The use of Information and Communication Technologies to report on Sustainable Development Goals in Portuguese Municipalities

Case study of *ODSlocal* platform

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Abstract — **Information and Communication Technologies (ICT) have brought new opportunities for interaction between municipalities and their citizens. In this sense, it is appropriate to understand how digital platforms, such as the *ODSlocal*, are being used for reporting on projects and good practices that contribute to the Sustainable Development Goals (SDGs) at the municipal level in Portugal.**

Through the application of non-parametric tests, it was possible to determine that the reporting of these practices is not uniform between municipalities, since it varies according to their location, dimension and adherence to sustainable networks or programs. Thus, a more robust focus on ICT and promotion of local community participation is suggested for the SDGs achievement.

Keywords - Sustainable Development Goals; Portuguese Municipalities; Information and Communication Technologies; ODSlocal platform; Reporting

I. INTRODUCTION

The 2030 Agenda, consisting of 17 SDGs, is a plan officially launched by the United Nations in 2015, which calls for action by countries in promoting economic growth, in line with the reduction of inequalities, promotion of the quality of life of populations and protection of the environment [1].

The SDGs are a challenge for all political levels (from national to local), so the achievement of their goals also depends on the municipalities or local governments' action, given the range of responsibilities to local citizens [2,3,4]. Since stakeholder engagement is one of the most important elements of sustainability in the public sector, the disclosure of information is essential to increase accountability and transparency [5].

While the challenges of sustainability become more evident and urgent, we live in a digital age that is revolutionizing the way organizations connect with their surroundings. New technological developments enable the digitization of data and feed new information needs, which puts even more emphasis on management systems and accounting information [6]. The 2030 Agenda's Goal 9.C encourages significantly increase access to information and communication technologies and commitment to providing universal internet access [1]. However, despite the evolution of ICT-based solutions and the pressure to drive sustainability, it is necessary to improve transparency of information and accountability in local governments [7].

With the launch of the 2030 Agenda, SDG 4 (quality education), SDG 5 (gender equality), SDG 9 (industry, innovation, and infrastructure), SDG 10 (reducing inequalities), SDG 13 (climate action) and SDG 14 (life below water) were defined as strategic priorities for the Portuguese government [8]. However, in Portugal there are territorial asymmetries regarding sustainable development, and there are still few studies that analyse the reporting and monitoring of SDGs in municipalities (for example [9, 10]).

In this context, the Portuguese municipal platform *ODSlocal*, launched in 2019, is an innovative and interactive solution to disclosure projects and good practices that contribute to the SDGs at municipal level [11]. In this context, there is an opportunity to explore the use of this platform, as an ICT tool, to reveal how the reporting of the SDGs varies according to municipalities' characteristics, as well as to find out which specific SDGs are more and less prioritized. Thus, this study intends to answer the research question: How is the use of the *ODSlocal* platform for reporting on Portuguese municipalities projects and good practices characterized?

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It is expected that this research will contribute to identify possible inequalities between municipalities, so that future public policies can blur these differences pursuit of uniform sustainable development at the local level.

II. Literature Review

Municipalities are considered key actors in the way they raise awareness and involve their community and different organizations to adopt behaviours and actions necessary to achieve the SDGs [12]. Strengthening these relationships and establishing a political commitment to the SDGs further stimulates citizens' demand for transparency in accountability [3]. In this context, ICT integration facilitates dynamism and timeliness in the detection, collection, and dissemination of information, contributing to an assessment of the SDGs at local level that helps to reveal trends, patterns, and behaviours [13,14]. The correct use of technological solutions contributes to making decisions and policies related to sustainability based on reliable and quality data [15].

This panorama transformed the reporting process, not only making it more flexible, versatile, and efficient, but also contributing to expand the potential and reach of the information disclosed. Additionally, the traditional reporting approach has evolved to include environmental and social responsibility issues, supporting in the creation of organizational value [6].

In this context, websites are one of the most important means for the SDGs reporting. However, it is common to find problems in the local governments' websites, such as little interconnection between content, dispersion in the distribution of information between different sections and lack of clarity of results on sustainability field [7]. For example, a study conducted by Meschede [16] in local governments in Germany revealed flaws in the online dissemination of SDGs' commitment and highlighted the heterogeneity in SDGs-related information, switching between website's subpages or referring to goals in reports. Thus, it is necessary not only to improve the process of SDGs reporting on municipal websites, but also to explore technological alternatives that facilitate the organization and disclosure of information.

