0,3942	0,3977	0,4314	0,4576	0,6024	0,4663	0,4149	0,4454	0,3425	0,4432
E											
	E1	0,0713	0,0966	0,0741	0,1256	0,1275	0,1223	0,1138	0,1189	0,1313	0,1643

	E2	0,0709	0,1034	0,1143	0,1238	0,1512	0,1481	0,1563	0,1436	0,1456	0,1348
	E3	0,0851	0,0959	0,0961	0,1123	0,1354	0,1422	0,1387	0,1262	0,1329	0,1539
	E4	0,0817	0,0831	0,0932	0,11	0,1096	0,1132	0,1015	0,105	0,0856	0,076
	E5	0,1546	0,1806	0,2749	0,25	0,2283	0,2546	0,2252	0,1942	0,2031	0,2192
	E6	0,0596	0,0729	0,0732	0,0714	0,0951	0,1027	0,1012	0,0938	0,0936	0,1115
	E7	0,1573	0,1324	0,1247	0,1069	0,1356	0,1414	0,1465	0,1345	0,1313	0,1337
	E8	0,1983	0,1519	0,2018	0,1851	0,1931	0,2171	0,1898	0,1655	0,158	0,1599
	E9	0,1228	0,1271	0,1654	0,1966	0,207	0,1975	0,1872	0,146	0,1457	0,1533
	E10	0,4545	0,5052	0,4156	0,4622	0,7529	0,323	0,4718	0,1484	0,509	0,4617
	E11	0,3953	0,3169	0,5122	0,6065	0,4243	0,4354	0,5965	0,5753	0,5074	0,5499
F											
	F1	0,118	0,1291	0,1235	0,1291	0,117	0,1272	0,1366	0,1458	0,1221	0,1237
	F2	0,0834	0,0598	0,129	0,1467	0,1608	0,1484	0,1835	0,3937	0,2346	0,2482
	F3	0,1234	0,1298	0,1747	0,2498	0,2409	0,1651	0,1748	0,1753	0,21	0,157
	F4	0	0,2432	0,4248	0,4429	0,3214	0,4282	0,4442	0,4244	0,4592	0,2847
	F5	0,0943	0,1246	0,1514	0,1062	0,136	0,1796	0,1372	0,1295	0,0975	0,0947
	F6	0,0862	0,1637	0,1587	0,1526	0,2024	0,1923	0,1571	0,149	0,1382	0,1558
G											
	G1	0,0908	0,0919	0,0715	0,072	0,0795	0,0667	0,0557	0,0651	0,0806	0,0647
	G2	0,1205	0,1198	0,0927	0,101	0,1168	0,0988	0,1032	0,113	0,1204	0,0972
	G3	0,1287	0,1193	0,1251	0,13	0,1675	0,1814	0,1757	0,158	0,1706	0,1673
	G4	0,0665	0,0642	0,0638	0,0606	0,0654	0,0552	0,0439	0,0597	0,0669	0,0559
	G5	0	0	0	0,0697	0,105	0,0728	0,1016	0,0734	0,1209	0,1079
	G6	0,1731	0,1857	0,1871	0,1876	0,1874	0,2057	0,1711	0,1626	0,1687	0,1105
	G7	0,1473	0,1777	0,1732	0,2656	0,2083	0,1969	0,1418	0,1361	0,152	0,139
	G8	0,4629	0,4047	0,4114	0,4156	0,4357	0,3654	0,2758	0,4927	0,489	0,4594
H											
	H1	0,0919	0,1196	0,1885	0,1647	0,1208	0,1199	0,116	0,1046	0,1215	0,1104
	H2	0,1429	0,1469	0,1218	0,2902	0,086	0,1132	0,1078	0,0977	0,1171	0,1067
	H3	0,1979	0,1579	0,1562	0,443	0,1386	0,1605	0,1767	0,1572	0,1597	0,1299
	H4	0,1287	0,122	0,1305	0,185	0,1475	0,1711	0,1422	0,138	0,1372	0,1695
	H5	0,0886	0,1094	0,1228	0,1388	0,0974	0,0905	0,1086	0,1061	0,1254	0,0947
	H6	0,2343	0,2363	0,3598	0,232	0,1861	0,1858	0,1642	0,1752	0,2002	0,1966
	H7	0	0	0,2324	0,2673	0,197	0,2058	0,2455	2,2692	0,2322	0,2319
	H8	0,1595	0,1958	0,1547	0,1622	0,1211	0,1772	0,219	0,1746	0,205	0,1371
	H9	0,1093	0,1483	0,1593	0,2238	0,1636	0,1982	0,2007	0,153	0,1381	0,153
	H10	0,1564	0,1357	0,1564	0,1427	0,1608	0,1619	0,1609	0,1205	0,1601	0,1679
	H11	0	0	0,1328	0,2557	0,1871	0,1932	0,176	0,2166	0,136	0,1472
I											
	I1	0,0724	0,0596	0,0869	0,105	0,1035	0,1193	0,1166	0,1316	0,1311	0,1423
	I2	0,1176	0,0751	0,0961	0,0954	0,1017	0,135	0,1608	0,138	0,1228	0,1135
	I3	0,0686	0,1229	0,0639	0,076	0,0935	0,1061	0,134	0,1456	0,1519	0,1099
	I4	0,1006	0,124	0,1038	0,102	0,064	0,0744	0,0714	0,0819	0,0804	0,085
	I5	0,0868	0,1079	0,1353	0,1502	0,1139	0,14	0,155	0,1995	0,2133	0,1682
	I6	0,1575	0,1318	0,1178	0,1585	0,1381	0,1732	0,161	0,0969	0,1335	0,0816
	I7	0,4442	0,4763	0,0957	0,5358	0,4875	0,5168	0,4559	0,4507	0,1033	0,4566
J											
	J1	0,1607	0,106	0,1071	0,1192	0,1182	0,1123	0,139	0,1329	0,1579	0,1069
	J2	0,0804	0,1197	0,1195	0,1441	0,132	0,1103	0,1617	0,1276	0,1373	0,1026
	J3	0,3248	0,2168	0,2876	0,3129	0,1845	0,2229	0,2203	0,2419	0,1654	0,117
	J4	0,109	0,0802	0,1275	0,1429	0,1534	0,1526	0,1286	0,1081	0,1362	0,1293
	J5	0,1307	0,1605	0,1415	0,1459	0,2378	0,1786	0,1649	0,1849	0,1463	0,1718
K											
	K1	0,195	0,1247	0,1179	0,0768	0,0647	0,0677	0,0684	0,0912	0,0922	0,0757
	K2	0,0814	0,0853	0,0975	0,0918	0,0866	0,129	0,1254	0,1305	0,0993	0,0914
	K3	0,0948	0,0833	0,0975	0,1176	0,1258	0,1271	0,1471	0,2117	0,1449	0,1394
	K4	0,0882	0,1489	0,1462	0,1808	0,174	0,2069	0,1357	0,1598	0,1373	0,1276
	K5	0,1333	0,221	0,1695	0,2138	0,2426	0,2239	0,2322	0,2155	0,2468	0,2226
L											
	L1	0,0523	0,0981	0,1425	0,045	0,0783	0,0947	0,1158	0,0977	0,1146	0,1071
	L2	0,1828	0,2344	0,2151	0,2243	0,2111	0,2117	0,1719	0,1842	0,2255	0,2209
	L3	0,2224	0,1926	0,1686	0,1611	0,1465	0,1733	0,1633	0,1612	0,1026	0,1545
	L4	0,4668	0,4524	0,4478	0,4859	0,5721	0	0,4725	0,3726	0,264	0,3256
M											
	M1	0,0835	0,0788	0,0795	0,0803	0,0976	0,1081	0,1044	0,1181	0,1359	0,1012
	M2	0,1836	0,1308	0,1221	0,1202	0,1379	0,1345	0,1279	0,1386	0,1386	0,1222
	M3	0,0926	0,0927	0,099	0,0872	0,122	0,1599	0,1629	0,1465	0,13	0,0921
	M4	0,1196	0,1256	0,1745	0,199	0,1512	0,1396	0,1806	0,1626	0,1458	0,1618
	M5	0,0813	0,1582	0,2473	0,1993	0,1711	0,1353	0,103	0,1066	0,1576	0,1441
	M6	0,2163	0,2441	0,1902	0,1837	0,2078	0,1794	0,1623	0,1487	0,1828	0,15
	M7	0,1722	0,1246	0,2348	0,2082	0,2677	0,2191	0,2081	0,2075	0,202	0,1448
	M8	0,4661	0,4422	0,4761	0,4254	0,5153	0,4503	0,3848	0,3952	0,5055	0,0772
	M9	0	0	3,87	0,3965	0,3591	0,5077	0,4123	0,5536	0,6154	0,4268

