Performance measurement and management system 4.0: an action research study in investee NPOs by local government

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Abstract

Purpose: The Fourth Industrial Revolution is increasing the use of digital technologies for delivering products and services. A performance measurement and management system (PMMS) is recognised as a useful system to guide era 4.0, however, literature has not adequately addressed this challenge in public government and not-for-profit organisations (NPOs). This research aims to investigate the evolution of the PMMS adopted by a local government for the control of investee NPOs in era 4.0.

Design/methodology/approach: Through action research, the authors investigate an Italian municipality and its main investee NPOs. The project involved 4 researchers and 25 managers of the local government and NPOs.

Findings: This paper describes the design of a PMMS developed for a local government to control its investee NPOs. Considering the regulations and managerial needs, the designed system evolved from a fragmented set of indicators based on legitimacy and economic perspectives to a holistic set of indicators based on a comprehensive set of perspectives to consider the changing business environment.

Originality/value: This study sheds light on the design of a PMMS adopted by local governments for controlling investee NPOs in era 4.0. The paper contributes (i) to identify the main control needs for the design of a PMMS in a public network and (ii) to capture the evolution of a PMMS in light of era 4.0 by developing two conceptual propositions.

Article Classification: Research paper.

Keywords: Performance measurement, performance management, public sector, not-for-profit organisations, Technology 4.0, Industry 4.0.

1. Introduction

In recent years, scholars recognised that the Fourth Industrial Revolution – also known as Industry 4.0, Service 4.0 or Public Administration 4.0 – would pose a significant challenge for all organisations; it is described as a revolution aimed at integrating a set of technologies within organisations, including public government and not-for-profit organisations (NPOs) (Fatorachian and Kazemi, 2018; Jain and Ajmera, 2021; Trotta and Garengo, 2018; Xu *et al.*, 2018).

Concerning the public sector, Public Administration 4.0 has been recognised as a set of services delivered to citizens based on the increasing use of digital technologies that are leading public organisations to develop new public business models (Wirtz *et al.*, 2021).

In light of recent studies on Industry 4.0 (Naeem and Garengo, 2022; Trotta and Garengo, 2018, 2019; VDMA, 2016), the set of technologies introduced by the Fourth Industrial Revolution includes additive manufacturing, augmented reality, autonomous robots, big data and analytics, the cloud, cybersecurity, horizontal and vertical system integration, the industrial internet of things and simulation (Boston Consulting Group, 2015). The new technologies facilitate data collection and analysis (Almada-Lobo, 2015; Buer *et al.*, 2018; Horváth and Szabó, 2019; Sanders *et al.*, 2016; Strange and Zucchella, 2017), improve the quality of products and services and strengthen the effectiveness and efficiency of processes (Frederico *et al.*, 2021; Grandinetti *et al.*, 2020; Li *et al.*, 2020; Mariani and Borghi, 2019). Furthermore, the use of these technologies enables collaborative networks that produce opportunities for co-creating value (Nudurupati *et al.*, 2021). These technologies can also guarantee service delivery, even in extreme conditions such as those posed by the COVID-19 pandemic (Acioli *et al.*, 2021).

The benefits of the technologies used have been highlighted by literature concerning the private sector; however, it rarely investigates the main managerial systems useful to drive and control 4.0 technologies. Literature should design new tools and frameworks for highly automated, connected and fully digitalized environments (Demartini and Taticchi, 2021; Garengo *et al.*, 2022). One of the main systems that has been successful in guiding and controlling this Fourth Industrial Revolution is the performance measurement and management system (PMMS) (Bourne, Melnyk, *et al.*, 2018; Garengo *et al.*, 2022; Korsen and Ingvaldsen, 2021; Naeem and Garengo, 2022; Nudurupati *et al.*, 2021). A significant number of studies contribute to improving PMMSs in the private sector (Frederico *et al.*, 2021; Kamble *et al.*, 2020; Sardi *et al.*, 2020b), whilst research on effective PMMSs in public organisations and NPOs is underdeveloped (Deschamps and Mattijs, 2018; Garengo and Sardi, 2021; Treinta *et al.*, 2020).

