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Research Article

The impact of the COVID-19 pandemic on accounting information systems and organizations' performance

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ARTICLE INFO	ABSTRACT
	This paper empirically examines the impact of COVID-19 on accounting information systems and organizations' performance. It follows a quantitative approach. For data collection, an online questionnaire was developed and tested. The final version of the questionnaire was applied to the 2556 largest companies in Portugal. The 3 research hypotheses under study were tested with 101 valid answers. The results reveal a high rate of implementation of accounting and performance measurement instruments during the COVID-19 pandemic. Regarding the dynamics of the updates of organizations' performance measurement systems, the impact of the COVID-19 pandemic was confirmed and described as primarily positive. In turn, the performance of the companies was negatively impacted by the COVID-19 pandemic. This study contributes to a better understanding of the role of accounting and performance instruments in organizations under a high level of organizational uncertainty. **Keywords:** COVID-19 Pandemic, Accounting Information System, Impact, Management, Performance

INTRODUCTION

Early studies on the COVID-19 Pandemic stated that the situation is unfolding with no foreseeable end, where fear and uncertainty are evident in the volatility of the financial market and in society itself (Cleghorn, 2020; McMillan, 2020; Mollenkopf, Ozanne & Stolze, 2020; Pedersen, Ritter & Di Benedetto, 2020; Rikhardsson, Wendt & Sigurjónsson, 2020; The Palladium, 2020). Although events such as COVID-19 are unexpected and uncontrollable, (under similar circumstances of uncertainty, organizations tend to react negatively: for example, the 2008 economic crisis case, which in all honesty negatively impacted the performance of many companies) they can also be seen as an opportunity for innovation (James, Wooten & Dushek, 2011; Pedersen et al., 2020).

Considering the instability created, the processes of decision-making and management control are hindered (Mangena, Tauringana & Chamisa, 2012). What's stated beforehand threatens the performance and the achievement of the strategies and organizations' goals (Kunc & Bandahari, 2011; Lucero, Kwang & Pang, 2009). Organizations must seek to improve their responsiveness, especially given the increasingly less favorable conditions, where all organizational processes must be controlled and optimized (Rongier, Lauras, Galasso & Gourc, 2013). Mobasher (2014) also adds that for better management of the crisis period, where performance is unstable, its measurement and evaluation prove to be essential for the survival and success of organizations.

In turn, performance measurement systems are defined by Neely, Gregory, and Platts (1995) as a set of metrics used to qualify the efficiency and effectiveness of organizations' activities. They can also support the organizations' decision-making by providing useful and relevant information for its realization (Gutierrez, Scavarda, Florencio & Martins, 2015). Given the context, it's important to refer that the performance

measurement systems are seen as an asset for the responsiveness of organizations to overcome the crisis period and drive them to change their strategic focus (Hall, 2012; Kolehmainen, 2010). Therefore, the design and content of performance measurement systems should be reviewed and adapted to the context to remain efficient (Herington, McPhail & Guilding, 2013; Neely, 1999, 2005).

The question that remains is: how does the COVID-19 pandemic impact the accounting and performance measurement systems? It was reported by Janke, Mahlendorf, and Weber (2014) that the perceived negative effects of the 2008 economic crisis led to higher interactive use of performance measurement systems. Hopwood (2009) argued that this same crisis induced organizations to modify and update the design of their performance measurement systems, which started to provide information with higher accuracy, quality, and frequency. Pavlatos and Kostakis (2015) defended that there was a difference in the use and importance of performance measurement systems during the 2008 economic crisis. According to Richardson et al. (2020), due to the increased uncertainty in the external environment, managers favor adding a greater quantity and variety of performance indicators to their performance measurement systems.

To answer the general research goal, the following specific objectives were defined:

A. To identify the impact of the COVID-19 Pandemic on the implementation and use of accounting and performance measurement systems.

B. To identify the impact of the COVID-19 Pandemic on the updates of the accounting performance measurement systems.

C. To identify the impact of the COVID-19 Pandemic on the performance of organizations.

In this study, a quantitative methodology was applied to answer the specific research questions to find solutions to the issue of the present study. The data collection process was carried out through the application of a questionnaire. This questionnaire was based on a literature review. For its validation, it was done a pilot application to a list of 46 Portuguese companies.

Following the introduction, the second section develops the research hypotheses. Subsequently, the methodologic approach, the procedures for data collection, and data analysis are described. In the fourth section, the results of the study are presented and discussed. Finally, the main conclusion and the limitations of this study are displayed in the last section, as well as the future research opportunities on the topic.

DEVELOPMENT OF THE RESEARCH HYPOTHESES

Based on the literature review, it was possible to develop the hypotheses for the research. The COVID-19 Pandemic was considered an economic crisis, that poses a constant threat to companies, increasing uncertainty and making the process of performance control a lot more complex (Janke et al., 2014; Mangena et al., 2012; Pearson & Clair, 1998; Waymire & Basu, 2011).

The literature mentions that these changes to an economic environment require new management tools capable of performing better crisis management (Arnold, 2009; Chenhall & Moers, 2015). The factors corresponding to the scenario may affect the implementation of performance measurement systems (Naranjo-Gil Maas & Hartmann, 2009; Zawawi & Hoque, 2010). Similarly, the literature also reports the existence of positive changes in the use of performance measurement systems in contexts with high levels of uncertainty (Janke et al.,2014; Pavlatos & Kostakis, 2015, 2018). It is believed that the perception of negative effects leads performance measurement systems to be used more interactively, providing information with more quality and relevance to the decision-making process (Janke et al., 2014; Pavlatos & Kostakis, 2015). Having said this, it is possible to define the first research hypothesis of this study:

H1. The COVID-19 Pandemic had a positive impact on the implementation and use of performance measurement tools in organizations.

In response to these changes derived from the COVID-19 Pandemic, both organizations, goals, and performance measurement systems must be dynamic by reviewing their performance indicators, goals, and objectives (Henri, 2010; Kennerley & Neely 2002, 2003). It is necessary to conduct a review and update process of the performance measurement system to ensure its relevance in the current context (Dixon, Nanni & Vollmann, 1990; Kennerley & Neely, 2002, 2003). This action becomes even more relevant when changes occur in the internal or external environment of the organization due to its ability to drive and lead strategic changes (Henri, 2010; Kaplan & Norton, 2001).

