

Minding the Gaps

Constraints and Opportunities for Digital Transformation in Portuguese SMEs

João P. C. Pinto

Information Management School (NOVA IMS), Nova University of Lisbon,
Lisbon, Portugal

Nuno António

Information Management School (NOVA IMS), Nova University of Lisbon,
Lisbon, Portugal

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MINDING THE GAPS

Constraints and Opportunities for Digital Transformation in Portuguese SMEs

João P. C. Pinto*, Nuno António
Information Management School (NOVA IMS)
Nova University of Lisbon
Lisbon, Portugal

* Corresponding author: joao.pinto@viadata.pt

Abstract — The widespread use of digital technologies is at the heart of a massive global transformation. Business models and processes are becoming increasingly more dependent on data to the point that it is a critical success factor for many companies. However, not all enterprises are fully engaged with this relatively new reality, while some others procrastinate due to the absence of knowledge or easily and financially accessible tools.

Based on data collected via a survey, we offer a characterization on the perception of people working in Portugal in respect to the value of technological innovation and its adoption on the enterprises where they work. Our data corroborates the existence of a bias, unfavourable to SMEs, both in terms of implementation and perception of relevance of Digital Transformation and Data-Driven Management in their operational and strategic routines.

Based on the assumption that SMEs will face an increasing competitive pressure in the future, since technology progressively benefits economies of scale, we set on to identify business sectors where those enterprises were already lagging compared to larger ones in respect to several structural business metrics. A comparison with information from other European Countries underlines a generic dire picture of businesses in Portugal, where the value added per unit of capital and labour investment are much lower than those found in most European countries.

This work emphasizes the need to facilitate the adoption and use of technology in Portuguese SMEs, as well as building up management literacy that encourages continuous improvement and innovation.

Keywords - *Micro, Small and medium-sized enterprises; Digital Transformation; Data-driven Management; Operational efficiency.*

I. INTRODUCTION

A. Background

Google, Facebook, Amazon, Twitter, Uber, etc, are giant companies and the number of their global users and the processes that they enable every single second are mind-blowing (see for example [1]). This evolution is shaping the World and is liable to produce great(er) gaps between enterprises. In this “arms race”, those that can, and will, adopt new practices will become more efficient and valuable. A McKinsey Analytics report designates the value capturing asymmetry between adopters vs. non-adopters of full-scale data-driven management and operation as “Breaking Away” [2]. Also, IDC reports a profit growth CAGR (2014-2018) gap between digital and non-digital manufacturers of over 10% [3].

Similarly, technical solution providers are also naturally quite effusive about the benefits that their products can bring about. SAP communicates, for example, that out of all the SP500 companies, the loyalty and customer experience oriented ones grow and create value twice as much as the others, and that Digital Transformation is a strong enabler of that performance [4]. Databricks, in association with Forrester, have estimated for example that their solutions lead on average to a 5% increase revenue [5]. Evidence, and logic, suggests that data-driven management and business models are going to be main determinants of the success of all companies.

B. Opportunity

For Portuguese companies, and for the national economy as a whole, the global dynamic described above can either be viewed as an opportunity or as a threat. So far, things do not look bright for Portugal. For example, attention/interest trends estimated via search engine queries suggest a “Business Intelligence” has hardly evolved since 2004 in Portugal, whereas it duplicated globally. Furthermore, attention to “Data Science” and “Digital Transformation” have increased globally much more than in Portugal (as can be observed *e.g.* through “Google Trends”; Data not shown).

Also, Portugal does not have a perceived strategy either in place or under consideration in respect to AI [6] and lacks some of the fundamentals of a strong economy. This may prove a crucial point, as rich companies/countries have naturally more available income that may be reinvested as data-oriented Capex/Opex investments.