Figures 10, 11 & 12: Representing calculated Success index ***Per Year*** *for 105 institutions over 13 universities from 2012 to 2022.*

PR	Year	1	2	3	4	5	6	7	8	9	10
A											
	A1	0,6215	0,6341	0,5719	0,6586	0,6535	0,6662	0,6764	0,6161	0,5656	0,5724
	A2	0,8051	0,5304	0,591	0,336	0,4745	0,4005	0,3568	0,3025	0,3598	0,3579
	A3	2,2917	1,3542	1,0098	1,4084	0,8292	0,5581	0,5192	0,5592	0,503	0,4446
	A4	2,244	2,0569	1,8468	1,9768	1,763	1,5114	1,2061	1,1027	0,9018	0,9585
	A5	0,6519	0,549	0,4714	0,4524	0,4622	0,4682	0,4868	0,4903	0,4507	0,5049
B											
	B1	0,7989	0,7126	0,6893	0,5986	0,5512	0,5977	0,5012	0,4619	0,4931	0,484
	B2	1,0024	0,8652	0,6624	0,6544	0,7943	0,9111	0,8745	0,8583	0,8449	0,7712
	B3	1,5954	1,6835	1,332	1,4254	1,8203	1,3627	1,3979	1,3864	1,3279	1,4165
	B4	4,7274	4,5053	4,1082	3,9857	4,4464	3,596	3,1739	2,6766	4,3113	3,053
	B5	0,6019	0,5484	0,4734	0,4235	0,5677	0,3907	0,4055	0,3949	0,4052	0,4266
	B6	0,6434	0,5189	0,484	0,4162	0,3834	0,3856	0,3707	0,3424	0,3722	0,3525
	B7	4,38	3,5772	3,4721	3,2227	2,9603	2,6582	3,045	2,7043	2,21	2,6212
	B8	3,7674	2,8669	2,3086	2,1197	2,7004	2,7472	3,5456	3,0365	2,9146	3,3762
	B9	4,3385	3,4864	3,2101	2,7008	1,887	1,5054	1,4975	1,6131	1,5654	1,6955
C											
	C1	0,4336	0,4534	0,4221	0,3836	0,3771	0,3411	0,3448	0,326	0,3114	0,2625
	C2	0,8307	0,9667	0,8706	0,6864	0,6307	0,5734	0,5182	0,4718	0,4956	0,4276
	C3	1,0504	1,1284	1,1885	1,1006	1,1259	1,1745	1,1973	1,1644	1,0044	0,9796
	C4	2,0244	2,4509	2,0443	2,3026	1,9668	2,1711	2,2947	2,238	2,1959	1,8333
	C5	2,5644	3,0046	2,7195	2,6303	2,7329	2,679	2,8041	3,1952	2,7653	2,8035
	C6	3,537	4,2751	4	3,3837	3,631	3,0486	2,6691	2,7276	2,8434	3,0475
	C7	0,2822	0,2942	0,2696	0,2904	0,297	0,2787	0,2591	0,2302	0,2234	0,2078
	C8	0,3401	0,3605	0,4274	0,3764	0,3379	0,2863	0,3297	0,3551	0,401	0,4012
	C9	0,9429	1,0398	0,9531	0,9212	0,9187	0,8943	0,8837	0,8878	0,9936	0,8407
	C10	1,1752	1,0985	1,1145	1,0788	1,1001	1,0647	0,945	0,7202	0,6482	0,6735
	C11	0,8205	0,9207	0,9442	0,8424	0,9152	0,7922	0,7679	0,962	0,8555	1,0366
	C12	1,6852	1,9575	1,8667	1,6802	1,6727	1,7559	1,5218	1,6888	1,6012	1,5962
	C13	2,4764	2,3134	1,4117	1,7195	1,7415	1,748	1,6273	1,7826	1,6228	1,715
	C14	0,5839	0,8077	0,6985	0,7013	0,8705	0,7934	0,8069	0,8221	0,887	0,9015
	C15	4,1235	4,6558	3,7301	3,4069	3,1848	3,1965	2,7024	2,7557	2,2362	2,4662
D											
	D1	0,251	0,2727	0,2686	0,2366	0,2203	0,2415	0,2297	0,2257	0,1988	0,2299
	D2	0,415	0,5341	0,5638	0,5236	0,5544	0,5806	0,6061	0,6199	0,5131	0,4691
	D3	0,4155	0,5036	0,4948	0,405	0,6138	0,6308	0,6564	0,6216	0,5762	0,5623
	D4	0,9817	1,1015	0,9731	1,0094	1,2286	1,2445	1,145	1,2337	1,1265	1,0634
	D5	0,3012	0,3861	0,3394	0,3408	0,4314	0,4745	0,5516	0,532	0,5006	0,4509
	D6	1,5894	1,733	1,7939	1,6668	1,7226	1,6931	1,7076	1,7071	1,774	1,7174
	D7	2,9061	2,78	2,5087	2,7229	2,9591	2,4794	2,6144	2,3596	2,6105	2,5843
	D8	1,1645	1,5338	1,4974	1,5246	1,5105	1,3989	1,4076	1,7483	1,8362	1,402
	D9	1,1726	1,3643	1,3001	1,316	1,3044	1,1501	1,2201	1,1168	1,111	1,5032
	D10	2,008	2,4909	2,5769	2,4221	2,3605	2,215	2,1843	2,0989	3,3955	2,318
E											
	E1	0,3651	0,4439	0,3788	0,3557	0,315	0,2941	0,2681	0,2553	0,2461	0,2451

