



Digital Governance and Electronic Waste Management at Federal University of Mato Grosso do Sul – Brazil

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Abstract. The Federal University of Mato Grosso do Sul (UFMS) has the Information and Communication Technology Master Plan (PDTIC) to guide and monitor the performance of the Information Technology (IT) area within the institution. The IT area at UFMS has the Digital Governance Committee (CGD), responsible for drafting the Information Security Policy (PSI); the Information and Communication Technology Procurement Plan (PCTIC); the Open Data Plan (PDA); and the University's PDTIC. In addition to the Information and Communication Technology Agency (AGETIC), which is responsible for coordinating, guiding, supervising, executing, and controlling the organization's IT activities. This work aims to demonstrate that sustainability is part of both Digital Governance and the curriculum of UFMS students, focusing on the management of Waste from Electrical and Electronic Equipment (WEEE) within the University. The UFMS Solid Waste and Health Services Management Plan (PGRS/PGRSS) outlines guidelines for the management of these materials, and annually, since 2017, the Faculty of Computing (FACOM) at UFMS organizes the Electronic Waste Collection Week, a project aimed at raising awareness among the academic community about disposal, reuse, and recycling, helping to conserve the environment. This action assists in the education of these students by making them protagonists in this initiative. In each edition hundreds of electronic devices have been reused by students and community, serving as an example of socio-environmental impact action. The methodology employed by UFMS to organize and advance electronic waste management efforts involved the establishment of digital governance regulations, along with sustainability management and governance practices, in order to structure and promote electronic waste management actions at UFMS.

Keyword: Electronic Waste Collection, Digital Governance, WEEE, University, Sustainability.

1. Introduction

Governance is one of the essential pillars for the proper functioning of organizations, comprising a set of processes, policies, regulations that guide and supervise the activities and decisions of the various stakeholders. Good governance is crucial to ensure the effectiveness, transparency, and legitimacy of actions taken. Governance plays a fundamental role in advancing sustainable development, including responsible management of natural resources, proper waste disposal, promoting gender equality, combating poverty, and mitigating climate change.

The Federal University of Mato Grosso do Sul (UFMS) has established an Institutional Governance System (SIGOVI) to ensure organization, participation, and necessary guidelines for interaction among UFMS stakeholders for the continuous improvement of institutional governance. The objectives of SIGOVI are: define the characteristics of governance by describing its elements, in line with the principles and guidelines established in the governance policy of the Federal Public Administration (FPA); describe institutional governance policies; establish the governance structure; define governance committees and their competencies, compositions, and operating procedures; and establish governance maturity indicators [1].

Considering that Information Technology (IT) plays an essential role in the context of the FPA, focusing on the use of information to support organizational practices and objectives, IT is indispensable in the pursuit of better resource management and higher service quality. It becomes essential to carry out effective IT planning that enables and enhances continuous improvement within the institution. Digital transformation is a reality within the Brazilian Federal Government and the UFMS, and it can bring resource savings for users and FPA. Thus, the use of data and technology is no longer optional, as it has become an indispensable pillar for the execution and improvement of public policies and services.

At UFMS, the Digital Governance Committee is one of the committees integrated into the Institutional Governance Committee (CGI), established in UFMS's SIGOVI, and is responsible, among other things, for drafting the UFMS Information and Communication Technology Master Plan (PDTIC). Another important committee linked to SIGOVI is the Committee for Contract Management and Sustainable Logistics (CGCLOS), which is responsible, among other things, for governance actions related to Sustainability at UFMS.

This article presents the main instances related to Governance at UFMS, involving the areas of Information Technology and Sustainability, as well as an important initiative called the Electronic Waste Collection Week. The rest of the paper is organized as follows: Section 2 presents the main governance instances at UFMS, as well as a brief overview of the Electronic Waste Collection Week. In Section 3, the Electronic Waste Collection Week improvement is described in more detail along with the main results, and finally, in Section 4, the conclusions, challenges and future perspectives of this important initiative are presented.

2. Scenario

Considering that UFMS is a multi-campus university and operates in various fields of knowledge, it is very common for several important actions on related topics to be carried out in isolation and, often, repeated. To structure sustainability actions at UFMS, policies and regulations were created to guide the academic community in implementing initiatives that align with institutional objectives.