However, vision is arguably even more important than financial statements. For example, in a survey conducted by McKinsey&Company, data indicates that a successful digital transformation is three times more likely to occur when key actions occur, such as those matching highly committed senior management [7]. Paradoxically, however, it has also been observed that star performer managers/employees are the ones most resistant to embrace data, due to their historically confirmed absence of need for it [8].

More and more, companies operate on a global market and are judged against a wider array of productivity and business model standards. On the positive note, the amount of literature, case-studies and application of Digital Transformation and Industry 4.0 in Portugal seems to be exponentially lifting off (as a reference, Scopus offers 29 papers from 2021 on Digital Transformation in Portugal, compared to only one in 2016 and

previous years). A recent research paper documented a study on the implementation of the Portugal I4.0 program in the Portuguese economy [9], and while suggesting the positive impact of the program, acknowledges the need to extend these analyses over a greater period of time. Additionally, on the topic of Digital Transformation on SMEs, a lot of relevant application information is continuously being documented (see for example [10]–[12] for recent relevant articles on the topic).

C. General Goal & Relevance

In these times of both urgency and scarcity, it seemed sensible to attempt to examine fits and gaps between Portuguese companies and international leading benchmarks, to plan ahead and make best use of our resources. “Poor” and small companies tend to be more vulnerable to upcoming changes, by lack of resources and adequate scale. Thus, emphasis was given to SME’s, as they play an important role in Portuguese economy and are most vulnerable to the increasingly fast maturing economy: 99.9% of all Portuguese companies are SME’s [13], and around 70% are not expected to survive 1 year after their setup [14]. We thus set on to characterize common perception of people working in Portugal towards innovation aspects such as digital transformation and data-driven management. Also, we aimed at analysing business metrics of Portugal, and comparing them to European benchmarks, to assess and identify efficiency opportunities among Portuguese businesses, in particular those of micro/small/medium sized companies.

II. MATERIALS & METHODS

A. Survey

A survey was set-up using the Qualtrics platform [15] comprising 4 sections in order to characterize: 1) The individual, 2) The organization where he/she works, 3) His/Her perception on digitalization and 4) His/Her perception on how digitalization is being implemented at the organization where he/she works. 104 answers were obtained from residents in Portugal during November and December 2020. All analysis that required sub-selecting classes of survey respondents were considered significant only for $n \geq 5$.

B. Consolidated SME’s Economic Data and Analysis

Consolidated business metrics of European enterprises, according to their economic activities (NACE Rev2. – Level 1 Granularity), were obtained via Eurostat [16]. We opted to use all current 27 EU member countries, as well as partners, candidate or potentially candidate countries for which information was made available for the pre-pandemic reference year 2019. Please note that, although comprehensive in terms of geographical scope, Eurostat only makes available a narrow set of business metrics and does not publish information from all classes of economic activities. Additionally, due to confidentiality considerations, some information was not made available for some metrics-dimensions. Overall, roughly 10% of information of 2019 for the analysed metrics-dimensions was missing (1 263 values out of 13 260) and was imputed following a sequential process: 1) If a value existed for 2019 for a given metric-dimensions, consider it. Else: 2) If a value existed for 2018 for a given metric-dimensions, consider the one for 2019 equal to it. Else: 3) If at least 3 values existed between 2010 and 2017, infer the one for 2019 via linear regression. Else: 4) If a value existed for 2017 for a given metric-dimensions, consider the one for 2019 equal to it. Else: 5) If a value existed for 2016 for a given metric-dimensions, consider the one for 2019 equal to it. All the information used in these analyses, either the one that was directly obtained from the above-mentioned sources and that that was imputed, is made available as supplementary material on

https://osf.io/4tgzm/?view_only=f80c4dd701644332b822ef9a83817665.

Visualizations were created using the Seaborn [17] and Matplotlib [18] python packages and the Jupyter Notebook’s software [19].