Since the New Public Management reform (Hood, 1991, 1995), public organisations and NPOs have often implemented performance measurement and management models adapted from the private sector, such as Balanced Scorecard (Bracci *et al.*, 2017; Carmona and Grönlund, 2003; Garengo and Sardi, 2021; Munik *et al.*, 2021; Toor and Ogunlana, 2010; Yuan *et al.*, 2010); however, the specific needs of the public sector are different from those of the private sector (Beer and Micheli, 2017; Bianchi, 2010; Bianchi *et al.*, 2017; Sardi and Sorano, 2019), and the literature evolution is still too generic to answer the public sector's needs (Agostino and Arnaboldi, 2015; Deschamps and Mattijs, 2018; Garengo and Sardi, 2021; Treinta *et al.*, 2020). When PMMS models have been implemented, they rarely fit the regulatory and managerial needs of public organisations and NPOs (Aulgur, 2015; Ryan *et al.*, 2014; Sardi *et al.*, 2020a).

A number of studies encourage the investigation of PMMS applied to public organisations and NPOs in light of the high complexity of the public environment and the technologies introduced by Industry 4.0 (Arnaboldi *et al.*, 2017; Garengo and Sardi, 2021; Moustaghfir *et al.*, 2016).

To bridge the research gaps and address the need for research, this paper aims to investigate the evolution of PMMSs adopted by a local government for the control of investee NPOs in era 4.0. Through action research, the paper answers the following research question: *How do performance measurement and management systems adopted by local government for the control of investee NPOs evolve in era 4.0?*

The paper is organised as follows: The successive sections describe the research background and the methodology adopted to conduct the study. The findings section presents the research results, and the discussion bridges findings, theory and the practice's needs. Finally, the conclusion section describes the contributions, implications, limitations and future opportunities in the PMMS area related to the public sector.

2. Research background

Public Administration 4.0 has been promoted recently by the international and national policies (e.g., the Next Generation EU plan) which aim for a digital transition (European Union, 2021). Currently, public administrations in numerous countries are implementing the set of technologies introduced by the Fourth Industrial Revolution which offer great advantages; for instance, Industry 4.0 technologies allow public administrations to communicate with citizens and deliver public services quickly and safely (Bunasim, 2020). To benefit from all opportunities offered by the Fourth Industrial Revolution, the digital transition requires a significant organisational and managerial change requiring public administrations to move from fragmented and bureaucratic organisations to specialised and lean organisations (Bunasim, 2020). To drive these organisational changes, organisations need effective PMMSs (Bunasim, 2020).

A PMMS is a holistic and balanced measure system that sustains a decision-making process through a set of performance measurement and performance management activities (Smith and Bititci, 2017). The implementation and use of PMMSs provide feedback to employees on the actions reflecting the procedures used to implement business strategy (Bititci and Muir, 1997; Ittner and Larcker, 2003; Kaplan and Norton, 2004; McAdam and Bailie, 2002; Neely *et al.*, 2001; Sardi *et al.*, 2019; Smith and Bititci, 2017). At the same time, a PMMS also includes accurate and precise measures that fit stakeholders' characteristics (Beer and Micheli, 2017; Kunz, 2015). Furthermore, it should allow internal and external communication, reward good behaviour, manage relationships and favour learning through continuous feedback (Bourne *et al.*, 2013; Franco-Santos *et al.*, 2007; Neely, 2005; Sardi *et al.*, 2019). An excellent PMMS should support democratic

and mature performance measurement and management to favour employee engagement and high organisational performance (Bititci, 2015; Smith and Bititci, 2017).

A PMMS should be based on an interplay between the performance measurement process – in other words, what to measure – and the performance management process – in other words, how to use the measures to manage an organisation's performance (Smith and Bititci, 2017). Recently, Smith and Bititci (2017) developed a conceptual framework to describe the interplay between performance measurement and performance management (Sardi *et al.*, 2021; Smith and Bititci, 2017; Tessier and Otley, 2012). On the one hand, Smith and Bititci's (2017) framework identifies the maturity level of performance measurement by developing a set of practices related to the highest level of the maturity scale, for example, balance of target setting, interval control and time of performance reviews. The performance measurement dimension reflects the diagnostic control dimension of Simons (1995) and Tessier and Otley (2012). On the other hand, the framework identifies a scale for performance management practices, for example, industrial democracy and the degree of autonomy and job enrichment, that evolves from command and control to participatory and democratic control. The performance management dimension represents the social control identified by Tessier and Otley (2012).