The UFMS has its Institutional Development Plan integrated with the Institutional Pedagogical Project (PDI/PPI), a product of UFMS's strategic planning that documents, at the very least, the value chain, mission, vision, values, objectives, indicators, goals, and strategic projects. Additionally, the medium and long-term guidelines aim to promote actions that enable the realization of the academic community and society's aspirations in their areas of operation, as well as to establish the continuity of good academic practices. The UFMS 2020-2024 PDI/PPI was approved by Resolution N° 17-COUN/UFMS, dated March 23, 2020 [2] and updated by Resolution N° 256-COUN/UFMS, dated May 2, 2023 [3].

The utilization of IT is crucial in the processes of governance and management. The reality of digital transformation is evident within the Brazilian Federal Government and the UFMS. This transformation can lead to resource savings for users and the FPA. Consequently, the use of data and technology has transitioned from being optional to becoming an indispensable support factor for the execution and enhancement of public policies and services.

The methodology used by UFMS to structure and promote electronic waste management actions was as follows: the regulation of digital governance, described in subsection 2.1; the regulation of sustainability management and governance, presented in subsection 2.2; subsection 2.3 presents the Electronic Waste Week, which is still being carried out in an isolated manner, with improvements to be presented in Section 3.

2.1. Digital Governance

The IT area at UFMS has two main bodies: the Digital Governance Committee (CGD) and the Information and Communication Technology Agency (AGETIC). The CGD was established by Ordinance N° 136/2017-RTR/UFMS, dated February 9, 2017, linked to the Rector's Office (RTR), with deliberative functions on matters related to IT within UFMS [4]. Currently, it is one of the committees integrated into the CGI established in SIGOVI.

Its purpose is to promote the institutional culture for governance, aligned with the principles of public ethics, respecting the rules of transparency and economy of Public Administration, developing activities and providing support in the IT area [1]. The specific competencies of the CGD include drafting the Information Security Policy (PSI), the Information and Communication Technology Procurement Plan (PCTIC), the Open Data Plan (PDA), and the UFMS IT Master Plan (PDTIC), and giving opinions on matters related to Digital Governance.

AGETIC's mission is to promote the digital transformation of UFMS by coordinating IT activities, contributing to the achievement of institutional objectives and values. Its vision is to be recognized by its users for the quality of IT services, consolidating itself as an essential unit for UFMS management and governance. In this sense, the institution's IT area was built on six strategic pillars: Promoting Quality of Work Life; Providing Data Management; Ensuring IT Infrastructure; Promoting Information Security; Improving Digital Services; and Strengthening IT Governance. Through the fulfilment of this last pillar, it is expected that the IT area will contribute to the good performance of UFMS, providing continuity, sustainability, and alignment with business needs, among other benefits. Thus, this article demonstrates that sustainability is present in the planning of the IT area, as well as in the curriculum of its students, focusing on the correct disposal of Electrical and Electronic Equipment (EEE), originating from the internal and external university community.

AGETIC, linked to the Rector's Office, is composed of the Software Engineering Directorate (DISOFT), which includes the Software Processes and Quality Secretariat (SEQS)

and the Software Development Secretariat (SEDS); and the Technological Infrastructure Directorate (DINTEC), which includes the Networks and Telecommunications Secretariat (SERT), the Customer Support Secretariat (SECLI), and the Services and Information Security Secretariat (SEIN). The Agency's objective is to create and maintain conditions for the systemic functioning of IT-related activities at UFMS, in order to support the development of teaching, research, extension, management, innovation, and services to the community. It is the University body responsible for coordinating, guiding, supervising, executing, and controlling IT activities [5].

UFMS's PDTIC is the instrument that guides and monitors the performance of the IT area. The PDTIC also aims to identify information needs, services, infrastructure, hiring, and personnel requirements in the area, as well as present a diagnosis of the current landscape prioritizing the demands of organizational units, in order to align the provision of IT services with the macro-planning of UFMS's PDI/PPI, defining strategies and action plans for implementing IT-related services. It represents a management tool for the execution of IT actions and projects in the organization, enabling greater efficiency in the administration of financial resources allocated to the area, with the consolidation of best management and governance practices not only in the use of technological capital but also in the continuous improvement of organizational results demanded by society.

The first PDTIC of UFMS was approved by the University Council (COUN) through Resolution Nº 48-COUN/UFMS, dated October 8, 2012, to be executed between 2012 and 2015 [6]. It marked the beginning of IT planning at UFMS, and as a process in the maturation phase, only 41% of the planned actions were successfully implemented due to lack of financial and human resources, as stated at the time. Continuity was ensured through Resolution Nº 45-COUN/UFMS, dated May 23, 2017, which established the PDTIC for the period between 2017 and 2020 [7]. This plan proposed 104 actions to be carried out, with 71% of them successfully achieved, representing a considerable increase in efficiency compared to the previous plan. The current PDTIC for the 2021-2024 quadrennium was approved by Resolution Nº 88-COUN/UFMS, dated April 9, 2021 [8]. The document is reviewed annually, with the current version approved by Resolution Nº 160-COUN/UFMS, dated February 1, 2022 [9].