III. RESULTS AND DISCUSSION

A. Perception of Individuals Regarding Digital Transformation in Portugal

A survey was elaborated in order to assess the current understanding, perceived value and actual development of Digital Transformation initiatives within Portuguese organizations. Participants of this survey were predominantly male (66%) and had a global average age of ~39 years. In respect to the position in the organization hierarchy, there was a slight prevalence of Middle Managers (40%), versus Top Managers (27%) or collaborators at a more operational level of the organization (26%). As to the industry in which each participant works, results were scattered among the many sectors of the Portuguese workplace scenario, as was the department/area within each organization where each survey participant is integrated (Data not shown). In terms of the localization of the main headquarters of the organizations where the survey participants work, the vast majority (69%) indicate that they are based in Portugal, 18% elsewhere in the European Union and 13% elsewhere in the World, although most reported organizations with a size greater than 10 000 employees were not Portuguese (86%).

The great majority of participants in the survey (74%) had past direct experience in the development and implementation of, at least, one Digital Transformation initiative. One should note that there is slightly higher chance of a Top Manager having somehow participated in one of these projects (82%) than Middle Managers (71%) or someone at an operational level (70%). Naturally, not only do Top Managers have a privileged position in the company that allows them to be involved and globally lead such initiatives but also, they tend to be more senior employees with longer professional experiences. Overall, participants in the survey shared that, on average, most past experiences are related to the improvement of information in support of operational processes, while the least common on average was the exploration of novel business models (Table 1).

One can observe that the participation of top management in Digital Transformation is skewed towards the exploration of new business models, a category naturally less prone to enable the participation of personnel at lower levels of the organization. It is however surprising that so little attention was, on average, given by them to the information that they consume. In fact, it is relatively much more likely that a person in other levels of the organization has helped to develop the nature of information to support decision making than the main decision makers. This could either mean that a particular logic applies to top management decisions, where historical know-how has greater value, or that little may be required to align the information that they consume with what is transversally available to the company. Although the coherence of information within an organization is quite critical, each position is likely to benefit from a specific view of the whole data. In this case, the consumption of highly detailed information by people occupying higher positions in a given organization, may inadvertently compel them towards a logic of micromanagement and supervision. Based on this survey, one assesses that operational efficiency and support information has been considered more critical along the professional paths of top managers.

TABLE 1 – PARTICIPATION IN DIFFERENT CATEGORIES OF DIGITAL TRANSFORMATION INITIATIVES, SPLIT BY HIERARCHICAL LEVEL. PLEASE NOTE THAT SURVEY PARTICIPANTS MAY HAVE PARTICIPATED IN MORE THAN ONE CATEGORY OF INITIATIVE (EACH ROW MAY SUM DIFFERENTLY THAN 100%).

	New Business Models	Organizational Efficiency	Decision Support Info	Operatio Support Data	None
Top Mgt	46%	39%	18%	36%	18%
Middle Mgt	17%	41%	46%	44%	29%
Operational	7%	30%	30%	48%	30%
Average	23%	38%	33%	43%	26%

Middle managers seem to have distributed their attention along the various categories of Digital Transformation initiatives, except for the less likely “Exploration of novel business models”. They seem to have invested their efforts in initiatives that promote the development of information to support top management decision making, naturally as they constitute the level of organization that directly reports to top managers. People working at an operational level of the organization seem to acknowledge more their efforts on the initiatives set to improve information that support their activity.

It is also interesting to observe that, with the exception of companies smaller than 10 people (where most of these questions have putatively yet to be posed and present-day concerns are elsewhere), Digital Transformation seems to involve all the organization, but falls with the size of the company (Figure 1). One cannot but hypothesize that this global trend is probably due to specialization of the workforce.