Although literature focused mainly on the performance measurement dimension, only the effective balance between performance measurement and management processes could favour people engagement and performance (Otley, 2012; Smith and Bititci, 2017). To improve overall performance, organisations need to move from command control to participatory control (Smith and Bititci, 2017). As defined by numerous scholars, a powerful organisational control (Barker, 1993; Gossett, 2009) is the concertive control strategy, studied by Barker (1993), in contrast to bureaucratic control. Under a concertive control strategy, employees are pushed by common values and compliance with their job rather than the rules and authority of the supervisors (Barker, 1993). Thus, the development of strategies and practices 'in concert' with employees increases democracy within organisations.

Notwithstanding the recognised benefits of PMMS in managing organisations – such as creating alignment and supporting, monitoring and controlling resource allocation (Bourne, Franco-Santos, *et al.*, 2018) – literature does not adequately support the development of PMMSs in public organisations (Agostino and Arnaboldi, 2018; Arnaboldi *et al.*, 2015; Garengo and Sardi, 2021). Thus, public organisations have often implemented PMMS models built on the private sector's needs, and the results are rarely a success (Garengo and Sardi, 2021). In public organisations and NPOs, unlike private companies, the main purpose is seldom income generation and profit, as they generate most of their income from the government and are accountable to several stakeholders (Boland and Fowler, 2000; Micheli and Kennerley, 2005).

Since the 1990s, in line with Micheli and Kennerley's (2005) review, public organisations and NPOs have needed PMMSs to manage limited resources, pursue efficiency and demand accountability (Evans and Bellamy, 1995; Harris, 1998; Micheli and Kennerley, 2005; Young and Dulewicz, 2009). However, financial measures alone, or even those supplemented with a collection of ad hoc non-financial measures, are insufficient to motivate and evaluate mission accomplishments. Instead, NPOs need PMMS developed according to the outputs and outcomes of their programs and initiatives (Kaplan, 2001). As several authors highlight in their review of PMMS in public and not-for-profit sectors (Garengo and Sardi, 2021; Munik *et al.*, 2021), a balanced scorecard is still one of the PMMS models most commonly used in social enterprises, the volunteer sector, healthcare organisations, et cetera. The holistic approach of a balanced scorecard contributes to favouring effectiveness and improvement in organisations (Garengo and Sardi, 2021).

However, the balanced scorecard strategy should be adapted to the needs of the non-private sectors (Kaplan, 2001). In recent years, literature has sought to adapt the balanced scorecard to public organisations and NPOs by creating new perspectives. Concerning NPOs, Moullin (2017) identifies the financial perspective, the service user and the stakeholder (instead of the customer); the service delivery (instead of the internal perspective); and the innovation and learning perspective (instead of the growth consideration) (Moullin, 2017). Inamdar and Kaplan (2002) examined the barriers to developing and implementing a balanced scorecard strategy in a healthcare organisation (Inamdar and Kaplan, 2002), while Moxham (2009) explored the drivers for measuring performance in NPOs, in other words, financial reporting, achievement exhibition, operational control and continuous improvement (Moxham, 2009). In the same context, regarding social enterprises, Bagnoli and Megali (2009) proposed a multidimensional model for control in which they identified three main perspectives: economic and financial performance, social effectiveness, and institutional legitimacy (Bagnoli and Megali, 2009).

Despite numerous studies, literature on PMMS still rarely explains how the current highly uncertain, volatile and ambiguous operating environment is affecting performance measurement and management (Nudurupati *et al.*, 2021) and how organisations should be managed in increasingly complex organisational environments (Bititci *et al.*, 2012; Bourne, Franco-Santos, *et al.*, 2018; Melnyk *et al.*, 2014; Nudurupati *et al.*, 2016, 2021).

Similar to the private sector, the Fourth Industrial Revolution technologies are also affecting the public and not-for-profit sectors (European Union, 2021). Recent studies have investigated the importance of 4.0 technologies, such as data intelligence and analytics, big data, artificial intelligence and human-centred artificial intelligence, in the public sector to improve the decision-making processes (Di Vaio *et al.*, 2022). However, the field remains underexplored. By recognising the potential of artificial intelligence, Fosso Wamba et al. (2021) highlight the need to investigate how social and public sector management could benefit

from artificial intelligence in delivering services (Fosso Wamba *et al.*, 2021). However, in contrast to private companies, literature on public management continues to explore whether public organisations are ready for new technologies such as big data (Agostino *et al.*, 2020) or artificial intelligence (Mikalef *et al.*, 2019). Whereas in the private sector, the Industry 4.0 concept emerged in 2014 (Trotta and Garengo, 2018) and developed in the following years, in the public and not-for-profit sectors, literature is still emerging and managerial practice remains in its infancy (Fosso Wamba *et al.*, 2021).