Thus, the purpose of the PDTIC can be summarized as aligning IT activities with UFMS's mission, vision, and strategic values, improving internal and external communication within the institution, monitoring the performance of its activities in relation to its strategic objectives, establishing well-defined processes aligned with national and international best practices in IT Governance, and evaluating results and deliveries for the university community and other users of UFMS's IT services. It is important to highlight that IT Governance at UFMS is guided by principles including aligning ICT plans with its strategic plans, compliance with the guidelines and directives of federal regulatory institutions, value delivery through the benefits that IT can provide, digital transformation through the provision of digital services, results-oriented management, risk management derived from IT, transparency and accountability, and promotion of security and privacy.

The PDTIC 2021-2024 is based on nationally and internationally recognized IT standards, practices, and models, including the Control Objectives for Information and Related Technology (Cobit), Information Technology Infrastructure Library (ITIL), Brazilian Software Process Improvement Model (MPS.BR), and the Project Management Body of Knowledge (PMBOK). Additionally, it considers Presidential Decree Nº 10.332, dated April 28, 2020, which institutes the Government Digital Strategy for the FPA for the period between 2020-

2022 [10]; Ministry of Economy Ordinance N^o. 778, dated April 4, 2019, which establishes the implementation of Information and Communication Technology Governance in the entities belonging to the Federal Executive Branch's Information Technology Resources Management System (SISP) [11]; Federal Law N^o 12.965, dated April 23, 2014, which establishes principles, guarantees, rights, and duties for the use of the Internet in Brazil [12]; Federal Law N^o 13.709, dated August 14, 2018, the General Data Protection Law (LGPD) [13]; and decisions issued by the Federal Court of Auditors (TCU) and recommendations from the Brazilian Office of the Comptroller General (CGU).

2.2. Sustainability Norms

The sustainability is embedded and permeates the most important regulations of the institution, also present in the highest law, the University Statute, established by Resolution N^o 93-COUN/UFMS, dated May 28, 2021 [14], which has evolved to become increasingly committed to the principles of sustainable development. The unit responsible for coordinating and articulating all sustainability actions developed at UFMS is the Sustainable Development Board (DIDES), created at the end of 2020, with competencies defined according to Resolution N^o 116-CD/UFMS, dated January 28, 2021 [15,16]. Regarding sustainability in the IT area, it is directly related to the management of Waste from Electrical and Electronic Equipment (WEEE), and to carry out environmentally responsible management, adequate planning is necessary on how to manage this waste.

In this scenario, UFMS has the Solid Waste and Health Services Management Plan (PGRSS) [17], a tool provided for in UFMS Sustainability Policy [18], inserted into the Sustainable UFMS Program along with the Sustainable Logistics Plan (PLS), the Annual Procurement Plan (PCA) [19], and the UFMS Carbon Neutral Program [20]. The responsibility for proposing, drafting, and monitoring the implementation of these instruments lies with the Sustainable Procurement and Logistics Management Committee (CGCLOS), established by Resolution N^o 311-COUN/UFMS, dated November 14, 2023 [21]. The PGRSS provides an overview of solid waste and healthcare waste generated by UFMS, addressing aspects related to generation, segregation, packaging, collection, storage, transportation, treatment, and final disposal. It also indicates the roles of the sectors responsible for waste management and establishes action goals for waste management.

2.3. Electronic Waste Collection Week

Regarding WEEE, in addition to what is stipulated by the PGRSS regarding its management obligations, the Faculty of Computing (FACOM) at UFMS organizes the Electronic Waste Collection Week, a project aimed at raising awareness among the academic community about disposal, reuse, and recycling, thus contributing to environmental conservation. The initiative takes place periodically at the UFMS University Campus in Campo Grande, Mato Grosso do Sul, with its first edition held in 2017 through the Society and Environment course of the Computer Engineering program [26, 27, 28].

The Society and Environment course was part of the curriculum of the Computer Engineering program in 2017 and addressed social and environmental aspects such as Introduction to Green Computing and the Environment, Basic Ecology and Ecosystem, and Solid Waste Treatment. Its purpose was to provide students with a space for reflection on the current and future impacts of IT on the world and to foster critical thinking about their own role in these issues.