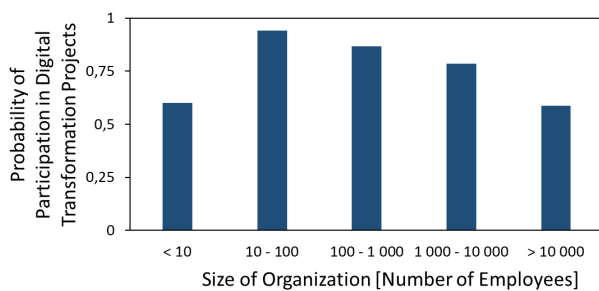


Figure 1 – Probability of a survey participant registering a past contribution in a Digital Transformation project and the size of the organization where they currently work.

It also appears that people working on foreign organizations have a relatively lower probability of having participated in Digital Transformation projects (68%), compared to employees of Portuguese organizations (77%). However, that bias may simply be explained by the relatively greater size (on average) of foreign organizations, and the greater specialization of its employees (in other words, project oriented and business development teams may be located elsewhere), as described above.

When asked to rank the level of risk and opportunity that globalization and digital transformation is likely to have on Portuguese organizations, participants generally perceive these global trends as net positive. However, it is interesting to observe that risk/benefit ratio varies with the hierarchical level of the person (Figure 2). It seems that people working at an operational level of an organization perceive on average those global trends as a great opportunity (~9/10), but also attached to some risk (~5/10). Top managers are much more likely to see them as great opportunity (~10/10) and very little risk (~2/10). Interestingly, middle managers seem to form a bimodal-like population where some individuals seem to stand half-way between operational personal and top managers, while other are much more concerned with the risk that

globalization and digital transformation is bringing to Portuguese companies.

We hypothesize that middle managers are offered on average greater visibility to the whole organization and are more sensible to the constraints that these global trends may pose, while top managers hold a more positive perspective due to 1) better/broader/longer perspective and vision, 2) a positive perspective that characterizes good leaderships, 3) a lack of perfect visibility of operational constraints.

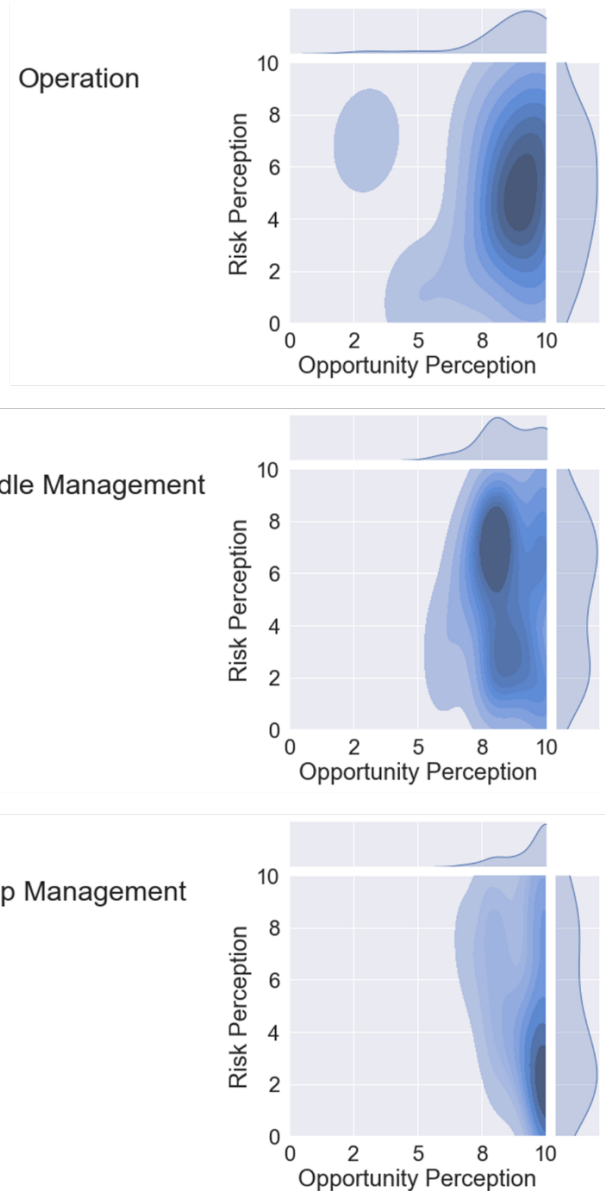


Figure 2 – Distributions of risk and opportunity perception of individuals towards the effect of globalization and digital transformation in Portuguese companies (ranked between “1-Lowest” and “10 – Highest”), split by the hierarchical level of individuals.