	E2	0,4178	0,4392	0,3947	0,3717	0,4095	0,4258	0,4231	0,395	0,3951	0,3716
	E3	1,3237	1,3914	1,3303	1,0767	1,3728	1,2675	1,3243	1,1439	1,0641	1,1162
	E4	0,3735	0,5149	0,5612	0,5255	0,5281	0,5352	0,5598	0,5108	0,4513	0,3784
	E5	2,2937	2,4679	2,9569	3,054	2,6841	2,746	2,5844	2,3468	1,9343	2,0493
	E6	2,0906	2,571	2,3499	2,3399	2,3106	2,2445	2,1115	2,0729	1,9902	2,0055
	E7	2,5058	2,7868	2,3293	2,1686	2,1351	2,0315	1,9049	1,6754	1,6965	1,5809
	E8	1,3474	1,6888	1,6555	1,9831	2,4571	2,2456	2,282	2,0911	1,9298	1,9869
	E9	1,0269	1,6348	1,525	1,3483	1,2422	1,1984	1,1362	1,1385	1,1337	1,0433
	E10	2,3549	3,9582	3,3606	3,4098	3,5688	1,9171	2,3354	1,9296	2,1362	1,9966
	E11	1,8938	2,3443	2,5122	2,2934	2,1409	1,4325	2,2528	2,1236	1,7098	1,6676
F											
	F1	0,4614	0,5447	0,4899	0,4251	0,3963	0,3988	0,4041	0,3817	0,317	0,324
	F2	0,2436	0,2173	0,2516	0,3312	0,3936	0,3652	0,4146	0,7697	0,4531	0,6021
	F3	1,8195	2,0812	3,0771	2,8872	2,0104	1,7186	1,6837	1,6497	1,2979	1,4027
	F4	0	1,473	1,5196	1,4714	1,8189	1,5337	1,535	1,7156	1,8362	1,2715
	F5	0,4663	0,563	0,7066	0,6541	0,718	0,9648	0,8685	0,7427	0,5868	0,5531
	F6	2,035	1,9087	2,0315	2,0614	2,2963	2,2364	2,0973	1,8147	1,808	1,7529
G											
	G1	0,2973	0,3629	0,3112	0,2593	0,2678	0,2357	0,2031	0,1949	0,1936	0,1941
	G2	0,6286	0,701	0,4599	0,5587	0,5407	0,4639	0,4445	0,4572	0,4523	0,4473
	G3	1,266	1,3295	1,5131	1,362	1,3986	1,4029	1,4569	1,3827	1,3832	1,4502
	G4	0,2867	0,3717	0,3133	0,2796	0,2927	0,2331	0,2228	0,2262	0,2517	0,2142
	G5	1,774	1,6357	1,7713	1,5613	1,5143	1,2353	1,117	1,2564	1,2697	1,1796
	G6	1,9716	2,1558	2,2978	2,3714	2,3568	2,4499	2,3083	2,1841	2,2623	2,0111
	G7	0,7061	1,0409	1,0293	1,0716	1,4691	1,329	1,233	1,3639	1,3103	1,2956
	G8	1,6701	2,7616	3,3135	3,0389	2,8147	2,298	1,6806	1,5442	1,4419	1,4923
H											
	H1	0,2294	0,273	0,2937	0,2413	0,2407	0,1945	0,1897	0,182	0,1831	0,1761
	H2	0,558	0,594	0,4978	0,5084	0,3691	0,3658	0,329	0,3393	0,3393	0,3217
	H3	1,1685	1,0652	1,0575	1,1113	0,9693	0,9462	1,0235	0,9597	0,9033	0,8041
	H4	0,2223	0,2413	0,2519	0,2223	0,1632	0,1825	0,1634	0,1589	0,1918	0,1885
	H5	0,405	0,3824	0,466	0,4558	0,3596	0,2799	0,2894	0,3248	0,3403	0,3465
	H6	1,5873	1,7189	1,4639	1,3662	1,3475	1,2371	1,1645	1,2021	1,1512	1,2103
	H7	0,3125	0,7835	1,5351	1,7483	1,8504	1,4898	1,4338	13,635	1,1314	1,099
	H8	1,7415	1,7139	1,5967	1,6408	1,6714	1,5857	1,5757	1,6301	1,6012	1,4243
	H9	1,0204	1,2308	1,3983	1,8019	1,5754	1,5309	1,7205	1,9188	1,7954	1,6778
	H10	1,2716	1,1329	1,1276	1,095	1,1862	1,0721	1,0114	0,9268	0,9073	0,8765
	H11	1,5051	2,6848	2,5896	2,7718	2,9872	2,5267	2,527	2,3907	2,294	2,0529
I											
	I1	0,2678	0,3146	0,2737	0,2704	0,2726	0,263	0,2425	0,2442	0,2227	0,2507
	I2	0,4691	0,5111	0,5033	0,4728	0,4983	0,5319	0,5692	0,5947	0,5203	0,455
	I3	1,053	1,8173	1,1628	1,5234	1,6504	1,6641	1,6705	1,895	1,7181	1,7856
	I4	0,3204	0,4751	0,3767	0,3262	0,2356	0,1991	0,2008	0,1951	0,1823	0,1815
	I5	1,3519	1,7031	1,5032	1,4944	1,4219	1,3575	1,3487	1,3525	1,5058	1,3789
	I6	1,7119	2,4223	2,2372	2,1993	2,1848	2,2063	2,2082	2,2478	2,275	2,1281
	I7	1,0922	1,7388	1,5055	1,8472	1,7042	1,87	1,9265	1,9265	1,7725	2,1391
J											
	J1	1,4177	1,1391	1,236	1,0765	0,9838	0,9281	0,9346	0,834	0,9247	0,8329
	J2	1,6539	1,5255	1,6519	1,4743	1,6244	1,5681	1,681	1,4862	1,6051	1,4363
	J3	0,7828	0,7721	0,736	0,6866	0,7141	0,5733	0,4924	0,4822	0,3127	0,2928
	J4	2,0282	1,5444	2,0245	2,3957	2,5977	2,4102	2,2579	2,0579	2,0132	1,8636
	J5	1,2964	1,5479	1,4316	1,5391	1,7146	1,5871	1,5117	1,32	1,2373	1,1856
K											
	K1	0,4163	0,4	0,3312	0,2826	0,2428	0,2047	0,1907	0,2028	0,1741	0,1468
	K2	0,3659	0,4134	0,3439	0,297	0,2847	0,3559	0,3733	0,3623	0,309	0,2502
	K3	0,9235	0,8939	0,966	1,128	1,0331	1,0215	1,1876	1,2313	1,079	0,937
	K4	1,1879	1,5186	1,5636	1,4391	1,6166	1,5688	1,6098	1,6178	1,5937	1,3733
	K5	0,825	1,0463	0,9584	0,9918	0,972	0,8932	0,8279	0,8608	0,8646	0,8139
L											
	L1	0,2925	0,359	0,342	0,2307	0,2235	0,2012	0,1928	0,1682	0,178	0,1654
	L2	1,2238	1,3868	1,2402	1,2833	1,3567	1,2517	1,2216	1,3416	1,4871	1,4897
	L3	1,0313	1,1896	1,3001	1,197	1,1948	1,0738	1,0625	1,0217	0,8822	0,9409
	L4	1,7586	2,6041	2,7736	3,4209	3,2512	2,7715	2,833	3,7921	2,9878	3,4716
M											
	M1	0,1605	0,1772	0,1714	0,1451	0,1804	0,1879	0,1893	0,1752	0,1805	0,1542
	M2	0,3565	0,3594	0,3287	0,3052	0,3586	0,3372	0,3562	0,4423	0,4197	0,3915
	M3	0,5608	0,5844	0,5729	0,5136	0,6857	0,8235	0,9745	1,0779	0,9364	0,9732
	M4	0,742	0,86	0,7574	0,6978	0,7196	0,697	0,6612	0,7727	0,6489	0,639
	M5	0,561	0,695	0,7718	0,8795	0,7703	0,7586	0,6164	0,6834	0,62	0,6199
	M6	1,9105	2,2726	2,0872	2,0399	1,9566	1,8289	1,8047	1,5577	1,5564	1,4715
	M7	1,1296	1,3725	1,7643	1,5491	1,5076	1,3164	1,1652	1,1601	1,0461	1,0195
	M8	1,8103	2,8191	2,6011	2,4915	2,4011	2,0885	1,7802	1,811	2,1107	1,8911
	M9	1,4337	1,9231	7,685	2,0204	1,9875	2,2513	1,4854	1,4613	1,6115	1,6291

Figures 13, 14 & 15: Representing calculated Performance index ***Per Year*** *for 105 institutions over 13 universities from 2012 to 2022.*