In 2017, during the offering of the Society and Environment course, the professor challenged her students to voluntarily help her organize an Electronic Waste Collection Week, which would take place in the corridors of the Faculty of Computing. The main objective was to create a space for the exchange and solidarity donation of electronic equipment among FACOM students. It was believed that students with more resources could bring items such as laptops, headphones, mice, keyboards, among others, which could be reused by other students. In this way, besides the solidarity aspect of the action, we would also raise awareness about sustainability issues, including the "R's" of sustainability, such as Reuse and Rethink. Figures 1 and 2 depict some images from the first edition of the event held in 2017.



Figure 1 – WEEE received during the Electronic Waste Collection Week



Figure 2 – 1st Edition of the Electronic Waste Collection Week.

The movement during the Electronic Waste Collection Week was surprising. Despite its success, this event was still an isolated and occasional action within UFMS.

3. Implementation

According to UFMS PGRSS, the WEEE must be stored in cardboard boxes specifically prepared for this purpose whenever possible. These boxes are kept in an isolated compartment, covered, well-ventilated, and free from moisture. The storage boxes are lined with insulating and waterproof material, with clear identification of the waste to be deposited there. UFMS has a dedicated storage facility for this purpose. All disposal of public assets must be carried out in accordance with Decree nº 9.373/2018, which regulates the environmentally appropriate alienation, assignment, transfer, destination, and final disposition of movable assets within the scope of the direct federal public administration [22]. The Services and Logistics Board (DISERV) of the Pro-Rector of Administration and Infrastructure (PROADI) is the sector responsible for the disposal process of this material, some of them directly with the supplier who handles the collection/reverse logistics, or through auction/donation to social organizations.

Sustainability is not limited to Management and Governance but is also embedded in the curricula of students at the institution, as well as in research, teaching, and extension projects registered at the University, which have been interconnected with the 17 Sustainable Development Goals (SDG) of the United Nations (UN) 2030 Agenda since 2018. [23-25].

It is indisputable that readings, research, discussions, and different classroom dynamics on issues related to IT and the environment are relevant for students' education. However, more needs to be done to ensure effective education that goes beyond academic boundaries and reaches the wider society. Implementing concrete actions that place students as actors and protagonists within society is an important advancement in education.

After the first edition of Electronic Waste Collection Week, in 2017, others took place in the years 2022, 2023, and 2024, with students from different disciplines and various undergraduate courses offered by the Faculty of Computing participating in them. An important point to highlight is that the initiative receives institutional support, without which the continuation of the action would not be possible. The Sustainable Development Board (DIDES) provides all the necessary support for the week to be successful, given its value to the internal community, especially FACOM students, as well as to society as a whole. It is considered a good practice, viewed with pride by the administration and students, and for this reason, it continues to this day.

The event has consolidated itself and has begun to improve. With each edition, new features and adjustments were made compared to the previous one. For example, students presented talk shows demonstrating to visitors the main components of a computer, differences between video cards, and other topics related to computing. You can watch videos of the Electronic Waste Collection Week editions by accessing <<https://link.ufms.br/weee>>.

Students are involved in the pre-event organization, preparing promotional materials, scheduling shifts at the collection site, and collecting equipment for testing to assess their conditions. Each year, desktops and laptops received in working condition are adjusted (software and hardware) and donated. The volume of these items donated by the team is still low, but visitors, especially students from FACOM courses, carefully inspect the received items. Parts such as monitors, memory, processors, video cards, etc., are removed and used to assemble machines in usable condition. Therefore, electronic components that would otherwise be discarded are reused to build equipment for people who cannot afford them,

demonstrating the social aspect of the action. After the week of collection and handling of the items by the organizing team and visitors, the remaining items, or their parts, are handed over to a partner company qualified to perform the proper disposal of electronics.

In 2023, the Electronic Waste Collection Week received the "ODS Education Seal" certification. This certification recognizes Brazilian educational institutions that promote sustainable development actions through management, teaching, research, and extension projects, and it is granted by the UnB (University of Brasília) 2030 Strategic Program, the Social Seal Institute, and the 2030 Agenda Working Group. The project was certified for its contribution to achieving the goals of SDG 4, Quality Education, SDG 12, Responsible Consumption and Production, and SDG 13, Climate Action [29,30,31]. In Figure 3, the project coordinator, Professor Luciana Montera, receives the certification plaque. The certificates were awarded at a ceremony at the Paulista School of Magistracy (EPM), in São Paulo – SP.



Figure 3 - Electronic Waste Collection Week receives the ODS Education Seal certification.