In general, it is expected that the review of performance measurement systems would occur more frequently in a context where the level of uncertainty is very high, such as the COVID-19 Pandemic case since they would be able to contribute to the performance of organizations and reduce the level of uncertainty set up by providing more valuable information about the context (Henri, 2010). Considering this discussion and the previous literature review presented, it is pertinent to answer the second research hypothesis:

H2. The COVID-19 Pandemic increased updates to the organization's Performance Measurement System.

Zhang, Wang, Rauch, and Wei (2020) report that COVID-19 Pandemic mitigation measures have caused significant changes in the way organizations, communities, and people interact. As an example of these measures, some periods of confinement were presented (Prochazka et al., 2020)

Nevertheless, the COVID-19 context allowed for the reinvention and creation of several organizations, which may have achieved competitive advantage and a positive impact on their organizational performance (Rapaccini, Saccani, Kowalkowsi Paola & Adrodegari, 2020; Tortorella, Narayanamurthy, Godinho Filho, Portioli Staudacher & Mac Cawley, 2021). The most recurrent in these high uncertainty contexts is the existence of a high risk of organizations'

performance being negatively affected (Kunc & Bhandari, 2011; Seles, Jabbour Latan, and Roubaud, 2019). In the case of the Pandemic, the performance was affected at various levels as in financial, operational, and human resources (Bartik, Cullen, Glaeser, Luca & Santon, 2020; Prochazka et al., 2020; Tortorella et al., 2021). Lastly, based on the literature review, it is also shown to be relevant to study the organizational environment, answering the third research hypothesis:

H3. The COVID-19 Pandemic impacted negatively the organizations' performance.

METHODOLOGY

The main aim of this research is to identify the impact that the COVID-19 pandemic has on the implementation, use, and updates of the performance measurement systems, as well as on the organizations themselves. To achieve this objective, three research hypotheses, which could be justified by the literature, were formulated. In this context, the study follows a positivist paradigm. (Bryman & Bell, 2011). Since it's quantitative research, it focuses on using a deductive approach (Bryman & Bell, 2011; Creswell, 2014), using data collection as a strategy with the application of a questionnaire (Leeuw et al., 2012). The questionnaire is original and was developed, validated, and afterward applied to the largest companies in Portugal.

The questions in this questionnaire are presented mostly on a 5- point Likert type interval scale. This scale was used in previous literature about the performance measurement systems, such as in Oliveira (2008), Quesado, Guzman and Rodrigues (2014), and Silva (2011). That said, elaboration, validation, and application procedures were carried out. The questionnaire that is applied throughout this work was designed and based on the literature on performance measurement systems, highlighting the relevant dimensions for the study (DE Geuser, Mooraj & Oyon, 2009; Pavlatos & Kostakis, 2018).

The present questionnaire seeks to analyze the impact of the COVID-19 Pandemic. It consists of 14 questions and is divided into 4 groups distributed as follows:

-The first question group aims at the characterization of the performance measurement system and the extent of its use. There is one main question, divided into four sub-questions, each of them is composed of 11 items, i.e., performance measurement instruments. The first one (1.1) is related to the implementation status of each performance measurement instrument and is based on the scales previously used by Pavlatos and Kostakis (2018) and by Silva (2011), with the latest contributions of Tortorella et al. (2021), namely regarding the definition of the maturity of the implementation time. The second and third (1.2 and 1.3) seek to appraise the extent of use regarding the systems before the pandemic and during the pandemic crisis, using a scale adapted from Pavlatosthi and Kostakis (2018). The fourth (1.4) is intended to gauge whether there is an intention to implement any of the performance measurement systems in the short term, in line with Pavlatos

and Kostakis (2018).

- The second question group aims to evaluate the impact of COVID-19 on the dynamics of the performance measurement system updates. It is divided into three sub-questions (2.1.; 2.2.; 2.3.), and each of them is composed of three items. A Likert scale was applied and the respondent must classify each item "before the COVID-19 Pandemic" and "during the COVID-19 Pandemic". This question is based on the scale used by Henri (2010).

- The third group, the characterization of the impact of the COVID-19 Pandemic on the organization and its performance, is based on two general questions. Question 3 is composed of four sub-questions adapting the scales used by Pavlatos and Kostakis (2018) and by Seles et al. (2019), further grounding the theoretical concepts based on Lai and Wong (2020) and Prochazka et al. (2020). It aims to identify the "impact on human resources". In turn, question 4 is directed to identify the "impact on overall performances" by adapting the scale previously used by Pavlatos and Kostakis (2018), and it is set by six sub-questions.

Finally, the fourth group focused on the characterization of the respondent and the organization, through ten questions. Initially, some general demographic questions were asked about the respondent such as: "year of birth"," gender" and"academic background". The following questions were also asked about the respondent: "training in management or related areas" (Silva, 2011) and "management level" (Oliveira, 2018). Regarding the organizations' profile, the six question items refer to "organizations CEA", as seen in Gomes (2007), "average number of employees", "Net Turnover" and "total balance sheet value", as mentioned in article 9 of Decree-Law 98/2015. In the last question, the respondent was asked to write their email address if he/she wishes to receive the final report of the study.

After designing the questionnaire based on the literature, we proceeded to the validation phase. First, the questionnaire was given to a heterogeneous group of 10 academic and non-academic individuals, both from management-related and non-related fields. As a result, the questionnaire was adjusted.

Subsequently, the validation pre-test was performed by applying the questionnaire to a random sample of the population, composed of 46 companies, and analyzing the sensitivity, reliability, and validity of the questionnaire. As for the sensitivity of the questionnaire, it is possible to verify that almost all items cover the entire scale (**Figure 1**). To assess the reliability of the questionnaire, Cronbach's alpha was calculated (**Figure 1**), with an α of 0.762 at the general level and an α between 0.735 and 0,899 for each factor, representing a very good internal consistency (Hair Hair, Black, Babin, & Anderson, 2018: Hill & Hill, 2005; Pestana & Gageiro, 2003).

The validity of the questionnaire (**Figure 1**), i.e., the ability to effectively measure what it was intended to measure, was measured through Spearman's Correlation (Hardy & Bryman, 2009; Hill & Hill, 2005). The correlation was performed in groups II and III of the questionnaires, seeking to correlate 13 items present in them with the respective factors, all showing a correlation with a very high degree of significance.

Sensitivity	Reliability	Validity
Extreme points • Almost all the items cover the entire scale (Likert 1 a 5).	**General Cronbach's Alpha** • 0,762 **Cronbach's Alpha Fators** • 0,735 a 0,899	**Spearman's correlation** • All the questions (13) are correlated with a very high degree of significance.