It is also observable that these risk/opportunity perceptions are also correlated with the size of the organization where people work (Figure 3). On average, the bigger the organization, the lower the perceived risk and greater the perceived opportunity. This makes perfect sense since, as a general rule, greater companies are more resilient and have more resources to develop key strategic areas, critical to their ongoing success.

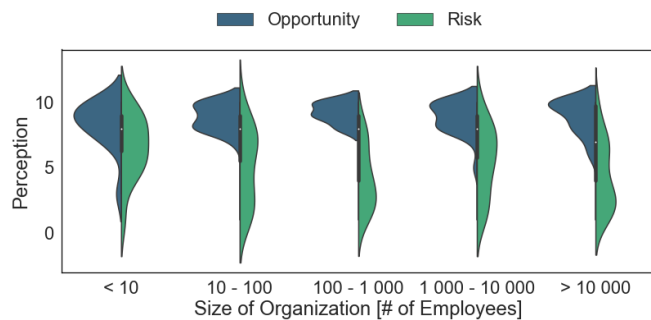


Figure 3 – Distributions of risk and opportunity perception of individuals towards the effect of globalization and digital transformation in Portuguese companies (ranked between “1-Lowest” and “10 – Highest”), split by the size of the organizations where they work.

When asked to grade the importance of the different types of Digital Transformation categories in respect to their importance, people generally identify them as being very critical and equally important (with a mode of 8/10 or 9/10). No great variation exists between the four categories, with probably the exception of the “Exploration of Novel Business Models”, which operational level and middle management personnel value slightly lower than top managers (~1.5/10 and 1/10 lower on average, respectively), and lower than their perceived importance of other categories.

When asked on the value of data-supported decisions and processes specifically in the different areas and departments within the organizations, participants in the survey generally apply the same level of importance to all of them. The exceptions are the “Legal” and “Human Resources” areas, where people tend to not recognize as equally critical in terms of data dependence (Data not shown).

When asked about their organizations, in particular their awareness regarding the implementation of several key strategic dimensions, one observes that higher complexity elements are naturally less commonly adopted (Figure 4). Also notably, the sophistication of the organizations is positively correlated with their size (Data not shown), which confirms the critical gap between SME’s and other organizations. The fact that the statements “E” and “F” were typically lower than “D” may lead to the conclusion that people understand that there is “room for improvement”. The most notable difference when comparing organizations of different sizes is the gap regarding the existence and communications of a long-term vision (Figure 4 - Statement “B”). Although one is forced to keep in mind that, since this data was obtained via a survey, it compounds the effect a specific element either existing or not, and the participant in the survey either being aware of its existence or not, smaller organizations are typically less sophisticated/robust and may indeed lack a long-term vision.

As to the production of the business intelligence data that is available at their organization, people were asked to what extent a centralized BI or departmental BI units prepare it, and to what extent the final users had to be themselves the ones to produce it (Figure 5). Without surprise, in organizations with less than 100 employees, final users of the information tend to be the ones that most commonly prepare the data that they require. For organizations with 100 to 1 000 employees, it seems that a centralized logic of information preparation is most relevant. However, for even greater organizations, their size and specialization trigger the necessity of departmental specific information, thus relatively reducing the weight of centralized produced information. Interestingly, regardless the size of the organization, self-produced information is always highly relevant, either as a result of the absence of a specialized Business Intelligence department within a company (most

likely in small organizations) or as a result of highly specific information needs that a general employee requires.