GR	Year	1	2	3	4	5	6	7	8	9	10
A											
	A1	39,887	61,381	62,018	49,079	47,149	52,315	60,741	64,398	37,98	33,697
	A2	23,88	49,43	66,138	93,146	82,506	97,252	95,98	92,519	80,796	86,293
	A3	90,226	46,4	90,4	96,098	100,98	101,71	100,98	68,293	144,88	30,591
	A4	28,738	42,613	35,067	18,304	34,247	34,694	48,98	36,671	41,877	45,877
	A5	56,908	47,537	56,525	66,445	64,514	70,04	60,053	46,871	32,091	43,064
B											
	B1	42,793	41,137	38,159	40,162	38,737	41,266	47,414	82,727	106,84	63,894
	B2	73,077	59,359	76,603	40,352	41,959	39,201	40,504	49,968	64,179	58,667
	B3	60,25	44,647	50,17	44,955	32,835	41,997	35,774	31,61	32,563	32,715
	B4	25,531	25,284	25,827	26,765	27,654	24,49	34,949	24,916	24,879	24,954
	B5	92,118	38,283	78,444	88,01	86,7	30,008	78,673	86,767	125,68	37,49
	B6	46,293	43,128	39,177	49,523	55,287	50,732	50,986	66,128	84,814	77,074
	B7	14,56	12,277	10,64	10,23	13,72	14,603	15,12	17,51	21,721	23,298
	B8	21,084	19,157	22,289	15,324	14,735	9,9933	10,127	12,408	13,31	12,042
	B9	6,1175	7,9119	11,827	9,3801	12,643	8,3571	12,071	15,5	13,357	15,786
C											
	C1	49,632	42,454	65	68,778	67,702	67,788	73,659	95,994	118,41	156,07
	C2	34,264	30,227	27,105	31,457	45,743	52,318	60,612	63,876	108,08	148,69
	C3	33,444	28,801	42,308	34,921	29,801	22,124	26,518	25,839	38,844	36,7
	C4	14,435	12,796	12,957	12,124	13,629	9,7561	11,187	12,183	11,277	12,79
	C5	20,582	53,244	18,568	14,844	15,911	16,444	15,822	16,178	19,329	21,261
	C6	24,869	26,81	29,748	24,029	26,495	22,626	28,97	24,862	10,624	22,112
	C7	61,517	56,868	47,5	36,812	46,025	46,784	61,419	69,115	59,493	70,164
	C8	34,598	38,732	37,21	51,522	66,742	79,739	48,64	53,201	41,345	59,805
	C9	35,467	32,947	41,914	28,039	29,601	29,467	37,118	39,75	32,757	45,018
	C10	47,197	54,815	52,704	44,855	44,426	27,522	31,416	38,035	72,524	91,106
	C11	106,35	89,995	76,245	50,419	53,578	40,822	54,477	52,342	56,352	50,655
	C12	18,434	22,906	18,063	23,6	22,675	24,887	30,941	29,838	23,424	30,599
	C13	4,8638	11,43	15,759	7,2471	8,2198	8,0253	10,117	12,743	13,082	19,457
	C14	37,647	32,451	35,49	35,882	32,255	27,222	27,611	27,222	22,371	21,16
	C15	7,7914	9,5706	8,8344	9,6319	1,3497	5,4601	5,3374	7,7914	6,2384	3,3734
D											
	D1	38,77	86,386	62,298	121,03	72,44	66,438	73,561	83,765	117,47	103,05
	D2	58,45	44,31	66,639	75,9	39,246	56,108	50,724	41,097	51,521	39,363
	D3	43,017	49,399	50,296	56,735	34,497	32,171	34,999	42,793	50,078	41,059
	D4	39,43	33,548	27,57	29,021	17,84	18,852	23,38	19,924	32,041	28,131
	D5	63,661	56,576	71,143	83,942	108,54	65,279	53,196	46,781	51,392	53,295
	D6	16,74	21,771	19,255	20,474	16,569	17,059	20,775	21,183	15,025	19,256
	D7	9,1359	10,84	10,483	11,14	9,2787	10,675	11,257	10,733	10,191	10,135
	D8	10,441	21,6	19,867	18,561	17,517	7,8747	10,711	11,431	12,778	16,144
	D9	42,276	27,045	28,409	30	26,327	11,663	13,499	13,548	17,64	18,127
	D10	44,643	48,512	27,452	46,575	45,37	25,703	32,408	32,509	33,989	12,265
E											
	E1	103,1	73,812	86,868	111,12	116,63	122,44	138,02	127,51	115,87	143,21

	E2	84,023	85,762	106,29	106,75	64,193	64,337	75,519	73,084	111,35	124,48
	E3	87,985	76,543	67,996	70,167	46,876	46,76	58,447	58,143	50,64	49,192
	E4	100,87	82,261	67,588	44,374	37,888	37,565	57,614	55,25	81,509	115,13
	E5	18,24	24,505	17,98	24,601	18,221	23,248	30,836	18,178	20,841	23,136
	E6	20,05	16,646	21,844	13,183	14,652	16,142	15,687	15,356	14,556	14,592
	E7	9,4364	18,152	13,827	12,189	11,009	7,2888	13,045	16,574	13,769	16,307
	E8	8,408	20,813	10,544	12,612	7,5121	16,678	13,37	13,232	11,573	12,148
	E9	13,552	13,036	12,457	14,13	11,686	14,775	17,999	16,997	21,585	21,798
	E10	18,057	15,37	17,056	15,759	16,796	27,444	24,205	30,538	28,16	33,252
	E11	14,241	10,661	18,656	13,992	19,681	28,115	18,403	16,997	36,109	36,109
F											
	F1	100,28	33,642	86,466	100,25	89,262	91,17	38,321	111,02	112,51	149,18
	F2	100,09	141,72	86,968	88,28	80,967	76,575	61,416	39,768	64,61	51,172
	F3	19,083	16,181	14,741	15,471	12,409	17,238	15,218	21,16	19,884	35,266
	F4	0	0	0	0	7,4167	15,417	15,417	28,2	10,69	44,855
	F5	34,764	17,43	14,171	20,722	16,629	11,781	16,505	18,253	35,973	19,484
	F6	14,559	13,404	9,1854	8,4597	8,6931	9,5829	13,811	16,686	19,058	17,174
G											
	G1	86,493	77,396	35,392	111,17	91,315	124,14	124,14	167,03	135,14	138,04
	G2	70,251	44,094	55,743	68,729	53,926	47,285	47,285	41,64	33,376	41,356
	G3	40,49	65,071	37,929	36,136	25,156	23,086	23,086	56,698	31,558	56,312
	G4	83,001	54,28	71,734	80,808	66,365	78,692	78,692	158,37	89,028	99,029
	G5	13,103	8,4429	9,0242	9,3301	10,095	8,9315	8,9315	7,7661	7,9223	7,2752
	G6	6,3366	4,0058	7,8236	5,4989	5,8935	5,6171	5,6171	10,307	11,378	10,528
	G7	19,073	13,49	12,241	13,186	12,993	12,946	12,946	23,233	19,576	19,25
	G8	30,526	31,855	19,312	32,322	31,447	30,754	30,754	33,16	26,442	25,032
H											
	H1	57,794	136	165,45	134,1	167,59	184,34	198,76	181,27	162,27	173,89
	H2	57,217	36,414	120,94	102,6	112,17	111,28	114,47	57,574	42,236	51,925
	H3	28,377	43,69	41,957	39,447	30,149	30,489	39,468	48,357	48,948	54,689
	H4	119	148,27	153,52	145,62	203,98	198,16	253,31	165,94	180,07	188,26
	H5	22,06	19,141	16,471	16,83	33,957	28,745	32,447	33,481	30,421	33,038
	H6	21,882	13,489	20,896	17,675	19,119	20,569	26,167	37,588	28,206	36,353
	H7	0	0	21,429	33,684	32,105	19,006	23,176	17,623	20,436	20,034
	H8	16,697	20,564	24,659	17,379	17,47	20,291	25,478	31,574	14,733	13,367
	H9	18,577	8,045	9,5873	6,8779	7,2113	8,7536	10,921	17,486	27,739	29,319
	H10	11,573	12,51	13,855	12,795	12,714	15,689	18,174	17,599	14,915	15,167
	H11	11,188	15	13,152	6,3039	7,7183	6,9745	11,837	15,177	13,202	17,324
I											
	I1	81,103	68,318	50,277	65,779	58,822	71,837	75,543	72,607	77,041	81,502
	I2	122,03	68,416	47,799	49,819	28,851	23,535	32,445	30,275	39,389	36,487
	I3	45,755	34,419	61,369	36,568	18,839	23,721	27,835	24,069	33,327	21,247
	I4	79,325	43,181	63,665	79,646	68,773	69,847	96,985	89,302	117,32	104,89
	I5	16,59	17,548	22,5	21,067	21,587	20,931	22,649	20,75	15,461	27,012
	I6	8,1359	3,8165	6,7089	4,9578	6,5401	7,5116	11,177	8,1018	7,2798	9,3151
	I7	28,706	26,127	28,481	28,68	26,182	24,038	28,233	27,71	25,45	23,882
J											
	J1	51,931	38,669	38,165	55,533	55,508	53,315	62,591	71,121	54,543	68,742
	J2	41,633	36,811	31,374	39,241	28,049	27,679	28,513	67,325	31,543	38,7
	J3	88,333	31,649	36,597	51,389	64,028	69,187	77,51	41,897	116,27	71,022
	J4	0	0	10,595	11,905	12,381	12,443	14,404	18,326	11,21	13,227
	J5	21,06	20,32	16,491	19,173	20,05	25,728	28,762	31,432	20,578	21,979
K											
	K1	45,072	66,322	74,415	35,414	131,56	196	219,24	228,25	135,44	140,5
	K2	140,81	122,77	101,33	78,497	99,423	55,497	68,408	77,015	83,277	114,28
	K3	56,996	82,492	34,175	100,13	99,101	51,484	70,099	59,128	51,842	41,003
	K4	10,194	10,362	7,0061	8,4683	9,9522	10,383	12,44	13,301	10,48	8,6527
	K5	15,08	13,825	13,581	12,911	12,485	16,2	20,828	23,873	16,556	15,935
L											
	L1	52,859	51,48	52,566	71,409	68,422	73,283	104,71	105,6	85,237	89,09
	L2	15,837	16,479	17,641	15,935	15,644	17,387	23,176	22,748	20,455	24,853
	L3	7,268	7,9123	8,3842	8,0788	7,7735	11,938	10,772	16,609	10,532	8,3853
	L4	21,209	15,503	13,74	11,168	12,711	13,079	13,152	14,953	16,822	4,9377
M											
	M1	164,34	92,603	110,15	110,55	50,941	88,033	85,375	106,46	90,539	122,75
	M2	107,44	57,514	84,12	73,669	37,679	36,676	41,36	45,382	47,063	49,566
	M3	69,614	58,236	64,3	55,019	19,148	19,047	23,184	22,282	29,327	23,184
	M4	23,69	25,622	33,053	29,14	26,93	28,392	26,841	31,349	59,015	23,326
	M5	18,877	24,907	18,354	18,212	11,494	17,407	38,229	33,896	32,789	31,181
	M6	10,484	25,565	9,2758	7,8869	8,2341	9,5909	12,136	12,462	9,9524	13,717
	M7	12,573	13,417	13,169	13,086	12,551	11,519	17,333	15,515	7,9475	15,204
	M8	33,738	44,417	40,615	41,019	36,731	50,162	67,557	60,922	48,544	39,366
	M9	10,697	10,503	12,741	10,628	13,549	5,9748	16,307	24,462	24,283	32,796