In this context, the importance of digital platforms to promote dialogic accounting has been discussed, facilitating feedback and stakeholder engagement, including in non-financial issues [17]. Since the main purpose of a platform is to connect people, data and services, there is room for empowerment of citizens to create public value [18]. Thus, digital platforms can assist in the search for excellence in public service, opening the way for the development of the so desired 'Smart Cities' [19,20,21].

Therefore, for the public sector, new technologies represent an increased opportunity in knowledge management and engagement with citizens, while helping to improve transparency and accountability [6]. As part of the 2030 Agenda, it is essential to use innovative information and communication systems that facilitate more open and participatory accounting.

However, monitoring and accountability using new ICT tools implies new changes and developments [14]. Not all local governments are equally prepared to respond to digital transformation, since there are factors such as organizational efficiency, technology skills or citizens' expectations that can affect the intention to use, as demonstrated studies by Xiao et al. [21]. Specifically about the technology to be used, also the credibility or the expectation of platform's performance can influence the intention of its use [22].

According to the view of Saner et al. [14], ideally would be to adhere to a relevant and shared monitoring system that includes stakeholder participation to contribute to the SDGs, which would help in the transparent transmission of information and continuous reporting and consensus building.

III. Methodology

A. ODSlocal platform

The *ODSlocal* municipal platform, which includes a technology-based online portal, aims to mobilize, and empower Portuguese municipalities, citizens, and other stakeholders to achieve the SDGs at local level. To this end, one of the value propositions of the platform is the mapping and dissemination of practical actions, consisting of: a) projects developed by citizens, companies, or other types of organizations, whether governmental or not; b) good practices developed by municipalities. Among the criteria for eligibility of projects and good municipal practices are, among others, their timeliness, regularity, practical impact, and positive contribution to at least three different SDGs [11].

Almeida's research [9] on the use of *ODSlocal* platform revealed that most Portuguese municipalities do not have projects listed, and it is in the large cities of Porto and Lisbon that the largest number of projects are concentrated. The results of this research also revealed that SDG 1 (reduce poverty), SDG 4 (quality education), SDG 11 (sustainable cities and communities) and SDG 13 (climate action) are those that have the largest number of corresponding projects, unlike SDG 7 (clean and affordable energy) and SDG 14 (life below water).

Since the information contained in the *ODSlocal* platform is constantly updated, it is important to carry out new analyses periodically, to verify the evolution in actions' reporting and eventual changes or trends in the profile of the disclosing municipalities.

B. Objectives and hypothesis

Based on the analysis of practical actions (projects and good practices) disclosed in the *ODSlocal* platform, this study aims to analyse how this platform is being used to report practical actions that contribute to the 2030 Agenda. Therefore, specific objectives are:

1. Account and analyse the distribution of projects and good practices by municipalities.

2. Understand how the reporting of practical actions varies according to some municipalities' characteristics.

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3. Analyse and compare the contribution of practical actions to specific SDGs.

While local governments can lead many local practices, citizens and other stakeholders can also mobilize local action [3]. This is because the challenges of the 2030 Agenda include citizens as co-creators of solutions to local sustainability problems, which requires more open, collaborative and connected governance [23].

Thus, the analysis of practical actions at municipal level should consider, in addition to the good practices recognized to municipalities, the contribution of the local community towards the SDGs through the development and dissemination of projects in the *ODSlocal* platform. Subsequently, this analysis can be related to some municipalities' characteristics.

Portugal is a country characterized by territorial inequalities in population distribution, economic development, and quality of life. These differences are evident when comparing inland and coastal regions, since the latter are characterized by youth, urbanism, and economic dynamics [24]. Development level tends to be greater in coastal regions, and therefore is easier access to financial and human resources. Thus, coastal municipalities tend to develop and disseminate more sustainability practices [25]. In this sense, it is suggested:

Hypothesis 1 (H1): The number of practical actions disclosed in the *ODSlocal* platform is significantly higher in the coastal municipalities.

Dimension is also an important factor, given that larger municipalities generally have greater pressure to legitimize their activities and disseminate sustainability-related information [25]. On the other hand, smaller municipalities have limited resources and may have greater difficulties in implementing the SDGs [2]. In the Portuguese context, the dissemination of projects framed with the 2030 Agenda tends to focus on more populated metropolitan areas, such as Porto and Lisbon [9]. Thus, the following hypothesis is suggested:

Hypothesis 2 (H2): The number of practical actions disclosed in the *ODSlocal* platform is significantly higher in larger municipalities.