When asked to evaluate the digital footprint of their organization (Figure 6), two main observations strike one’s attention. First, although the digital presence was generally considered quite critical (typically >8/10; Figure 6 – Statement “A”), all aspects of its implementation fall short in respect to that perceived need (typically < 8/10; Figure 6 – Statements “B-H”). Second, there is a remarkable positive correlation between the probability of an organization having implemented any given element relevant to its digital footprint and its size (Figure 6). Furthermore, it is in smaller organizations that the gap between the perception of importance and the implementation of the different dimensions is greater. Not only do small companies most often lack a functional website, aligned with current best-practices and client needs, they also tend to lever less communication on third-party platforms, not optimize their digital presence with standard SEO best practices, and not make good use of the information that they might already possess via their online presence (Figure 6).

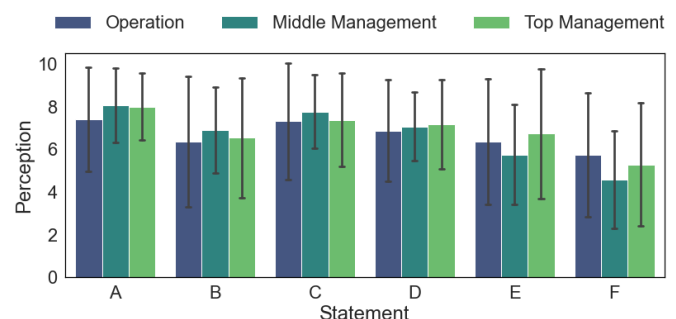


Figure 4 – Perception on the awareness and implementation of several organizational strategic dimensions (A-There is full knowledge of global trends in the sector; B-There is a consistent and well-communicated vision for the company, with a horizon of more than 5 years; C-The company continually allocates resources to develop critical areas to keep it competitive; D-The company assumes a management logic mainly based on numbers, and little on intuition; E-Management information is centralized in databases across the entire company (Data Warehouse) and made available to all users; F-Processes are highly automated and use artificial intelligence in some elements), split by the hierarchical level of the participants in the survey (colour of each bar, as indicated in the legend). The vertical black lines represent the standard deviation of each question for the represented population.

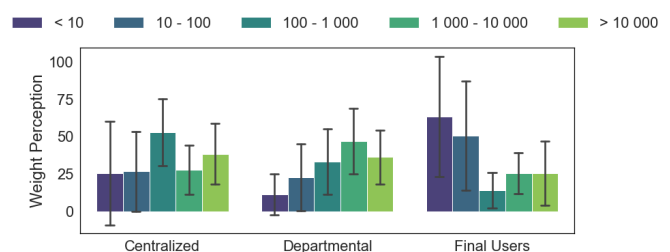


Figure 5 – Relative weight of different sources of business information (“Centralized”, “Departmental”, or produced by the “Final Users”), as a function of the size of the organization where of the participants in the survey work, as referenced in the legend. The vertical black lines represent the standard deviation of each question for the represented population.

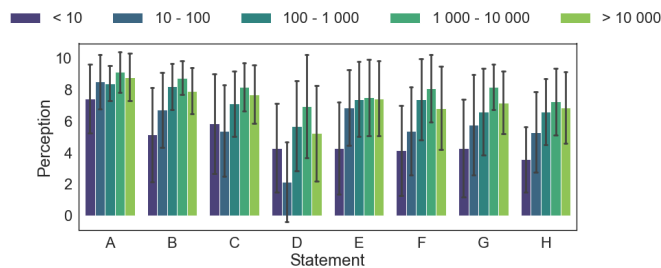


Figure 6 – Perception of different dimensions of the digital footprint relative to the dimension of the organization where each participant in this survey works, as referenced in the legend. The vertical black lines represent the standard deviation of each question for the represented population. A-A digital presence is critical in the sector where it operates; B-The organization is digitally present through a website perfectly aligned with the needs of its customers; C-The organization's website is at the level of the best in the sector; D-The organization has an application on the main platforms (IOS, Android) at the level of the best in the sector; E-The organization is present on social networks and is very close to its community; F-The organization invests in digital communication on third-party platforms; G-The company's digital presence is optimized in terms of search engine results (SEO); H-The organization makes good use of the information it collects through its digital presence.