Figure 1. The Questionary Validation

During May and June 2021, the link to the questionnaire was placed on the Qualtrics XM online platform and sent by e-mail to a list of the largest companies in Portugal. The list is representative of the research population and is composed of 2556 companies in Portugal, distributed in this manner: 1000 Largest SMEs in Portugal (Exame, 2021)- 35.84% (916); 500 Largest & Best Companies in Portugal (Exame, 2020)- 18.31% (468) companies present in the Ranking of the 2000 Largest Companies in Portugal (DinheiroVivo, 2020) – 45.85% (1172). Finally, SPSS (Statistical Package for Social Sciences) and Microsoft Excel were used for the statistical analysis.

Characterization of the sample

Within the sample for this scientific research 170 companies (6.65% of respondents), contributed to the study, only 101 of these (3.95% of respondents) completed the questionnaire, with 54.46% of whom were female, and 45.54% of whom were male. The age of the respondents is mainly between 30 and 59 years old, and we found that almost half of the respondents belong to top management (49.50%), 39.60% occupy a position in middle management and only 10.89% belong to operational management. We also found that most respondents have an academic level corresponding to a bachelor's degree (62.38%) or a master's degree (27.72%) and that 83.17% of respondents have training in the area of management.

Regarding the Classification of Economic Activities (CEA) of the companies, we found that 27.72% belong to group "G – Wholesale and retail trade; repair of motor vehicles and motorcycles"; 26.73% belong to group "C - Manufacturing"; 8.91% belong to group "H –Transportation and storage" and 4.95% belong to group "N – Administrative and support services activities". The companies were further characterized through article 9 of Decree-Law 98/2015, based on their average number of employees, net turnover, and total balance sheet value, where: 43.56% of the companies have more than 250 employees, 35.64% have between 51 and 250 employees; 16.83% with between 11 and 50. Regarding net turnover, it was found that 33.66% of the organizations had a net turnover of more than 40.000.000 euros; 51.49% of the companies had between 8.000.001 euros and 40.000.000 euros; 12.87% of the respondents had a net turnover between 700.000 euros and 8.000.000 euros and only 1.98% of the companies had a value of up to 700.000 euros. As for the balance sheet total, 42.57% of the organizations have a balance sheet greater than 20.000.000 euros; 34.65% between 4.000.001 euros and 20.000.000 euros;

19.80% of the respondents between 350.001 euros and 4.000.000 euros. Finally, 2.97% have a balance sheet total value of fewer than 350.000 euros.

RESULTS ANALYSIS

Analysis and Discussion of the Results

Identifying the impact of the COVID-19 Pandemic on the implementation and use of performance measurement systems

The analysis and discussion of the results can be found in group 1 when it comes to "Identifying the impact of the COVID-19 Pandemic on the implementation and use of performance measurement systems", which are aimed to answer the research hypothesis:

H1. The COVID-19 Pandemic had a positive impact on the implementation and use of performance measurement instruments in organizations.

Based on the frequency table of Group I, question "1.1 - Currently Implemented", we can verify that among the respondents, the performance measurements system that holds a percentage of implementation higher than 50% are: the Key Performance Indicators (83.33%); the Budget Based Control (79.80%); the SWOT Analysis (70.71%); the Cost-Benefit Analysis (70.53%) and the Benchmarking (58.70%) (**Table 1**). As for the response more than 2 years ago, the implementation of the systems focuses on Key Performance Indicators (47.06%), Budget Based Control (45.45%), and SWOT Analysis (40.40%) (**Table 1**).

In terms of implementations in the last two years, the performance measurement systems with the highest percentage were: Key Performance Indicators (36.27%); Cost-Benefit Analysis (35.79%), and Budget Based Control (34.34%) (**Table 1**). It is also pertinent to state that some systems were implemented more in the last two years than before, such as Value Chain Analysis, Activity Based Costing, and Cost-Benefit Analysis. Overall, we see that close to half (47.38%) of the implementation tools were carried out in the last two years, a period mostly composed of the COVID-19 Pandemic (14 months). These implementations may have been carried out to meet some needs arising from the pandemic context.

Table 1. Frequencies – Implementation (Question 1.1)

Systems	No		Yes > 2 years		Yes		Total
	N	%	N	%	N	%	
Balanced Scorecard	58	61,70%	18	19,15%	18	19,15%	94
Activity Based Costing	61	69,32%	10	11,36%	17	19,32%	88
Value Chain Analysis	46	50,55%	19	20,88%	26	28,57%	91
Cost-Benefit Analysis	28	29,47%	33	34,74%	34	35,79%	95
Swot Analysis	29	29,29%	40	40,40%	30	30,30%	99
Benchmarking	38	41,30%	31	33,70%	23	25,00%	92
Budget Based Control	20	20,20%	45	45,45%	34	34,34%	99
Key Performance Indicators	17	16,67%	48	47,06%	37	36,27%	102
Lifecycle Costing	60	69,77%	14	16,28%	12	13,95%	86
Tableau de Bord	51	54,84%	21	22,58%	21	22,58%	93
Others	14	82,35%	2	11,76%	1	5,88%	17

Table 2. Frequencies – Extent of Use before COVID-19 Pandemic Context (Question 1.2)

Systems	avg.	SD	1		2		3		4		5		Total
			N	%	N	%	N	%	N	%	N	%	
Balanced Scorecard	2,21	1,517	42	55,26%	4	5,26%	12	15,79%	8	10,53%	10	13,16%	76
Activity Based Costing	2,23	1,541	36	58,06%	1	1,61%	6	9,68%	13	20,97%	6	9,68%	62
Value Chain Analysis	2,65	1,589	29	42,03%	4	5,80%	9	13,04%	16	23,19%	11	15,94%	69
Cost-Benefit Analysis	3,23	1,519	20	25,32%	4	5,06%	12	15,19%	24	30,38%	19	24,05%	79
SWOT Analysis	3,18	1,577	23	27,38%	5	5,95%	13	15,48%	20	23,81%	23	27,38%	84
Benchmarking	2,91	1,643	27	35,53%	5	6,58%	11	14,47%	14	18,42%	19	25,00%	76
Budget Based Control	3,76	1,470	13	15,66%	5	6,02%	8	9,64%	20	24,10%	37	44,58%	83
Key Performance Indicators	3,60	1,543	17	19,10%	6	6,74%	10	11,24%	19	21,35%	37	41,57%	89
Lifecycle Costing	2,16	1,598	36	62,07%	2	3,45%	3	5,17%	9	15,52%	8	13,79%	58
Tableau de Bord	2,71	1,712	32	45,71%	1	1,43%	9	12,86%	11	15,71%	17	24,29%	70
Others	2,00	1,541	11	64,71%	1	5,88%	1	5,88%	2	11,76%	2	11,76%	17