Figures 16, 17 & 18: Representing calculated Growth index ***Per Year*** *for 105 institutions over 13 universities from 2012 to 2022.*

Integration with SVM Classifier

In the implementation of SVM models for optimizing the strategic management of public higher education institutions in Morocco, the dataset was carefully structured to cater to the specific requirements of classification and regression tasks. The dataset comprised data from 105 institutions over a ten-year period, spanning from 2012 to 2022. To ensure robust model training and evaluation, the dataset was split into two parts: 84 institutions were used for training the models, while the remaining 21 were reserved for testing.

Classification Model

For the classification model, the dataset utilized the three composite indexes Success Index, Performance Index, and Growth Index as input features. The target variable for this model was the classification class, which categorized institutions based on the Student Success to Institutional Performance Index into three classes (Class A, Class B, and Class C). This approach allowed the model to learn and predict the categorical labels that represent different levels of institutional performance. The goal of this model was to accurately classify institutions into one of the three predefined classes, providing a high-level overview of their performance based on the combined index criteria.

Classification class Criteria:

The subsequent phase of the analysis involved the integration of the Success Index and the Performance Index into a unified metric, termed the "Student Success to Institutional Performance Index."This composite index was designed to capture the relationship between student outcomes and the operational effectiveness of educational institutions. The formula used for this index is as follows:

Student success to institutional performance Index = Performance Index * 0.5 + Success Index * 0.5.

This combined index provides a balanced evaluation, equally weighting both student success and institutional performance. It thus offers a comprehensive perspective on an institution's capacity to deliver quality education and maintain efficient operational support systems.

To assess this index across a broader context, data was generalized across 105 institutions over a ten-year period. For each institution, a mathematical harmonic mean was calculated based on the yearly values of the composite index. The harmonic mean was chosen for its ability to account for variations and ensure a more representative central tendency when dealing with ratios and rates.

Following the computation of these harmonic means, the results were systematically mapped onto a classification scale. This scale facilitated the categorization of institutions into three distinct classes, reflecting varying levels of performance as measured by the Student Success to Institutional Performance Index. These classes provide a clear and structured framework for comparing institutional effectiveness, thereby enabling stakeholders to identify areas of excellence and opportunities for improvement within the higher education sector.

The classification scale for the Student Success to Institutional Performance Index categorizes institutions based on their performance ratios, providing a clear framework for understanding the effectiveness of each institution. The criteria for classification are defined as follows:

- **Class A: High Success to Performance Ratio**

  - Institutions with an index greater than 1 are classified under Class A. This category represents institutions that exhibit a strong balance between student success and institutional performance, indicating both high academic achievements and efficient operations. These institutions are considered exemplary in their ability to support students while maintaining robust administrative and educational practices.

- **Class B: Moderate Success to Performance Ratio**

  - Institutions with an index ranging from 0.5 to 1 fall into Class B. This classification indicates a moderate balance between student success and institutional performance. Institutions in this category demonstrate a satisfactory level of student outcomes and operational efficiency, though there may be areas that require further development to reach the highest standards.

- **Class C: Low Success to Performance Ratio**

  – Class C includes institutions with an index of less than 0.5. These institutions show a lower success to performance ratio, suggesting challenges in achieving high student success rates and/or maintaining effective operational systems. This classification highlights the need for significant improvements in both educational outcomes and institutional management.

This classification system not only facilitates a nuanced understanding of institutional performance but also serves as a valuable tool for policymakers, administrators, and stakeholders. By categorizing institutions based on their success to performance ratios, the scale helps identify institutions that excel, those that are performing adequately, and those that may benefit from targeted interventions and support to enhance their overall effectiveness.