B. Benchmarking Structural Business Statistics of Portuguese Enterprises against those of other European Countries

The number of persons employed in the various European countries is consistent with their global population, and presents Germany in the first place, with France, Italy, Spain and Poland following, and Portugal occupying the 9th position in this metric. In terms of the distribution of the number of persons employed in different sectors, Portugal does not appear to show a significantly different reality than many countries, with both manufacturing and wholesale/retail account each for more than 20% of the workforce. The most notable highlights are the European-lowest workforce contracted by Information and communication activities and to Transportation and storage. The former might indicate a relative low advancement of technologies within the country, whereas the latter could be the result of the peripheric localization of the country (and the concentration of the population in some regions and mostly along a narrow coastline). In respect to the distribution of labour according to the size of companies, one observes that Portugal has one of the highest number of persons employed in micro companies, and one of the lowest number of persons employed in big ones. This general bias is roughly conserved throughout all sectors.

Looking at the absolute number of enterprises per country, Italy leads with more than 3.5 million registered enterprises, and Portugal appears quite on top, on the 8th place, with approximately 1 million enterprises. Micro sized companies are the ones that contribute the most to the total in every country, typically accounting for more than 90%. Portuguese companies with 20-49 persons employed are more likely to operate in the manufacturing sector than on the EU on average (32% versus 21%), whereas in the EU on average this sector is predominantly more populated by bigger companies.

Germany is the country whose enterprises globally produce the highest total business turnover, more than twice than those in France and Italy, that occupy the second and third place in that ranking. Portugal is the ninth highest country in Europe in this list. Portugal demonstrates a similar distribution of business turnover among the different sectors like most countries, and clusters close to Spain and France (Data not shown). However, in Portugal the contribution of big companies towards the total business turnover is much less significant than in most countries, being approximately half of that found in Germany or France. This general trend of

relatively greater contribution of smaller businesses is valid across all sectors.

In respect to “Value Added”, Portugal falls along the ranking of European countries and occupies a mere 16th position. The fact that Portugal “loses” so many positions, when compared to total business turnover, evidently translates to a poor “Value Added” per “Turnover” ratio. The contribution to the total “Value Added” by each sector is not particularly different in Portugal, when compared to other countries, and is again quite like those found in France and Spain (Figure 7). This is quite a significant observation since it goes to show that the deficit of value added by business to the Portuguese economy is not a problem of the mix/relative importance of particular sector, but rather a global issue affecting all sectors across the board. In Portugal, as in most countries, manufacturing and wholesale/retail are the sectors contributing the most to the total economy (Figure 7). The only significant sector-business size dimension where a “Value added” gap seems to exist is the relative lower contribution of big companies in the manufacturing sector (Data not shown). Part of the above-mentioned lower business efficiency can be credited to a relatively lower weight of big companies, that tend to use economies of scale in the benefit of their operation. However, this bias is not extremely significant and is shared among many other smaller countries (e.g. the Netherlands), which suggests that this business efficiency problem is valid across the board of all businesses of all dimensions and sectors.