Table 3. Frequencies – Extent of Use in COVID-19 Pandemic Context (Question 1.3)

Systems	avg.	SD	1		2		3		4		5		Total
			N	%	N	%	N	%	N	%	N	%	
Balanced Scorecard	2,26	1,571	41	55,41%	4	5,41%	9	12,16%	9	12,16%	11	14,86%	74
Activity Based Costing	2,23	1,577	35	58,33%	1	1,67%	7	11,67%	9	15,00%	8	13,33%	60
Value Chain Analysis	2,67	1,618	28	41,79%	4	5,97%	10	14,93%	12	17,91%	13	19,40%	67
Cost-Benefit Analysis	3,16	1,531	21	27,27%	3	3,90%	14	18,18%	21	27,27%	18	23,38%	77
SWOT Analysis	3,14	1,609	24	28,92%	6	7,23%	10	12,05%	20	24,10%	23	27,71%	83
Benchmarking	2,89	1,638	28	36,84%	2	2,63%	15	19,74%	12	15,79%	19	25,00%	76
Budget Based Control	3,71	1,527	14	17,07%	5	6,10%	11	13,41%	13	15,85%	39	47,56%	82
Key Performance Indicators	3,53	1,617	20	22,47%	6	6,74%	8	8,99%	17	19,10%	38	42,70%	89
Lifecycle Costing	2,14	1,612	35	62,50%	2	3,57%	4	7,14%	6	10,71%	9	16,07%	56
Tableau de Bord	2,68	1,697	31	45,59%	1	1,47%	12	17,65%	7	10,29%	17	25,00%	68
Others	1,94	1,478	11	64,71%	1	5,88%	2	11,76%	1	5,88%	2	11,76%	17

Analyzing the frequency tables of Group I, question "1.2 - Extent of Use Before the COVID-19 Pandemic" (**Table 2**) question "1.3 - Extent of Use in the Context of the COVID-19 Pandemic" (**Table 3**). It is possible to ascertain that the performance measurement systems used on average before the pandemic and in the context of the COVID-19 pandemic, were the same: Budget Based Control (3.76 and 3.71); Key Performance Indicators (3.60 and 3.53) and Cost-Benefit Analysis 3.23 and 3.16) (**Table 2**; **Table 3**). Likewise, the least used in both contexts also remained the same: Lifecycle Costing (2.16 and 2.14); Activity Based Costing (2.23 and 2.23), and Balanced Scorecard (2.21 and 2.26) (**Table 2**; **Table 3**).

Resorting to the frequency table of Group I, in question "1.4 - Intentions to Implement in the Short Term", we verified the existence of some intention by the respondents to implement, in the short term, the performance measurement systems (**Table 4**). In this context, we can see that the systems with more intentions to implement in the short term were the Balanced Scorecard (22.00%); the Activity Based Costing (12.00%), and the Benchmarking (12.00%) (**Table 4**). In some way, the respondents' intention may have resulted from their view that, in a pandemic context, these systems could help their organization meet certain needs or take advantage of opportunities.

Table 4. Frequencies – Intention to Implement in the Short-Term (Question 1.4)

Systems	N	%
Balanced Scorecard	11	22,00%
Activity Based Costing	6	12,00%
Value Chain Analysis	3	6,00%
Cost-Benefit Analysis	2	4,00%
SWOT Analysis	3	6,00%
Benchmarking	6	12,00%
Budget Based Control	5	10,00%
Key Performance Indicators	3	6,00%
Lifecycle Costing	5	10,00%
Tableau de Bord	4	8,00%
Others	2	4,00%
Total	**50**	**100,00%**

Notwithstanding the previously performed analysis of the average extent of use of the performance measurement systems, we will explore this theme based on the levels of use identified by the respondents (**Table 5**). Despite this analysis not having statistical significance, through **Table 5**, we can see that the extreme points 1 "zero use" (+0.92%), 5 "extensive use" (+1.42%), and the middle point 3 (+1.75%) had an average percentage increase, as well as increase in most systems. On the other hand, the remaining points are found to have negative average changes, point 2 (-0.29%) and point 4 (-3.79%). This may have occurred in the case that some organizations, to respond better according to the pandemic context, decided to take a step forward in their use of performance measurement systems, as well as in the situation where they were pressured to take a step back or even stop using them, due to lack of resources, lack of capacity to update them or even the lack of identifying the usefulness. The fact that the level of use has been maintained or increased in certain performance measurement systems may reveal that they are adequate and able to cope with change.

Table 5. Extent of Use of Performance Measurement Tools

	1		2		3		4		5	
Systems	BP	PC	BP	PC	BP	PC	BP	PC	BP	PC
Balanced Scorecard	55,26%	55,41%	5,26%	5,41%	15,79%	12,16%	10,53%	12,16%	13,16%	14,86%
Activity Based Costing	58,06%	58,33%	1,61%	1,67%	9,68%	11,67%	20,97%	15,00%	9,68%	13,33%
Value Chain Analysis	42,03%	41,79%	5,80%	5,97%	13,04%	14,93%	23,19%	17,91%	15,94%	19,40%
Cost-Benefit Analysis	25,32%	27,27%	5,06%	3,90%	15,19%	18,18%	30,38%	27,27%	24,05%	23,38%
SWOT Analysis	27,38%	28,92%	5,95%	7,23%	15,48%	12,05%	23,81%	24,10%	27,38%	27,71%
Benchmarking	35,53%	36,84%	6,58%	2,63%	14,47%	19,74%	18,42%	15,79%	25,00%	25,00%
Budget Based Control	15,66%	17,07%	6,02%	6,10%	9,64%	13,41%	24,10%	15,85%	44,58%	47,56%
Key Performance Indicators	19,10%	22,47%	6,74%	6,74%	11,24%	8,99%	21,35%	19,10%	41,57%	42,70%
Lifecycle Costing	62,07%	62,50%	3,45%	3,57%	5,17%	7,14%	15,52%	10,71%	13,79%	16,07%
Tableau de Bord	45,71%	45,59%	1,43%	1,47%	12,86%	17,65%	15,71%	10,29%	24,29%	25,00%
Others	64,71%	64,71%	5,88%	5,88%	5,88%	11,76%	11,76%	5,88%	11,76%	11,76%
	+0,92%		-0,29%		+1,75%		-3,79%		+1,42%	