To add even more complexity to this background, public sectors and NPOs often operate as networks. As Agostino and Arnaboldi (2018) highlighted, there are two main streams related to network control (Agostino and Arnaboldi, 2018). The first is related to diagnostic control and is focused on indicators to measure performance (Mandell and Keast, 2007). The second, which is based on the collaboration and the relationships surrounding the network, is related to social control and the belief that networks are controlled by informal mechanisms, in other words, shared values among the actors (van Raaij, 2006). As argued by Smith and Bititci (2017), Agostino and Arnaboldi (2018) also discuss the coexistence of both the dimension of control, called social and technical control by Smith and Bititci, and hierarchical and socialising components of control by Agostino and Arnaboldi (2018).

The challenge of the new 4.0 era is to manage organisations, even in complex networks, by benefiting from technologies. A recent study evaluates the digital readiness of the museum sector through a balanced approach (Agostino and Costantini, 2021); however, literature on PMMS in the context of the 4.0 era in public networks is still lacking. It requires more integrated and holistic approaches because of the complexity related to the adoption of innovative technologies that lead to rapid business process re-engineering (Demartini and Taticchi, 2021; Garengo *et al.*, 2022).

3. Methodology

Given the theoretical background, the authors conducted action research (Coughlan and Coghlan, 2002; Voss *et al.*, 2002) to answer the research question and to enable important insights into unknown problems. According to several scholars (Eisenhardt and Graebner, 2007; Yin, 2017), action research allows the study of a contemporary phenomenon in its real context, favouring exploratory investigations when the variables are not clearly understood. Recently, Sardi et al. (2020a) and Aulgur (2015) stated that no single theory or hypothesis is capable of meeting the challenges of the public sector, therefore, public organisations and NPOs must identify their own unique and customised solutions to solve specific problems (Aulgur, 2015; Sardi *et al.*, 2020a).

Due to these premises, the authors adopted action research to increase a new scientific understanding of an under-explored topic by involving researchers in an actual context.

The preliminary step to conduct the action research is the identification of the suitable selection criteria (Garengo and Sharma, 2014; Jardioui *et al.*, 2019; Paolone *et al.*, 2020; Santoro *et al.*, 2019). As a representative network, the authors chose a local government and its investee NPOs based on the following criteria: (a) They represent a best practice at a national level (Sardi *et al.*, 2020a), (b) They highlight a strong commitment of managers (Garengo and Biazzo, 2012) and (c) They include a panel of NPOs that represent excellence and that receive investments from a local government, according to the International Classification of Not-for-Profit Organisations (Salamon and Anheier, 1992, 1996). Based on the selection criteria, the authors conducted the action research at the municipality of Turin by involving its main investee NPOs that represent excellence at the international level. The identified panel included culture and art NPOs, for example, Fondazione Museo delle Antichità Egizie di Torino, which manages the world's oldest Egyptian museum, (Fondazione Museo delle Antichità Egizie di Torino, 2021) and Fondazione Teatro Stabile di Torino, which produces, distributes and hosts theatrical performances (see Table II in the next section).

The municipality of Turin aimed to develop a PMMS able to improve internal control on its investee NPOs in era 4.0, according to their specific regulatory framework and managerial needs explained through Resolution 00928/064 (Municipal Council of Turin, 2020). In addition to the local government's need, as suggested by Coughlan and Coghlan (2002), the action research method can be used if there are reasons for both action and research. Concerning the reason for the research, the literature on PMMS in the public sector claims the need for understanding the design of holistic PMMS in era 4.0 (Arnaboldi *et al.*, 2015; Garengo and Sardi, 2021). Consequently, the overall aim was to determine the evolutionary trend of PMMSs adopted by the local government for the internal control of its investee NPOs in era 4.0.

The research process followed the approach developed by Sardi et al. (2020a) and depicted in Figure 1.