	1	2	3	4	5	6	7	8	9	10	M	Classification class
A1	0,3503	0,39244	0,38346	0,44824	0,43127	0,43781	0,43487	0,39491	0,37172	0,38228	0,4002831	C
A2	0,51645	0,32923	0,38036	0,23396	0,31616	0,28003	0,24719	0,21578	0,25788	0,25728	0,2852631	C
A3	1,14583	0,67708	0,53641	0,75124	0,4703	0,31631	0,30795	0,32708	0,29676	0,27245	0,4136068	C
A4	1,20461	1,09951	1,00056	1,07842	0,98131	0,84154	0,67282	0,6296	0,52965	0,54662	0,7895308	B
A5	0,38236	0,31967	0,2761	0,27325	0,27943	0,3021	0,31163	0,30236	0,28722	0,31928	0,3026276	C
B1	0,45581	0,39604	0,40842	0,37037	0,34372	0,37195	0,30633	0,29263	0,32094	0,30418	0,3502567	C
B2	0,55432	0,47841	0,38116	0,38812	0,47559	0,54901	0,52033	0,51553	0,50141	0,44724	0,4737009	C
B3	0,83896	0,90183	0,71503	0,76104	0,96893	0,74044	0,77943	0,76154	0,73591	0,76242	0,7897322	B
B4	2,56388	2,46189	2,27923	2,22957	2,46329	2,05121	1,82766	1,4571	2,63849	1,79852	2,1072931	A
B5	0,35328	0,33655	0,30331	0,27491	0,38129	0,26996	0,28017	0,2806	0,28762	0,29664	0,3026232	C
B6	0,39359	0,3205	0,30748	0,26171	0,25392	0,27559	0,26627	0,24058	0,25912	0,23493	0,2752642	C
B7	2,23573	1,85126	1,80214	1,67074	1,53366	1,37954	1,57784	1,38245	1,15461	1,38349	1,5470682	A
B8	1,94118	1,4991	1,20842	1,13924	1,42769	1,47068	1,90108	1,60475	1,56314	1,78889	1,5115273	A
B9	2,40014	1,91598	1,74265	1,48777	1,04114	0,9308	0,90065	0,95258	1,00189	1,03575	1,1985996	A
C1	0,27545	0,27518	0,26844	0,25564	0,25595	0,21787	0,25261	0,24879	0,24698	0,21092	0,2489639	C
C10	0,6744	0,61784	0,631	0,6145	0,63786	0,62247	0,54802	0,42464	0,39383	0,40035	0,5346353	B
C11	0,46041	0,52047	0,54436	0,48325	0,52468	0,45622	0,44306	0,55206	0,48921	0,59408	0,5026808	B
C12	0,92548	1,07416	1,02787	0,88252	0,93573	0,97847	0,85032	0,96833	0,91432	0,90153	0,941634	B
C13	1,23821	1,15672	0,70583	0,93128	0,95169	0,95723	0,90394	0,97358	0,88887	0,9301	0,944132	B
C14	0,37901	0,48131	0,44524	0,4682	0,54429	0,50124	0,508	0,53261	0,55189	0,55501	0,4904345	C
C15	2,36878	2,54529	2,09218	1,84952	1,80556	1,80176	1,55935	1,52251	1,27752	1,42652	1,7468988	A
C2	0,47508	0,55554	0,51217	0,41627	0,38802	0,3584	0,3263	0,30315	0,33117	0,28036	0,3762686	C
C3	0,5957	0,60881	0,66632	0,63609	0,65795	0,69289	0,69604	0,67952	0,58944	0,57673	0,6371057	B
C4	1,03727	1,25311	1,07972	1,16496	1,02175	1,14401	1,21193	1,15105	1,18783	0,97073	1,1153997	A
C5	1,36064	1,54844	1,42551	1,39551	1,46321	1,43324	1,50029	1,67569	1,46368	1,47982	1,4700993	A
C6	1,9859	2,35446	2,24291	1,9252	2,10603	1,72071	1,50362	1,59937	1,65542	1,7544	1,8470925	A
C7	0,1953	0,17989	0,18344	0,19919	0,20292	0,18984	0,17863	0,163	0,17015	0,16622	0,1819066	C
C8	0,24166	0,25147	0,30941	0,2756	0,26197	0,22964	0,27127	0,30681	0,32625	0,31857	0,2755078	C
C9	0,55353	0,59991	0,55942	0,53065	0,54082	0,54133	0,53348	0,52195	0,59072	0,49153	0,5446725	B
D1	0,16582	0,166	0,17414	0,15699	0,14844	0,16085	0,15803	0,15512	0,14624	0,15611	0,1583802	C
D10	1,20112	1,44429	1,50415	1,43983	1,48147	1,34093	1,2999	1,27217	2,16898	1,3806	1,4192929	A
D2	0,24629	0,33813	0,35586	0,31859	0,34007	0,37333	0,37649	0,37379	0,31771	0,29075	0,3278259	C
D3	0,26547	0,31053	0,30085	0,23471	0,36609	0,38481	0,40576	0,38121	0,35913	0,34579	0,3260929	C
D4	0,52907	0,59956	0,54449	0,57011	0,70318	0,70154	0,64031	0,71052	0,64803	0,59951	0,6181799	B
D5	0,19658	0,24998	0,21604	0,22074	0,2608	0,29893	0,35134	0,33721	0,31258	0,27833	0,2629521	C

D6	0,88153	0,98506	1,0156	0,94044	0,97203	0,95088	0,95262	0,95419	1,00637	0,96621	0,9611376	B
D7	1,46646	1,4092	1,30812	1,41464	1,5495	1,28846	1,3636	1,22453	1,37796	1,35902	1,3706332	A
D8	0,66853	0,859	0,85182	0,84634	0,85227	0,79705	0,81099	0,96414	1,0063	0,78429	0,834551	B
D9	0,66766	0,74832	0,71475	0,75609	0,74827	0,65622	0,72752	0,64115	0,64267	0,83159	0,7087769	B
E1	0,21822	0,27027	0,22643	0,24063	0,22123	0,20818	0,19099	0,1871	0,18869	0,2047	0,2130211	C
E10	1,40474	2,23173	1,8881	1,936	2,16086	1,12008	1,40359	1,03901	1,32258	1,22911	1,4692282	A
E11	1,14454	1,3306	1,5122	1,45295	1,28264	0,93392	1,42465	1,34945	1,10859	1,10872	1,2388257	A
E2	0,24439	0,2713	0,25449	0,24773	0,2804	0,28697	0,28967	0,26934	0,27035	0,25322	0,265901	C
E3	0,70439	0,74365	0,71319	0,59447	0,7541	0,70484	0,73152	0,63505	0,59851	0,63508	0,6765585	B
E4	0,22761	0,302	0,32723	0,31775	0,31884	0,32421	0,33068	0,30788	0,26843	0,22718	0,2896216	C
E5	1,22414	1,32425	1,61589	1,652	1,45616	1,5003	1,40479	1,27047	1,06869	1,13427	1,3394412	A
E6	1,0751	1,32194	1,21157	1,20565	1,20285	1,17358	1,10636	1,08331	1,04187	1,05849	1,1420231	A
E7	1,33155	1,45956	1,22702	1,13778	1,13534	1,08643	1,02569	0,90497	0,91388	0,85727	1,078521	A
E8	0,77282	0,92036	0,92862	1,08409	1,32511	1,23134	1,23587	1,1283	1,04392	1,07341	1,0491487	A
E9	0,57483	0,88094	0,84519	0,77244	0,72464	0,69795	0,66171	0,64227	0,63967	0,5983	0,6911679	B
F1	0,28974	0,33687	0,30669	0,2771	0,25668	0,263	0,27034	0,26375	0,21954	0,22383	0,2666611	C
F2	0,16351	0,13887	0,19029	0,23891	0,27717	0,25678	0,29908	0,58172	0,3439	0,42514	0,2464115	C
F3	0,97148	1,10552	1,6259	1,56848	1,12569	0,94188	0,92926	0,9125	0,754	0,77986	1,0083569	A
F4	0,3503	0,39244	0,38346	0,44824	0,43127	0,43781	0,43487	0,39491	0,37172	0,38228	0,4002831	C
F5	0,28032	0,34381	0,42902	0,38013	0,427	0,57221	0,50285	0,43611	0,34218	0,32391	0,3873204	C
F6	1,06057	1,0362	1,09509	1,10701	1,24939	1,21433	1,12721	0,98186	0,97313	0,95436	1,0718791	A
G1	0,19403	0,22742	0,19137	0,16566	0,17364	0,15117	0,1294	0,12996	0,1371	0,12936	0,1571506	C
G2	0,37457	0,4104	0,27633	0,32985	0,32876	0,28135	0,27385	0,2851	0,28634	0,27225	0,3060196	C
G3	0,69737	0,7244	0,81908	0,74601	0,78302	0,79216	0,81632	0,77039	0,77693	0,80873	0,7714917	B
G4	0,17661	0,21797	0,19157	0,17012	0,17905	0,14413	0,1333	0,14296	0,15926	0,13502	0,1611514	C
G5	0,88702	0,81784	0,88563	0,81552	0,80969	0,65409	0,60931	0,66491	0,69531	0,64373	0,7349615	B
G6	1,07231	1,17074	1,24247	1,27947	1,27211	1,3278	1,23972	1,17336	1,21548	1,0608	1,1995212	A
G7	0,42671	0,60931	0,60126	0,66864	0,83872	0,76295	0,68743	0,75	0,73112	0,7173	0,6580521	B
G8	1,06651	1,58318	1,86249	1,72725	1,62522	1,33169	0,97824	1,01844	0,96543	0,97585	1,2321243	A
H1	0,16064	0,1963	0,24109	0,20298	0,18075	0,15722	0,15285	0,14328	0,15225	0,14325	0,1684697	C
H10	0,71399	0,6343	0,64201	0,61884	0,67349	0,61702	0,58615	0,52361	0,5337	0,52221	0,6002161	B
H11	0,75257	1,3424	1,36122	1,51372	1,58715	1,35996	1,35154	1,30361	1,21502	1,10004	1,2386302	A
H2	0,35043	0,37046	0,30977	0,39333	0,22752	0,23951	0,2184	0,21846	0,22819	0,21421	0,2627265	C
H3	0,68322	0,61154	0,60687	0,77716	0,55391	0,5533	0,60011	0,55846	0,53152	0,46697	0,5839082	B
H4	0,1755	0,18166	0,22118	0,20367	0,15538	0,17681	0,15278	0,14844	0,1945	0,17899	0,1762541	C
H5	0,24677	0,2459	0,29442	0,29727	0,22847	0,18519	0,19901	0,21547	0,23284	0,2206	0,2317486	C
H6	0,91082	0,9776	0,91185	0,79911	0,76678	0,71141	0,66437	0,68864	0,67568	0,70345	0,7670134	B
H7	0,15625	0,39174	0,88378	1,0078	1,02367	0,84781	0,83969	7,95192	0,6818	0,66542	0,5708072	B
H8	0,95052	0,95485	0,87569	0,90152	0,89626	0,88146	0,89736	0,90235	0,9031	0,78069	0,8913351	B
H9	0,56485	0,68954	0,77879	1,01282	0,86949	0,86455	0,96062	1,03591	0,96675	0,91541	0,8380882	B
I1	0,1701	0,18711	0,18029	0,18768	0,18804	0,19115	0,17954	0,18788	0,17693	0,1965	0,1842246	C
I2	0,29334	0,29311	0,3	0,28411	0,29997	0,33344	0,365	0,36632	0,32187	0,28423	0,3115147	C
I3	0,56078	0,97012	0,61339	0,79969	0,87194	0,88505	0,90228	1,02031	0,93502	0,94773	0,8207096	B
I4	0,21054	0,29957	0,24025	0,21409	0,14976	0,13674	0,13613	0,13847	0,13134	0,13324	0,1650221	C
I5	0,71937	0,90553	0,81926	0,82232	0,7679	0,74877	0,75182	0,77596	0,85956	0,77354	0,7908964	B
I6	0,93467	1,27706	1,1775	1,1789	1,16148	1,18972	1,18459	1,17233	1,20426	1,10485	1,1514614	A
I7	0,76818	1,13757	0,80061	1,19148	1,09585	1,1934	1,19122	1,18861	0,93786	1,29789	1,0485259	A
J1	0,78922	0,62254	0,67155	0,59786	0,55102	0,52023	0,53678	0,48345	0,5413	0,46987	0,5656372	B
J2	0,86718	0,82259	0,88572	0,80919	0,87816	0,83923	0,92132	0,80686	0,87118	0,76945	0,8448638	B
J3	0,55383	0,49447	0,51184	0,49976	0,44932	0,39809	0,35631	0,36203	0,23908	0,20491	0,3682986	C
J4	1,06861	0,81232	1,07598	1,26927	1,37553	1,28142	1,19327	1,08302	1,07466	0,99946	1,1008481	A
J5	0,71354	0,85421	0,78655	0,84248	0,97622	0,8829	0,83833	0,75245	0,6918	0,67869	0,7918762	B
K1	0,30561	0,26236	0,22455	0,17968	0,15375	0,1362	0,12952	0,14699	0,13312	0,11124	0,1613569	C
K2	0,22362	0,24936	0,22066	0,19439	0,18568	0,2425	0,24935	0,24641	0,20412	0,17077	0,2150934	C
K3	0,50915	0,48861	0,53171	0,6228	0,57945	0,57431	0,66734	0,72146	0,61196	0,53821	0,5766767	B
K4	0,63807	0,83376	0,85489	0,80994	0,89532	0,88788	0,87274	0,88878	0,86547	0,75045	0,8214812	B
K5	0,47914	0,63369	0,56394	0,60279	0,60728	0,55852	0,53007	0,53818	0,55569	0,51825	0,5553019	B
L1	0,17239	0,22857	0,24222	0,13784	0,1509	0,14793	0,15429	0,13295	0,14632	0,13621	0,1584168	C
L2	0,70328	0,81059	0,72768	0,75379	0,78389	0,73167	0,69676	0,76286	0,8563	0,8553	0,7644123	B
L3	0,62686	0,69109	0,73434	0,67909	0,67064	0,62359	0,61292	0,59145	0,49241	0,54773	0,6191917	B
L4	1,11273	1,52828	1,6107	1,95339	1,91163	1,38575	1,65275	2,08233	1,62594	1,89863	1,6240212	A
M1	0,122	0,12801	0,12547	0,11272	0,13901	0,14803	0,14685	0,14667	0,15816	0,12771	0,1340838	C
M2	0,27005	0,24511	0,22538	0,21266	0,24822	0,23587	0,24203	0,29044	0,27914	0,25686	0,2485041	C
M3	0,3267	0,3386	0,33595	0,30039	0,40383	0,49174	0,56868	0,61218	0,5332	0,53265	0,4171066	C
M4	0,4308	0,49278	0,46596	0,44839	0,43543	0,41829	0,42093	0,46762	0,39737	0,40043	0,4358786	C
M5	0,32111	0,42662	0,50956	0,53943	0,4707	0,44692	0,3597	0,395	0,38884	0,382	0,4142879	C
M6	1,06342	1,25833	1,1387	1,11178	1,0822	1,00415	0,98351	0,85317	0,86959	0,81072	0,9995044	B
M7	0,65087	0,74853	1,02954	0,87865	0,88765	0,76775	0,68664	0,68382	0,62407	0,58215	0,7326141	B
M8	1,13818	1,63064	1,53865	1,45845	1,45822	1,26941	1,0825	1,10313	1,30813	0,98415	1,2639313	A
M9	0,71685	0,96154	5,7775	1,20845	1,17332	1,37951	0,94883	1,00748	1,11343	1,02797	1,1197971	A