The extent of Use: Before the Pandemic (BP); Pandemic Context (PC)

Table 6. Wilcoxon Test (Extent of Use)

The extent of Use (Before the Pandemic; Pandemic Context)	
	Wilcoxon
Systems	Z
Balanced Scorecard	-0,378
Activity Based Costing	-0,412
Value Chain Analysis	-0,378
Cost-Benefit Analysis	-0,302
SWOT Analysis	-0,632
Benchmarking	-0,061
Budget Based Control	-0,431
Key Performance Indicators	-0,679
Lifecycle Costing	-0,378
Tableau de Bord	-1,414
Others	-1,000

However, when we reviewed the terms of the extent of use of the performance measurement systems, against the period since the system is implemented, we verified statistically significant results through the Mann-Whitney U test (**Table 7**). This proves that some systems implemented more than two years ago have higher levels of usage extension than those implemented less than two years ago, as in the case of Value Chain Analysis ($p < 0.05$), Cost-Benefit Analysis ($p < 0.05$), Benchmarking ($p < 0.05$), Budget Based Control ($p < 0.01$), Key Performance Indicators ($p < 0.01$), and Tableau de Bord ($p < 0.01$) (**Table 7**). However, when the test is performed in the pandemic context, only two systems remain with the same level of significance, Budget Based Control ($p < 0.01$) and Key Performance Indicators ($p < 0.01$) (**Table 7**). The Tableau de Bord decreased to a significant level ($p < 05$) and there are no longer any statistically significant differences in Value Chain Analysis, Cost-Benefit Analysis, and Benchmarking (**Table 7**).

This study reveals that a longer implementation time tends to result in a higher level of use. However, in a pandemic context, these differences were reduced and there was a tendency towards the homogenization of the use. Our study did not identify the reasons behind it. However, we propose some hypotheses: the systems are adequate and useful to respond to the pandemic context, making the level of use similar in all organizations; the newly implemented systems had time to monitor the usage phase of those previously implemented or systems implemented more than two years ago were less used as they were not suitable for change, thus reducing differences.

Table 7. Mann-Whitney U (Extent of Use)

	The extent of Use (Yes; Yes > 2 years)			
	Mann-Whitney U			
	Before the Pandemic COVID-19		**Pandemic Context COVID-19**	
Systems	Z	Results	Z	Results
Balanced Scorecard	-1,640	-	-1,567	-
Activity Based Costing	-1,168	-	-0,169	-
Value Chain Analysis	-2,070*	Yes < 2years	-1,395	-
Cost-Benefit Analysis	-2,135*	Yes < 2years	-1,753	-
SWOT Analysis	-1,412	-	-1,484	-
Benchmarking	-1,981*	Yes < 2years	-1,788	-
Budget Based Control	-3,060**	Yes < 2years	-2,773**	Yes < 2years
Key Performance Indicators	-3,839**	Yes < 2years	-3,382**	Yes < 2years
Lifecycle Costing	-1,642	-	-1,026	-
Tableau de Bord	-2,930**	Yes< 2years	-2,288*	Yes < 2years
Others	-1,414	-	-1,414	-

* The correlation is significant at 5%

** The correlation is significant at 1%

Based on the results obtained from the questions in group 1 "*Identify the impact that the COVID-19 Pandemic had on the implementation and use of performance measurement systems*", it is also important to note that it is possible to test the research hypothesis:

H1. The COVID-19 Pandemic had a positive impact on the implementation and use of organizations' performance measurement tools.

In the context of the use of performance measurement systems, when comparing the means and percentages in **Table 2**, **Table 3**, and **Table 5**, we found that there was a variation in the level of use of performance measurement systems when it comes to the COVID-19 Pandemic. However, it was not possible to find statistically significant differences that prove the impact of the Pandemic when it comes to the use of performance measurement systems (**Table 6**).

At the implementation level, we can also state that almost half of the implementations of the instruments were carried out in the last two years, a period largely composed of the COVID-19 Pandemic context (**Table 1**). These implementations may have been carried out to meet some needs arising from the pandemic context, as suggested by Arnold (2009) and by Chenhall and Moers (2015).

Additionally, when cross-referencing the information between implementation and use of the performance measurement instruments, we found that the level of the extent of use before the COVID-19 Pandemicwas higher in certain instruments that were implemented more than two years ago, meeting the two-year maturity level used in Tortorella et al. (2021) (**Table 7**). However, in the context of the COVID-19 Pandemic, these statistically significant differences were no longer observed for some of the instruments (**Table 7**). Having said this, we can affirm that homogenization of the levels of use of the performance measurement systems has occurred. This phenomenon may have occurred due to the need for better information to respond to the context, raising the level of use by organizations that have implemented them more recently (Janke et al., 2014; Pavlatos & Kostakis, 2018).

Although it is impossible to fully confirm the research hypothesis, it can be stated that the COVID-19 pandemic positively impacted the homogenization and development of the use of organizations' performance measurement systems.

Identifying the impact of the COVID-19 Pandemic on updates to performance measurement systems.

The analysis and discussion of the results presented in group 2 "Identifying the impact of the COVID-19 Pandemic on performance measurement system updates" aims to test the research hypothesis:

H2. _The COVID-19 Pandemic has increased updates to the organizations' Performance Measurement System.

Considering the frequency table of Group II - Updating, where question 2 "Dynamism" is present, we can verify that, in order, the statements with the highest average updates before and during the pandemic context, were: the "Q2.3 - Have the target goals been changed?" (3.34; 3.62); the "Q2.2 -

Have performance indicators been added/removed/changed?" (3.28; 3.52) and lastly the "Q2.1 – Have strategic objectives been added/removed/changed?" (3.19; 3.46) (**Table 8**).