"Insert Figure 1"

To design a PMMS for the investee NPOs to fulfil the local government constraints, the authors adopted the approach by Sardi et al. (2020a). It is recognised as a circular and collaborative approach useful for developing PMMS to support inter-institutional networks (Sardi *et al.*, 2020a). It follows the methodology criteria suggested by Garengo and Biazzo (2012) and Coughlan and Coghlan (2002).

The research process exploited researchers' and managers' competencies involved in the action research, favouring the performance discussion and the decision-making process during periodic meetings.

The action research was a 17-month-long process, lasting from May 2020 to September 2021. It involved four researchers and 25 managers, of whom 11 were public managers (four in the municipal participation area

and seven in the art and culture area of the municipality of Turin) and 14 were NPO managers (two managers for each NPO).

Table I lists the main activities for each step conducted following the approach by Sardi et al. (2020a) and describes the actors and the roles they played in each activity to deliver the given outputs.

"Insert Table I"

Through a within-case analysis (Eisenhardt, 1989) of the large amount of data collected by the researchers and managers (Coughlan and Coghlan, 2002), the authors first mapped the research context for a deep understanding of the background (Step 1 in Table I) and, consequently, identified the control needs and the documents necessary to achieve the internal control (Steps 2 and 3 in Table I).

Steps 4 and 5 in Table I produced the drafts of the PMMS by involving first the municipality and then each NPO. The collection of needs and perspectives from a different point of view improves the socialising component of control, (Agostino and Arnaboldi, 2018) also called the social control dimension, (Smith and Bititci, 2017) by developing trust and collaboration between the actors of the networks.

Finally, as indicated in Table I, the action research adopted produced the PMMS for the main NPOs of the local government (Step 6), which public managers deliberately used because it was designed in agreement with all actors.

4. Findings

The municipality of Turin is the local administration of Turin, the regional capital of the Piedmont Region, with a population of approximately 875,000. The municipality provides public services, such as theatre, museums, et cetera, that are also supported by investee NPOs. Action research focused on seven NPOs supported by the municipality of Turin. The NPOs revealed different needs due to their history, their focus, their organisational culture and their revenues.

The main features of NPOs of the municipality of Turin are described in Table II).

"Insert Table II"

Table II describes the main objectives of the NPOs, which are essential in understanding the core values of the foundations and their motivation to use a PMMS. During the analysis, the authors divided the NPOs by the sector to which they belong according to the NPO classification (Salamon and Anheier, 1992, 1996). They identified the art and museum sectors (Table II): The museum sector aims to promote art and studies for the citizens, mainly through exhibitions, while the art sector aims to support and promoting music, theatre and

cinema. The initial differentiation of sectors improves the analysis of the specific needs for the design of a suitable PMMS for the municipality of Turin.

By mapping the context (Table I, Step 1), the researchers analysed the PMMS that the municipality was using before the action research. The PMMS adopted a model similar to the balanced scorecard that involved three main perspectives: the institutional legitimacy perspective, the economic and financial perspective and the social and cultural perspective (Figure 2). Each year, the municipality collected one scorecard for each NPO.

The first perspective, named the institutional legitimacy perspective, aimed to verify the compliance concerning the NPOs' statute and legal norms applicable to each NPO. The indicators measured the percentage of the participation of the municipality of Turin in NPOs, the number of councillors representing public bodies and the compliance with the normative. An example of normative is Legislative Decree 33/2013, which pushes the Italian public administration to reorganise the regulations concerning the obligations of publicity, transparency and dissemination of information by public administrations (Legislative Decree 33, 2013).

The second perspective, named the economic and financial perspective, aimed to check the economic equilibrium and the economic-financial efficiency. It measured indicators such as profits or losses, the amount of administration charge and the value of the endowment fund.

The third perspective, named the social and cultural perspective, aimed to determine the results of the NPO's activities. The indicators were the number of tickets sold, events presented, educational tours given and laboratories done.

Figure 2 reveals the tool adopted for the PMMS by presenting all indicators.

"Insert Figure 2"

Considering the evolution of recent legislation and the strategy of the public managers, the municipality of Turin needed an improved PMMS. A first project, described in the work by Sardi et al. (2020a), aimed to improve the internal control of investee companies that deliver public and community services, such as local road maintenance, registry records, et cetera. However, the characteristics of the art and entertainment sectors motivated the municipality to lead a new project for the development of a PMMS.