To implement actions that contribute to the SDGs achievement it is essential to develop partnerships with several stakeholders [26]. This mobilization requires a transformative and transversal culture that enhances public innovation through the networking promotion [23]. Specifically, the involvement of local authorities in programs or networks that enhance sustainable development can represent an increased spur for the implementation of practical actions at local level.

For this study, three Networks or Programs with notoriety in Portugal will be considered:

- **CESOP-Local Network (Rede CESOP-Local)** – it is a local authority observatory that contributes to the monitoring of the SDGs at local level, including the level of sustainability, organisational performance, and stakeholder engagement. In 2022 it had 25 acceding municipalities [27]. In this sense the following hypothesis is suggested:

Hypothesis 3 (H3): The number of practical actions disclosed in the *ODSlocal* platform is significantly higher in the municipalities belonging to the CESOP-Local Network.

- **ECOXXI 2022** – it is a programme run by the Blue Flag Association of Europe (Associação Bandeira Azul da Europa) which, based on sustainability indicators, measures and recognises the municipality's performance in environmental education and sustainability. In 2022, 54 ECOXXI Green Flags were awarded for municipalities with an ECOXXI Index ≥ 50% [28]. The following hypothesis is therefore proposed:

Hypothesis 4 (H4): The number of practical actions disclosed in the *ODSlocal* platform is significantly higher in the municipalities distinguished with ECOXXI Green Flag 2022.

- **Portuguese Network of Healthy Municipalities (Rede Portuguesa de Municípios Saudáveis)** - is an association of municipalities that take the prioritization of health, stimulating local strategies, cooperation, and development of the Healthy Cities project of the World Health Organization. In 2022, the network consisted of 66 municipalities [29]. In this sense, it is suggested that:

Hypothesis 5 (H5): The number of practical actions disclosed in the *ODSlocal* platform is significantly higher in municipalities belonging to the Portuguese Network of Healthy Municipalities.

C. Method of data collection and analysis

The sample of this study consists of 278 municipalities located in mainland Portugal. Were excluded from the analysis the municipalities belonging to the Autonomous Regions of the Azores and Madeira, because they have a small number of municipalities (N = 19 and N = 11, respectively) and to facilitate the approach to the inland-coastal location variable. The list of municipalities was removed from the Financial Yearbook of the Portuguese Municipalities 2021 [30], giving rise to a database with a quantitative variable and six categorical variables.

Firstly, the quantitative variable that will be tested with the categorical variables concerns the 'practical actions' (*PA*), whose value results from the sum of projects and good practices of each municipality disclosed in the *ODSlocal* platform [11].

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The variable 'location' (*LOC*) distinguishes two groups of municipalities, namely those located in inland (code=0) and on the coast (code=1). This was based on the Nomenclature of Territorial Units Statistics (NUTS) III [31], followed Ribeiro et al. [25] approach, which considered coastal municipalities those belonging to coastal regions or nearby, and those remaining in the inland.

The variable 'dimension' (*DIM*) aggregates municipalities in three categories, according to the Financial Yearbook of Portuguese Municipalities [30]: 1) small, if inhabitants < 20,000; 2) medium, if 20,000 < inhabitants < 100,000 and 3) large, if > 100,000 inhabitants.

Subsequently, the municipalities that integrate (code=1) or not (code=0) the local CESOP Network (*CESOP*), Green Flag 2022 (*ECOXXI*) and the Portuguese Network of Healthy Municipalities (*HEALTH*) were classified, according to their listing on the respective websites [27,28,29]. Thus, the data collection method is found in table I.

TABLE I. DATA COLLECTION METHOD

Variable	Codification	Source
AP	Absolute value of the sum of projects and good municipal practices.	[11]
LOC	0, if the municipality is located on the inland. 1, if the municipality is located on the coast.	[25,31]
DIM	1, if the municipality is small. 2, if the municipality is medium sized. 3, if the municipality is large.	[30]
CESOP	0, if the municipality does not belong to the CESOP-Local Network. 1, if the municipality belongs to the CESOP-Local Network.	[27]
ECOXXI	0, if the municipality has not joined the ECOXXI 2022 program. 1, if the municipality joined the ECOXXI 2022 program.	[28]
HEALTH	0, if the municipality is not part of the Portuguese Network of Healthy Municipalities. 1, if the municipality integrates the Portuguese Network of Healthy Municipalities.	[29]

Data were collected between October and November 2022. Statistical analysis was performed using the software Statistical Package for Social Science (SPSS), version 28.0 [32].