Table 8. Descriptive Statics (Group II_Update)

Group II - Update	Before the Pandemic COVID-19		Pandemic Context COVID-19	
	avg.	SD	avg.	SD
2 - Dynamism				
Q2.1 – Have strategic objectives been added/ removed/ changed?	3,19	0,957	3,46	0,964
Q2.2 – Have performance indicators been added/ removed/ changed?	3,28	0,966	3,52	0,980
Q2.3 – Have the target goals been changed?	3,34	0,954	3,62	0,983

After the previous analysis, a further Wilcoxon test was carried out on every answer of the sample in aggregate form, at the level of the Group II items. This study identified significant differences with greater relevance to the period before the pandemic versus the pandemic context, in the statement "Q2.2 – Have performance indicators been added/removed/changed?" (p < 0.05) (**Table 9**). Moreover, a significant difference is seen, in the statement "Q2.3 – Have target goals been changed?" (p < 0.01), showing a greater change in the pandemic context compared to the period before the pandemic (**Table 9**). This may have occurred because the previously defined performance indicators were already prepared for the external changes, not requiring changes in the pandemic context. However, the opposite may be true for the targets since it would be practically impossible to determine an exact target in such an unpredictable business scenario and with such a high level of uncertainty.

Table 9. Wilcoxon Test (Group II_Update)

Wilcoxon Test (Before the Pandemic COVID-19; Pandemic Context COVID-19)	Z	Results
2 - Dynamism		
Q2.1 – Have strategic objectives been added/ removed/ changed?	-1,762	-
Q2.2 – Have performance indicators been added/ removed/ changed?	-2,068*	Before > Context
Q2.3 – Have the target goals been changed?	-2,962**	Before < Context

*. The correlation is significant for 5%
** The correlation is significant for 1%

When we check on the Group II items, categorizing companies by their net turnover, we find an agreement in

Table 10 with the general study (**Table 9**). It is possible to affirm the existence of a statistically significant and positive difference from the pandemic context, in companies with a net turnover of "More than 40,000,000 €" in the item "Q2.3 – Have the target goals been changed?" (p < 0.01) (

Table 10). This may be driven by the need for companies to stay up to date and ready to respond to changes in the business context. The fact that this difference only occurs in larger companies may be a result of their theoretically higher target goals than the other remaining companies.

When we analyze the items in the scope of the total balance sheet value, we once again find a statistically significant and positive difference in the item "Q2.3 – Have the target goals been changed?" (p < 0.05) shows in companies with balance sheet total value between "€4,000,000 to €20,000,000" (**Table 11**).

In agreement with the tests performed earlier on Group II items, we once again found statistically significant differences in "Q2.3 - Have the target goals been changed?" (p < 0.05) (**Table 12**). That said, organizations with an average number of employees of "11 to 50" and with "More than 250" changed their goals more in the pandemic context than before.

Table 10. Wilcoxon Test (Group II Update - Net Turnover)

(Net Turnover) **Wilcoxon Test** **(Before the Pandemic (B)**; Pandemic Context**(C))**	Up to 700.000 €		700.000 € to 8.000.000 €		8.000.001 € to 40.000.000 €		More than 40.000.000 €	
	Z	Res.	Z	Res.	Z	Res.	Z	Res.
2 - Dynamism								
Q2.1 – Have strategic objectives been added/ removed/ changed?	-	-	0,000	-	-1,251	-	-0,962	-
Q2.2 – Have performance indicators been added/ removed/ changed?	-	-	0,000	-	-1,059	-	-1,667	-
Q2.3 – Have the target goals been changed?	-	-	-1,342	-	-1,303	-	-2,640**	B<C

** The correlation is significant for 1%

Table 11. Wilcoxon Test (Group II_Update – Total Balance Sheet)

(Total Balance Sheet) **Teste Wilcoxon** **(Before the Pandemic (B)**; Pandemic Context **(C))**	Up to 350.000 €		350.001 € to 4.000.000 €		4.000.001 € to 20.000.000 €		More than 20.000.000 €	
	Z	Res.	Z	Res.	Z	Res.	Z	Res.
2 - Dynamism								
Q2.1 – Have strategic objectives been added/ removed/ changed?	-1,000	-	-1,190	-	-0,632	-	-1,276	-
Q2.2 – Have performance indicators been added/ removed/ changed?	-1,000	-	-1,134	-	-0,707	-	-1,730	-
Q2.3 – Have the target goals been changed?	-0,447	-	-1,730	-	-2,121*	B<C	-1,249	-

*. The correlation is significant for 5%

Table 12. Wilcoxon Test (Group II_Update - Average Number of Employees)

(Average Number of Employees) **Teste Wilcoxon** **(Before the pandemic (B)**; Pandemic Context **(C))**	Up to 10		11 to 50		50 to 250		More than 250	
	Z	Res.	Z	Res.	Z	Res.	Z	Res.
2 -Dynamism								
Q2.1 – Have strategic objectives been added/ removed/ changed?	0,000	-	-1,890	-	-1,513	-	-0,213	-
Q2.2 – Have performance indicators been added/ removed/ changed?	0,000	-	-1,890	-	-1,000	-	-0,541	-
Q2.3 – Have the target goals been changed?	-1,000	-	-2,121*	B<C	-1,115	-	-2,271*	B<C

*. The correlation is significant for 5%

Through the results achieved in group 2 "Identifying the impact of the COVID-19 Pandemic on performance

measurement system updates", it was possible to test the research hypothesis:

H2. The COVID-19 Pandemic has increased updates to the organizations' Performance Measurement Systems.

Based on the study of the updates to the performance measurement system of organizations, we found that although there is a negative impact on "Q2.2 – Have performance indicators been added/removed/changed?", something that contradicts the trend of adding indicators, predicted by Henri (2010) (**Table 9**). There is a positive and more relevant impact on "Q2.3 - Have the target goals been changed?", proving this time the scenario of a higher level of updating expected by Henri (2010) (**Table 9**)

Again, when we categorize the organizations based on their net turnover, total balance sheet value, and average number of employees, we found four statistically significant differences with a positive impact on the changes in the targets to be achieved (

Table 10; **Table 11**; **Table 12**). Demonstrating that the systems were more updated in the context of the COVID-19 Pandemic, confirming the response expected by Henri (2010), it is possible to confirm the research hypothesis, i.e., that the COVID-19 Pandemic predominantly increased the updates of organizations' performance measurement systems.

Identify the impact of the COVID-19 Pandemic on the performance of organizations.

The analysis and discussion of the results obtained in group 3 "Identifying the impact of COVID-19 Pandemic on the performance of organizations", are aimed to test the research hypothesis:

H3. The COVID-19 Pandemic had a negative impact on the organizations' performance.

Based on the frequency table of group III, where we find question 3 "Impact on Human Resources" and question 4 "Impact on Overall Performance" (**Table 13**).