Figure 7 – Contribution of each sector to the global value added by businesses throughout European countries. A-Agriculture, farming of animals, hunting and forestry; B-Mining and quarrying; C-Manufacturing; D-Electricity, gas, steam, cold and hot water and cold air; E-Water collection, treatment and distribution - sewerage, waste management and remediation activities; F-Construction; G-Wholesale and retail trade - repair of motor vehicles and motorcycles; H-Transportation and storage; I-Accommodation and food service activities; J-Information and communication activities; L-Real estate activities; M-Consultancy, scientific and technical activities; N-Administrative and support service activities; P-Education; Q-Human health and social work activities; R-Arts, entertainment, sports and recreation activities; S-Other service activities

In respect to “Apparent Labour Productivity”, Portugal occupies a mere 22th place in the same list of European

countries. In Portugal, the energy sector is the one that is characterized by the highest value, corresponding even to the highest above-country-average bias of all sectors within all analysed countries (Data not shown). When normalizing for the global labour productivity of each country, Portugal and Spain seem to share an equal pattern in respect to the expected labour productivity of each sector (Data not shown).

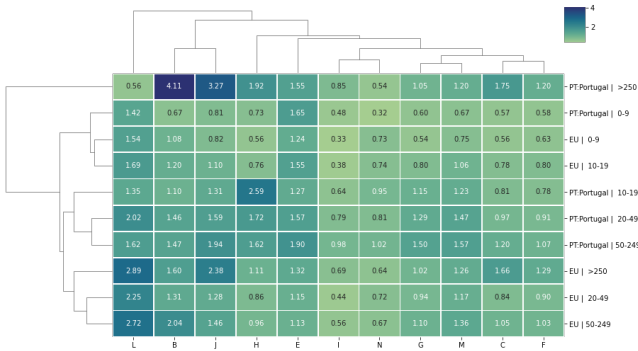


Figure 8 – Apparent labour productivity biases of enterprises of different sizes (number of persons employed classes on each column), compared to national/regional averages, in Portugal and the European Union. Please refer to the legend of figure 7 for a description of economic activities.

In Portugal, enterprises with up to 9 persons employed from the Mining and Administrative and Support Services sectors display particularly lower labour productivities than what is observed in EU (67% and 32% compared to national average, respectively) (Figure 8). Across all enterprise sizes Real Estate Activities are characterized by a much bigger labour productivity on average in the EU than Portugal. Interestingly, both accommodation/food services (although below the country average) and transport/storage display better-than-expected apparent labour productivities in Portugal, when compared to national/regional averages (Figure 8). In Portugal, the biggest labour productivity gaps of micro and small sized companies, when compared to medium and big companies within the same sector, are the ones in the Information and Communication sector, as well as the ones that operate in Mining and Quarrying.

IV. CONCLUSIONS

Data obtained via survey confirms the natural expectation that smaller companies tend to be less sophisticated than bigger ones. This was observed not only through the less frequent use of advanced tools (such as *e.g.* centralized BI Databases), but also seen on the higher probability of inexistence of long term goals/vision or operational tools.

Overall, and across enterprises of all sizes and sectors, there is a global sense that daily concerns dominate an eventual long-term/strategic vision. It is the supremacy of the urgent over the important.

When analysing business metrics of Portuguese enterprise, and in particular comparing them to those of other European countries, one sees that there is a general lack of value created, both compared to the level of total business turnover (which is relatively good) and the level of human effort invested in all economic activities. In fact, labour productivity in Portugal is one of the worst in Europe (22nd place in the panel used in this work), particularly when one considers that scale of its economy (9th place in in total business turnover and number of persons employed).

This lack of economic performance of Portuguese companies is alarming, particularly since there does not seem to exist any sector “mix” difference when compared to most other countries. Rather, a lower global level of wealth affects the expectation and *de facto* returns of capital and labour investment made in all activities. The low value added and low labour productivity in Portugal is virtually true for all activities. Thus, and since we operate in an open market economy, this highlights the importance of being particularly innovative and competitive in the sectors that compete with other countries, at the risk of only continuing competing on red ocean markets and offering low value commodity products [20].

In respect to micro and small companies, the biggest labour productivity gaps within enterprises of the same sector occurs in the Information/Communication and Mining/Quarrying sectors.

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