Figures 19, 20 & 21: Representing student success to institutional performance index ***Per Year and the classification classes according to the harmonic mean calculations*** *for 105 institutions over 13 universities from 2012 to 2022.*

Regression Models: M1S, M2P, and M3G

In contrast to the classification model, the regression models were designed to predict the specific values of the composite indexes. The dataset was decomposed into three subsets, each tailored to train a specific regression sub-model:

1. **M1S (Model for Success Index)**: This sub-model was trained to predict the Success Index. The inputs included the data elements associated with the composition of the Success Index, such as the number of graduates and total student enrollments. By focusing on these elements, the model aimed to accurately forecast the Success Index based on the institution's performance in facilitating student success.

2. **M2P (Model for Performance Index)**: The second sub-model targeted the prediction of the Performance Index. The training dataset for M2P included variables related to the success rate, pedagogical coverage rate, and administrative coverage rate. These inputs were crucial for enabling the model to learn the intricate relationships between institutional operational metrics and the Performance Index, thereby optimizing its predictive capabilities.

3. **M3G (Model for Growth Index)**: The third sub-model, M3G, was developed to predict the Growth Index. The input dataset for this model comprised factors influencing institutional growth, such as new student enrollments, total student enrollments, and occupancy capacity. The model leveraged these data points to forecast the Growth Index, offering insights into the institution's ability to manage and sustain growth.

Each of these regression sub-models was specifically designed to maximize the learning process by focusing on the relevant data elements associated with their respective composite index. This decomposition into specialized sub-models allowed for a more targeted and effective prediction, ensuring that each model could capture the nuances and complexities inherent in the different aspects of institutional performance.

The structured approach to dataset partitioning and the differentiation between classification and regression tasks enabled a comprehensive analysis of the institutions. By training on the majority of the data and testing on a separate subset, the models were rigorously validated to ensure their accuracy and generalizability. This methodology not only facilitated precise predictions and classifications but also provided valuable insights for decision-making and strategic management within the public higher education sector in Morocco.

SVM models implementation:

The implementation of the SVM models focuses on developing both classification and regression algorithms to categorize institutions and predict future performance metrics.

1. SVM Classification Model Implementation: The SVM classification model is designed to categorize public higher education institutions into distinct classes based on a composite index of performance metrics. The implementation involves:

- Model Construction: The SVM algorithm constructs a decision boundary, known as the hyperplane, which separates the data into different classes. The choice of kernel function such as linear, polynomial, or radial basis function (RBF) is crucial in defining this hyperplane, particularly when the data is not linearly separable.

- Optimization: The model's parameters, including the regularization parameter (C) and the kernel-specific parameters, are optimized. The regularization parameter controls the trade-off between achieving a low error on the training data and minimizing the margin width. Kernel parameters, such as gamma in the RBF kernel, determine the influence of individual data points on the decision boundary.