Under question 3 "impact on human resources", we can see for example that 74.38% of organizations had a "Q3.1 - % time in layoff" of less than 21% (**Table 13**). On the other hand, 18.18% of the organizations had a "Q3.3 - % time spent telecommuting" greater than 80% (**Table 13**).

Regarding question 4 "impact on overall performance", for example, 54.17% of the companies had a decrease in their "Q4.1 - turnover" and 48.33% had a decrease in "Q4.2 - the number of orders" (**Table 13**). In contrast, 9.17% of the companies had a significant increase in both "Q4.1 - turnover" and "Q4.2 - the number of orders" (**Table 13**). That said, it also reveals the fact that 34.17% of the companies suffered from shortcomings in "Q4.6 - supplier delivery compliance" (**Table 13**).

Table 13. Descriptive Statistics (Group III_Pandemic Impact on Performance)

Grupo III – Impact on Performance	Min.	Max.	avg.	SD	1	2	3	4	5
3 – Human resources impact									
Q3.1 - % layoff time	1	5	1,55	1,088	74,38%	9,92%	6,61%	4,96%	4,13%
Q3.2 - % HR who went into layoff	1	5	1,85	1,400	67,77%	8,26%	4,13%	10,74%	9,09%
Q3.3 - % telecommuting time	1	5	2,66	1,547	37,19%	11,57%	17,36%	15,70%	18,18%
Q3.4 - % HR who entered in telecommuting	1	5	2,44	1,527	43,80%	14,05%	10,74%	17,36%	14,05%
4 – Overal performance impact									
Q4.1 - turnover	1	5	2,64	1,262	20,00%	34,17%	16,67%	20,00%	9,17%
Q4.2 - the quantity of orders	1	5	2,68	1,216	18,33%	30,00%	25,83%	16,67%	9,17%
Q4.3 - meeting deadlines for receiving customers	1	5	3,08	0,945	5,00%	15,83%	55,83%	13,33%	10,00%
Q4.4 - fulfillment of deliveries to costumers	1	5	3,08	0,773	2,50%	10,83%	70,00%	9,17%	7,50%
Q4.5 - compliance with payment deadlines for suppliers	1	5	3,09	0,745	3,33%	6,67%	74,17%	9,17%	6,67%
Q4.6 - supplier deliveries compliance	1	5	2,80	0,922	7,50%	26,67%	49,17%	11,67%	5,00%

For better analysis and study of COVID-19 Pandemic impact on organizations, the ratings from 1 to 5 were transformed into average points (10%; 30%; 50%; 70%; 90%, respectively), to calculate the General Average of each item and respective question (**Table Table** 14).

Regarding the impact on human resources during the pandemic, on average were: the "% time spent telecommuting" (43.23%); the "% of HR who telecommuted" (38.76%); the "% of HR who went on layoff" (27.02%) and the "% time spent on layoff" (20.91%) (**Table 14**).

When it comes to the impact of the pandemic on the overall performance of the organizations, it is important to analyze the overall average and the respective impact of each item. Since point 3 (no change) equals a midpoint of 50%, we state that the results above 50% were positively impacted and the results below 50% were negatively impacted (**Table 14**). Also based on the average rate of change, the most impacted items were: "Q4.2 - turnover" (-14.33%); "Q4.2 - order quantity" (-12.67%), and "Q4.6 - supplier delivery fulfillment" (-8.00%) (**Table 14**). According to this evaluation, it is possible to state that on average, the overall performance of the organizations was impacted by -4.17% (**Table 14**).

In this case, we verified that the results are in line with what is expected in most companies in the pandemic context, i.e., a negative impact due to layoffs and telecommuting. There was also an expected decrease, on average, in turnover, the number of orders, and the level of compliance with suppliers' delivery times. However, these results may be skewed since, on average, those items that depend directly or indirectly on the responding organizations had a positive impact.

After the previous analysis, Spearman's Correlation test was performed between the items referring to the impact of the pandemic on the organizations' performance. When correlating the items of the impact on human resources, we verify the existence of expected and positive correlations among them

(**Table 15**). In turn, as for the impact on overall performance, most of the items are also positively correlated with each other (**Table 15**). We can consider that the fact that in each group practically all items are positively correlated proves that the scale is aligned with the overall performance of the organization.

However, when both topics of analytics cross, we find the confirmation of some expected correlations, such as the existence of negative correlations between the two layoff items and the overall performance of the organization.

For example, the negative correlation of "% time on layoff" with the items: "turnover" ($R=-43.1\%$; $p < 0.01$); "order intake" ($R=-43.2\%$; $p < 0.01$); "meeting deadlines for receiving customers" ($R=-18.9\%$; $p < 0.05$) and "meeting customer delivery deadlines" ($R=-25.9\%$; $p < 0.01$) (**Table 15**).

These results show that an increase in layoffs at all levels could cause a decrease in turnover and order intake, as well as customer receivables. Considering that on layoff the employees are not operating, they will not produce for turnover, receive orders, or even collect receipts from customers. On the other hand, it may be the decrease in the number of orders and the respective turnover that forces the organization to go on layoff. A failure to meet customer receivables could also drive the organization into a layoff period due to a lack of liquidity during this period.

Some non-correlations prove to be relevant, such as the fact that there is no correlation between meeting suppliers' delivery deadlines with any kind of impact on human resources, or turnover. Finally, a very relevant conclusion that we can draw from this analysis is that telecommuting itself has not shown any negative or positive correlation with the overall performance of the organization.

Table 14. Overall Average and Impact (Group III_Pandemic Impact on Performance)

Grupo III – Overall Average and Impact	1 p.méd. = 10%	2 p.méd. = 30%	3 p.méd. = 50%	4 p.méd. = 70%	5 p.méd. = 90%	Overall Average (%)	Impact (%)
3 – Human resources impact							
Q3.1 - % layoff time	74,38%	9,92%	6,61%	4,96%	4,13%	20,91%	20,91%
Q3.2 - % HR who went into layoff	67,77%	8,26%	4,13%	10,74%	9,09%	27,02%	27,02%
Q3.3 - % telecommuting time	37,19%	11,57%	17,36%	15,70%	18,18%	43,22%	43,22%
Q3.4 - % HR who entered in telecommuting	43,80%	14,05%	10,74%	17,36%	14,05%	38,76%	38,76%
						32,48%	32,48%
4 – Overal performance impact							
Q4.1 - turnover	20,00%	34,17%	16,67%	20,00%	9,17%	42,83%	-14,33%
Q4.2 - the number of orders	18,33%	30,00%	25,83%	16,67%	9,17%	43,67%	-12,67%
Q4.3 - meeting deadlines for receiving customers	5,00%	15,83%	55,83%	13,33%	10,00%	51,50%	3,00%
Q4.4 - fulfillment of deliveries to costumers	2,50%	10,83%	70,00%	9,17%	7,50%	51,67%	3,33%
Q4.5 - compliance with payment deadlines for suppliers	3,33%	6,67%	74,17%	9,17%	6,67%	51,83%	3,67%
Q4.6 - supplier deliveries compliance	7,50%	26,67%	49,17%	11,67%	5,00%	46,00%	-8,00%
						47,92%	-4,17%