IV. ANALISYS AND DISCUSSION OF THE RESULTS

After counting the practical actions in the *ODSlocal* platform, space is opened for its descriptive analysis. To meet the first objective of the study, a total of 604 projects and 533 good practices were counted, which makes a total of 1137 practical actions. Of the 278 municipalities analysed, 106 (38.1%) have at least one project, while only 38 (13.7%) have at least one good practice. In total, the results show that there are 113 municipalities (40.6%) that have at least one practical action (either project or good practice). In this sense, most municipalities (165 equivalent to 59.4% of the sample) do not have any project or good practice disclosed on the *ODSlocal* platform. These results are shown in table II.

TABLE II. RESULTS OF THE DISTRIBUTION OF PRACTICAL ACTIONS

	Projects		**Good practices**		**Total of practical actions**	
Total	**604**		**533**		**1137**	
Frequency:	**N**	**%**	**N**	**%**	**N**	**%**
Yes	106	38.1%	38	13.7%	113	40.6%
No	172	61.9%	240	86.3%	165	59.4%

According to the results of the previous table, it is observed that the number of projects (promoted by companies, citizens, or others) is slightly higher than the good practices recognized by municipalities. However, it is noteworthy that the 604 projects are divided by 106 municipalities, which makes an average of 5.7 projects per municipality. On the other hand, 533 good practices refer to only 38 municipalities, resulting in an average of 14 good practices per municipality. Thus, while projects are distributed among a significant number of municipalities, good practices are concentrated only in a restricted group.

Then, to respond to the second objective of this study, we tested the hypotheses under study. Since none of the variables has normal distribution (α <0.001), the Mann-Whitney nonparametric test was performed for all variables (two groups), except for the *DIM* variable where the Kruskall-Wallis nonparametric test was applied, because it considers three groups [32]. The interpretation of the results of these tests are supported by the presentation of the mean (M) and the standard deviation (SD) between all groups. According to the results of table III, all hypotheses were confirmed.

TABLE III. RESULTS OF NONPARAMETRIC TESTS

Variables	Categories	N	M(DP) *PA*	Nonparametric test
LOC	Inland	135	1.57(5.90)	**α=0.004***
	Coastal	143	6.47(20.27)	
DIM	Small	164	1.20(5.45)	**α<0.001** **Significant differences (α<0.001) between all groups**
	Medium	91	5.55(21.43)	
	Large	23	18.91(23.29)	
CESOP	Yes	24	15.08(31.86)	**α<0.001***
	No	254	3.05(12.29)	
ECOXXI	Yes	50	10.24(25.74)	**α<0.001***
	No	228	2.74(11.48)	
HEALTH	Yes	60	11.38(29.07)	**α<0.001***
	No	218	2.08(7.05)	

*Mann-Whitney test; **Kruskal-Wallis test

Initially, based on Mann-Whitney test (α=0.004), it was found that the average of practical actions in the coastal municipalities (M=6.47, SD=20.27) is significantly higher than the municipalities located in the inland (M=1.57, SD=5.90), which confirms hypothesis 1.

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Subsequently, the dimension of the municipality was also important, since there are significant differences between all groups, according to the Kruskal-Wallis test ($\alpha<0.001$). That is, large municipalities have an average of practical actions (M=18.91, SD=23.29) significantly higher than the average municipalities (M=5.55, SD=21.43). This superiority is also significant between the latter two and small municipalities (M=1.20, SD=5.45). These results also support hypothesis 2.

Regarding the involvement in sustainable networks or programs, the results show that the municipalities that integrate the CESOP-Local Network (M=15.08, DP=31.86), the Green Flag ECOXXI 2022 (M=10.24, DP=25.74) and the Portuguese Network of Healthy Municipalities (M=11.38, DP=29.07) have an average number of practical actions significantly higher than those that do not integrate these networks (respectively M=3.05, D=12.29; M=2.74, SD=11.48; M=2.08, SD=7.05). These statements are supported by the Mann-Whitney nonparametric test result ($\alpha<0.001$) for all three variables, which confirms hypotheses 3, 4 and 5.

Regarding the analysis and comparison of the contribution of practical actions to specific SDGs, as specified in the third objective of this investigation, figure 1 demonstrates substantial variability in the SDGs disclosed on the platform. First, the SDGs 3, 4, 11 and 17 stand out as the most cited goals, with more than 600 practical actions in the total of the municipalities. On the contrary, SDGs 6, 7 and 14 are the least disseminated, with less than 300 practical actions.