This demonstrates the recognition by society of the contribution of this action, establishing it as a reference. UFMS was also certified for four other projects in 2023, and five more projects in 2022 [32,33]. It is hoped that this initiative will inspire other educational institutions to incorporate and implement actions aligned with the premises of sustainable development and the SDGs. Students are the protagonists of the action, contributing directly both to their environmental awareness and to their professional training. At the same time, they are aiding in the reuse and recycling of materials that might otherwise be discarded, and WEEE can cause serious environmental problems.

4. Conclusions and Future Perspectives

Governance is vital for organizational functionality, overseeing processes, policies, and regulations to ensure effectiveness and transparency. The Federal University of Mato Grosso do Sul (UFMS) has implemented an Institutional Governance System (SIGOVI) to facilitate organization and participation, aligned with Federal Public Administration (FPA) principles. Recognizing the importance of Information Technology (IT), UFMS emphasizes digital transformation for resource management and service quality improvement.

Digital governance is integrated into SIGOVI through committees overseeing

initiatives like the UFMS Information and Communication Technology Master Plan (PDTIC) and sustainability actions. UFMS's Institutional Development Plan (PDI) integrates strategic planning, aiming to meet academic and societal aspirations.

IT governance is crucial at UFMS, managed by the Digital Governance Committee (CGD) and the Information and Communication Technology Agency (AGETIC), aligning IT activities with institutional objectives. AGETIC comprises directorates supporting teaching, research, and management activities, guided by the PDTIC principles.

Sustainability is ingrained in UFMS's regulatory framework, with efforts coordinated by the Sustainable Development Board (DIDES). The university implements waste management plans, including Electrical and Electronic Equipment (WEEE) disposal, in compliance with environmental standards. Sustainable procurement and logistics practices are overseen by dedicated committees [34].

UFMS aligns research, teaching, and extension projects with the 17 UN Sustainable Development Goals (SDGs), with initiatives like the Electronic Waste Collection Week organized by the Faculty of Computing (FACOM). This initiative raises awareness and promotes proper disposal and recycling of electronic waste, receiving institutional support and contributing to SDG 4, Quality Education, SDG 12, Responsible Consumption and Production, and SDG 13, Climate Action. By involving students in sustainable actions, UFMS fosters environmental awareness and professional development.

Despite individually having our collection of electronic items that we no longer use because they are broken or have been replaced by new ones, most people have no idea of the volume of electronic waste generated annually, nor of the risks that improper disposal of these can cause to the environment. The Global E-Waste Monitor 2024 [35] report indicates that 62 billion kilograms of e-waste were generated worldwide, which represents 7.8 kilograms per capita, and that by 2030, 82 billion kilograms will be generated.

The Electronic Waste Collection Week is an initiative capable of fostering critical thinking throughout the community, both within and outside the university, as it provides an environment where reusing, reducing, and above all, rethinking our consumption habits are encouraged before discarding and sending electronics for proper disposal.

We can conclude that through the application of the methodology described in Section 2, we achieved greater visibility, reach, and participation, attracting the attention of various media outlets throughout the state of Mato Grosso do Sul. What was intended to be a local event within FACOM and, at best, reach the entire UFMS community, also reached the external community, which brought both functioning and faulty equipment for disposal.

The challenges are significant, but so are the possibilities. Improving infrastructure for the event, effective materials to inform and raise awareness among the community, adequate spaces for sorting and processing the received items, a policy for donating the items collected, efficient metrics to generate indicators for the teaching and learning process of the involved students, and expanding the event's reach, as well as expanding partnerships with companies qualified for collecting the waste, are some of the issues.

One possibility for expansion is to extend the initiative to the other nine campuses of UFMS. For instance, drawing inspiration from another waste collection-related action of the university, the UFMS Zero Waste Week, which takes place throughout the state of Mato Grosso do Sul. During this event, recyclable materials (paper, cardboard, glass, aluminum, plastic), used cooking oil, batteries, medicines, and electronics are collected. This initiative was created by the Zero Waste Brazil Institute and is held annually in hundreds of cities across the country, featuring simultaneous activities such as lectures and workshops [36,37].

The university is an ideal environment for collection and disposal actions, as it is a diverse environment with highly qualified individuals (faculty, staff, and students) who are opinion leaders. UFMS, based on its incorporated regulations such as PDTIC, PDI/PPI, and strategic sectors like DIDES, aims to develop internal policies that further strengthen initiatives such as the Electronic Waste Collection Week. We hope that other institutions will be inspired by these good practices and promote the adoption and implementation of attitudes that contribute to the academic community, society, and the environment.

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