Table 15. Spearman Correlations Test (Pandemic Impact on Performance)

Spearman's Correlations	HR: % layoff time	HR: % HR layoff	HR: % teleco. time	HR: % HR teleco.	OP: turnover	OP: quantity of orders	OP: deadlines customers receive	OP: customer delivery deadlines	OP: deadlines pay supply	OP: delivery deadline supply
HR - % layoff time	1,000	,729**	0,067	0,118	-,431**	-,432**	-,189*	-,259**	-0,028	-0,080
HR - % HR that went into layoff	,729**	1,000	0,081	0,058	-,385**	-,385**	-,211*	-0,178	-0,027	-0,145
HR - % time in telecommuting	0,067	0,081	1,000	,820**	-0,087	-0,037	0,072	0,076	0,083	0,102
HR - % HR who entered telecommuting	0,118	0,058	,820**	1,000	-0,008	0,010	0,074	0,090	0,050	0,146
OP - turnover	-,431**	-,385**	-0,087	-0,008	1,000	,865**	,301**	,274**	0,167	0,160
OP - quantity of orders	-,432**	-,385**	-0,037	0,010	,865**	1,000	,278**	,276**	,244**	,245**
OP - meeting deadlines for receiving customers	-,189*	-,211*	0,072	0,074	,301**	,278**	1,000	,635**	,314**	,286**
OP - meeting customer delivery deadlines	-,259**	-0,178	0,076	0,090	,274**	,276**	,635**	1,000	,439**	,425**
OP - fulfillment of payment to suppliers	-0,028	-0,027	0,083	0,050	0,167	,244**	,314**	,439**	1,000	,316**
OP - fulfillment of suppliers deliveries	-0,080	-0,145	0,102	0,146	0,160	,245**	,286**	,425**	,316**	1,000

*. The correlation is significant for 5%

** The correlation is significant for 1%

According to the results achieved in group 4 "*Identifying the impact of the COVID-19 pandemic on the performance of organizations*", it was possible to test the research hypothesis:

H3. The COVID-19 Pandemic impacted negatively the organizations' performance.

When analyzing the impact of the COVID-19 Pandemic on the performance of organizations through the individual and overall average of the responses, we identify a predominantly negative impact. At the human resources level, the study shows that on average, organizations were negatively impacted by 32.48%, confirming what is exposed by the literature (Bartik et al., 2020; Choudhry, Marelli & Signorelli, 2012; Chzhen, 2016; Perles-Ribes et al., 2016; Prochazka et al., 2020; Tortorella et al., 2021) (**Table 14**). In turn, when analyzing the overall performance of the organizations, we also identified a negative impact of on average 4.17%, confirming what was expected by Pavlatos and Kostakis (2018) (**Table 14**).

When correlating the impact on human resources with the impact on the overall performance of the organizations, we can also see that there are several negative correlations between them. In particular, the "% time on layoff" and "% HR that went on layoff", which were strongly caused by the COVID-19 Pandemic, are negatively correlated with most of the items present in the overall organizational performance factor (**Table 15**). These results prove that organizations' performance was effectively impacted by the adverse context of the COVID-19 Pandemic, as expected by Kunc and Bhandari (2011) and by Seles et al. (2019). Based on all this evidence, it is possible to confirm the research hypothesis, i.e., that the COVID-19 Pandemic effectively impacted negatively on organizations' performance.

CONCLUSION

The purpose and relevance of this study and respective research are related to the existence of the COVID-19 Pandemic context experienced at the time of the study. This context can be compared to economic crisis scenarios previously experienced. It's characterized as uncontrollable, with high levels of uncertainty, capable of hindering the decision-making process and impacting both the organizations and their performance. In this way, organizations needed to seek to improve their responsiveness, and performance measurement systems have proven to be very useful tools in overcoming adverse contexts. Based on these statements, the overall objective of the research is to Identify the Impact of the COVID-19 Pandemic on Performance Measurement Systems.

As the main findings, we can confirm that the COVID-19 Pandemic had a positive impact on the development of the

overall implementation and use of performance measurement systems. At the level of updates, it can also be defined that the COVID-19 Pandemic has predominantly increased updates to performance measurement systems. As main conclusions, we can confirm that the COVID-19 Pandemic had a positive impact on the development of the overall implementation and use of performance measurement systems. At the level of the organization's performance, we see this time a negative impact of the COVID-19 Pandemic. In summary, although organizations were negatively impacted by the atypical COVID-19 Pandemic context, their performance measurement systems were positively impacted.

This study also contributes to the dissemination of the literature on performance measurement systems and the dissemination of the literature on performance measurement systems in adverse contexts. The study also defines itself as innovative research, for revealing a still understudied topic and for taking the opportunity to study and collect information about the COVID-19 Pandemic, still in its course. It also contributes with a well-founded and validated research instrument. It also allows for a better understanding of the use of performance measurement systems in adverse contexts, an issue that proves to be current for organizations and that may be useful in future practical situations.

As the main limitation of this study, the impossibility of generalizing the results was identified, due to the low response rate. The fact that this is a sensitive and confidential subject for many organizations was identified as a hindrance to their response. However, considering the specificity and complexity of the topic, as well as the length of the questionnaire, the collection of 101 complete responses (3.95% of respondents), can be seen as a positive point, especially in the atypical context of the COVID-19 pandemic. As clues for future research, this study could be applied to more objective populations, such as a sector or group of companies. Conversely, the knowledge and means produced for research can also be applied to the overall business fabric, nationally and internationally. At the research level, it is possible to conduct several studies to verify if there are differences between the various performance measurement systems, to look for correlations between the different dimensions and factors studied, and to repeat the study in other contexts. Lastly, it would also be interesting to verify if the conclusions of this study are maintained in the "post-Pandemic" period.

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