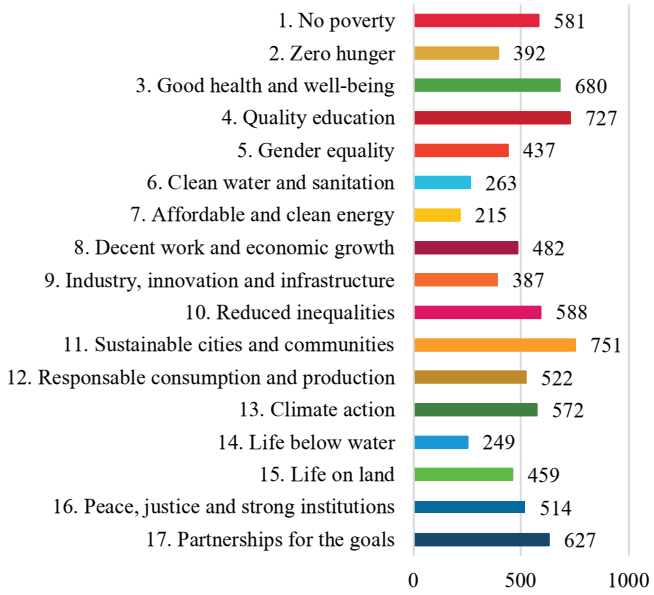


Figure 1. The SDGs in practical actions

Findings can be compared to Almeida [9], which confirmed the heterogeneity in the distribution of projects in Portugal, with a higher prevalence in population centers and a lower number in the inland regions. Thus, this research confirms that coastal municipalities have a greater tendency to implement and disseminate sustainability actions. That can be explained by the higher degree of economic development and access to resources [24,25]. In addition, as also demonstrated by Ribeiro et al. [25], dimension is a factor that influences the dissemination of information. This was to be expected given the greater potential for reach and social scrutiny. Finally, the integration in programs such as the Green Flag ECOXXI or CESOP-Local Network and Portuguese Network of Healthy Muncipalities seems to leverage the dissemination of sustainable practical actions, which confirms the importance of partnerships and networking [23,26].

Findings also shows a greater local attention to issues of poverty, education and climate action, as also evidenced by Almeida [9]. However, this study further highlights the contribution of actions to health, a goal which Oliveira et al. [10] pointed out implementation difficulties in Portugal. The large volume of references to SDG 11, on sustainable cities and communities, because it stand outs as a central axis associated to the urban dimension of other SDGs and related to government responsibilities, particularly with regards to basic services and the assurance of human rights, as well as social and environmental responsibilities of companies, with the support of universities and the civil society [33]. Positive emphasis also for SDG 17, which shows good evidence of the development of partnerships to enhance local development [26]. Overall, there seems to be slightly less attention to environmental issues. In this sense, negative emphasis for SDG 14 disclosure, which, constituting one of the priority objectives for Portugal [8], requires the constant development of practices aimed at the protection of marine ecosystems.

V. CONCLUSIONS

The use of the *ODSlocal* platform to disclose practical actions is characterized by a heterogeneity of information between municipalities, varying significantly according to geographical location, dimension and adherence to sustainable programs or networks. Larger municipalities with greater economic development (coastal municipalities) and participating in networks are under pressure from stakeholders and need to disseminate information on their sustainable practices, to legitimize and improve their public image.

We argue that the lack of stakeholder engagement, as well as the lack of skills and knowledge in SDGs and new technologies can explain the lack of use of digital platforms such as the *ODSlocal*. However, future studies can deeper explore the explanatory factors of the use of ICT in municipalities.

This research is expected to raise awareness among policy leaders at local level about the importance of the 2030 Agenda by promoting their adherence to the *ODSlocal* platform, and involvement in networks and programmes that stimulate practices for sustainable development. This study can also contribute to the learning process of municipalities, towards the benchmarking and continuous improvement of projects and actions promoted by adherents to the *ODSlocal* platform.

Digital platforms are often very dynamic, with information constantly changing. Thus, we present as limitations of the study the constant change in the number of good practices and projects

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disclosed on the platform. On the other hand, the platform does not cover all the actions implemented in the municipality, because the information provided is dependent on sending the information to the portal. Therefore, the analysis performed in this study should be continuously updated. It would also be important for future research to deepen the social, economic, or environmental impact of the practical actions implemented and how ICT can assist in this process.

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