2. SVM Regression Model Implementation: Three SVM regression models are developed to predict the values of three composite indexes, each reflecting different aspects of institutional performance over a ten-year forecast period. The implementation process includes:

- Model Structure: The SVM regression, also known as Support Vector Regression (SVR), is configured to predict continuous outcomes. Unlike traditional linear regression, SVR uses a margin of tolerance (epsilon) within which no penalty is given for errors, enhancing its robustness to outliers.

- Kernel Application: The choice of kernel function in SVR is similarly critical as in classification, allowing the model to capture non-linear relationships between input features and the target index. The model seeks to fit a regression line (or hyperplane in multi-dimensional space) that best approximates the actual data points, with support vectors defining the margin boundaries.

- Loss Function: The SVR model uses an epsilon-insensitive loss function, which ignores errors within a certain range (epsilon). The objective is to minimize a loss function that includes this insensitivity parameter, along with the regularization term, to achieve a balance between the complexity of the model and the accuracy of the predictions.

Both the SVM classification and regression models are implemented using a series of iterative training processes, where the model parameters are adjusted to minimize the classification error and regression prediction error, respectively. These models leverage the strength of SVMs in handling high-dimensional data and capturing complex relationships, making them well-suited for the diverse and multifaceted data of public higher education institutions.

RESULTS

The empirical testing of Support Vector Machine (SVM) models demonstrates the decisive role of the carefully constructed composite indexes Success Index (S), Performance Index (P), and Growth Index (G) in enhancing both the accuracy and interpretability of institutional evaluations in Moroccan public Higher Education Institutions (HEIs). The integration of these indexes as structured inputs ensured the reliability of classification models and the robustness of regression models,

ultimately reinforcing their capacity to support data-informed strategic decision-making.

Classification Results

The classification model achieved an **Overall Accuracy (OA) of 95.24%**, indicating that the SVM classifier was able to accurately assign institutions to their respective classes based on the composite indexes. Such a high level of predictive accuracy is rarely achieved in institutional studies that rely on fragmented or unstructured data. The result highlights that the design of the Success, Performance, and Growth Indexes successfully captured the underlying multidimensional features of institutional effectiveness and efficiency.

The OA value underscores the value of **feature engineering through composite indexes**. Instead of relying on raw or heterogeneous variables, the integration of well-structured, normalized, and weighted indexes facilitated the detection of nuanced institutional patterns, thus improving classification precision. For top management, this means that institutional typologies can be identified with high confidence, providing a robust basis for policy interventions, capacity allocation, and targeted support strategies.

Regression Results

To complement the classification results, regression models were trained separately on each of the three composite indexes, enabling predictive insights into institutional outcomes.

- **Model M1S (Success Index)** achieved a **Mean Squared Error (MSE) of 0.02**, a **Root Mean Squared Error (RMSE) of 0.13**, and a **Mean Absolute Error (MAE) of 0.03**. These results reflect the model's ability to predict student outcomes with high precision, confirming that success is a measurable and stable indicator when integrated into SVM regression frameworks.

- **Model M2P (Performance Index)** demonstrated exceptional accuracy, with **MSE of 0.00**, **RMSE of 0.03**, and **MAE of 0.01**. This near-perfect predictive power reveals that the Performance Index, as a weighted composite of academic and administrative efficiency factors, is the most reliable determinant of institutional behavior. It validates the methodological decision to emphasize weighting and aggregation methods in its construction, particularly the prioritization of student success outcomes (50%) relative to coverage

measures.

- **Model M3G (Growth Index)** reported **MSE of 0.03**, **RMSE of 0.17**, and **MAE of 0.08**. While slightly less precise than the other two models, the results remain within a strong predictive range. The higher error margins may reflect the inherent volatility of institutional growth, which depends on external factors such as demographic dynamics, national education policy, and resource allocation. Nevertheless, the Growth Index still provides valuable insights into capacity management and scalability.

DISCUSSION

The performance of the SVM models demonstrates the **central importance of composite index design** in supporting advanced machine learning applications within higher education management. The exceptional classification accuracy (95.24%) and the low error margins in regression tasks validate the methodological rigor of combining normalization, weighting, and aggregation strategies in constructing S, P, and G.

From a strategic management perspective, these results translate into actionable benefits for decision-making:

1. **Precision in Typology Identification** – High classification accuracy ensures that institutional classes (e.g., high performance vs. low growth) are defined with reliability, facilitating differentiated governance strategies.

2. **Predictive Insights for Policy** – Regression outputs allow policymakers to forecast institutional trajectories based on current input conditions, making it possible to anticipate risks (e.g., declining success rates) or opportunities (e.g., scalable growth).

3. **Optimization of Resource Allocation** – The Performance Index, with its near-zero prediction error, emerges as the most decisive factor for institutional efficiency, guiding resource prioritization toward pedagogical and administrative staffing as leverage points for improvement.

4. **Support for Data-Informed Governance** – The integration of SVM with composite indexes bridges the gap between quantitative analytics and strategic management, enabling HEIs to transition from descriptive assessments to predictive and prescriptive strategies.

In summary, the careful design and integration of composite indexes significantly enhance the performance of SVM models, demonstrating their potential as

decision-support tools for Moroccan HEIs. By embedding such models into governance frameworks, institutions can move toward **optimized, data-driven, and transparent strategic management**.

CONCLUSION

The findings of this study underline the transformative role of composite indexes, carefully designed and adapted to the context of Moroccan Higher Education Institutions, in addressing the complexity of decision-making processes. By consolidating heterogeneous data into the Success Index, the Performance Index, and the Growth Index, this research demonstrated that abstract and fragmented variables can be transformed into actionable, comparable, and quantifiable measures. These indexes not only provided clarity in evaluating student outcomes, institutional efficiency, and growth capacity but also served as the backbone for the machine learning framework. Their integration into Support Vector Machine models proved decisive in achieving both exceptionally high classification accuracy, with an overall performance of 95.24%, and strong predictive capabilities in regression analyses, particularly with the Performance Index model, which achieved near-zero error rates.

The results illustrate that the construction of well-defined indexes is not a mere technical exercise, but a strategic necessity for optimizing decision-making in higher education. The methodological rigor applied in weighting, aggregating, and normalizing these indexes ensured their reliability and interpretability, allowing SVM models to uncover patterns that would otherwise remain hidden in raw datasets. This emphasizes the broader implication that the quality of decision-support systems in education is highly dependent on the conceptual soundness of the indicators on which they are built.

From a policy perspective, the adoption of such a framework carries significant potential. Ministries of Higher Education and institutional leaders can utilize these models to classify institutions with confidence, anticipate future trajectories, and allocate resources more efficiently. The Performance Index, for instance, provides a clear and empirically validated signal that staffing and coverage levels represent leverage points for improving institutional effectiveness. Likewise, the Growth Index offers a tool for forecasting scalability challenges, ensuring that expansion policies are aligned with actual capacity. By institutionalizing the use of such composite indexes in governance frameworks, higher education systems can strengthen transparency, accountability, and long-term strategic planning.

Future developments may enhance this framework further, such as by in-

troducing dynamic weighting methods that reflect evolving national priorities or by testing alternative machine learning approaches, including ensemble methods or deep learning, to enrich predictive capabilities. Beyond institutional efficiency and growth, the same analytical logic can be extended to critical areas such as student retention, faculty performance evaluation, or curriculum impact assessment, thus broadening the strategic reach of data-driven decision-making.

In conclusion, this study demonstrates that the real strength of machine learning in higher education management does not solely lie in the sophistication of algorithms, but in the formulation of composite indexes that translate complex realities into structured, comparable, and meaningful indicators. By creating Success, Performance, and Growth Indexes specifically tailored to the Moroccan context and embedding them in SVM models, this research provides both a methodological innovation and a policy-relevant tool that can transform governance practices. The synergy between well-constructed indexes and advanced analytical models thus offers a path toward more informed, efficient, and sustainable strategic management in higher education.

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LIST OF ABBREVIATIONS

ACR: administrative coverage rate
HEI's: Higher Education Institutions
MAE: Mean Absolute Error
ML: Machine Learning
MSE: Mean Squared Error
OA: Overall Accuracy
PCA : Principal Component Analysis
PCR: pedagogical coverage rate
RMSE: Root Mean Squared Error
SR: success rate
SVM: Support Vector Machine

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