The context analysis highlights a historical period in which there is a strong focus on NPOs. NPOs in Italy number more than 350,000 and are supported by 844,000 employees and 5.5 million volunteers (ISTAT, 2019). Due to the key role played by NPOs and as a result of pressure from the European Union, Italy enacted the Third Sector reform (Law 106, 2016). The reform seeks a regulatory reorganisation of NPOs through the publication of the code of the Third Sector (Legislative Decree 117, 2017). In particular, it requires a large NPOs the social reporting and the social impact assessment. The reform of the Third Sector excludes the

investee NPOs by public administrations; however, the principles of transparency and fairness and the reporting required by the reform play a key role in monitoring NPOs that are supported by local governments. The reform should guide the internal control of NPOs that are supported by local governments because it favours maximum transparency of NPOs and communication with their stakeholders, such as funders, citizens and public bodies.

According to the second step of the adopted approach (Figure 1 and Table I), the main control needs have been identified and described in Table III.

"Insert Table III"

The identification of the control needs (Table III) allows the researchers to detect the documents needed to design the new PMMS, as displayed in Figure 3, in line with the third step of the approach by Sardi et al. (2020a); see Table I.

"Insert Figure 3"

The identification of the documents and their collection in specific folders of the municipality's information system favour the standardisation of the collected information to design the PMMS. For the first time, the documents needed to control the investee NPOs have been gathered in a specific virtual place, they have been shared within the investee NPO office of the municipality and they are easy to reach.

The new PMMS adopts a customised balanced scorecard model by identifying various perspectives and the related indicators to control and improve the NPOs' activities, outputs and outcomes. To design the PMMS, the researchers led group discussions first between public managers (Step 4, Figure 1) and then between NPOs and public managers (Step 5, Figure 1). The final version of the PMMS, depicted in Figure 4, responds to the regulatory and managerial needs by strengthening the internal control (normative need) and enhancing the value created by the NPOs (managerial need).

"Insert Figure 4"

Figure 4 describes the PMMS that includes new indicators and three new perspectives (grey boxes).

The institutional legitimacy perspective highlights the municipality's control strategic objectives; it aims to verify the compliance with the normative and the agreement between the municipality and NPOs. The perspective implements the normative control need and includes a set of indicators (indicated in the grey boxes in Figure 4) that measure and determine whether there is compliance between the values of the indicators and the normative constraints.

The economic and financial perspective aims to reach economic equilibrium, economic-financial efficiency and self-financing capacity as well as to record the workforce numbers. The related indicators have been updated to be compliant with the national laws. New key performance indicators (KPIs) have been included in the perspective to evaluate the production costs, the operating margin and the self-financing activity costs. The first two perspectives were motivated by the normative control need (Law Decree 174, 2012). Law 174/2012 requires improvement in the internal control of NPOs; consequently, the municipality needed to revise the indicators by including, for example, other laws concerning the organisational model, transparency and corruption (Law 190, 2012), and by specifying the details of the costs in the financial perspective.

The last four perspectives are motivated mainly by the managerial control need to promote the public value that NPOs provide to the community.

The social and cultural perspective aims to understand an NPO's service quality and the impact of its activities on people. Unlike the previous version (see Figure 3), the updated social and cultural perspective considers the changing environment, in other words, era 4.0. In recent years, digital technologies – such as big data, augmented reality using social networks, virtual tours, et cetera – began to take root in the most innovative art and museums organisations. However, even if the involved NPOs represent excellence according to the International Classification of Not-for-Profit Organisations (Salamon and Anheier, 1992, 1996), the use of digital technologies dramatically accelerated mainly after the COVID-19 outbreak, as other studies in the museum sector highlighted (Agostino *et al.*, 2021). Thus, framed in the era of 4.0, the pandemic acted as an accelerator of digital transformation, (Agostino *et al.*, 2021) and the public managers promoted control of the use of digital technologies to deliver new value to the community through public assets. Thus, the identified KPIs aim to control the use of technology and the degree of digitalisation by monitoring, for instance, virtual tours, the NPO's website and the digitised arts. In such a way, the municipality can verify the attractiveness of the NPO's activities (e.g., review scores and numbers of followers on social media). Moreover, the adoption of virtual tours, which increased during COVID-19, allowed an interactive experience with museums and theatres, for instance, through augmented reality by computer-generated perceptual information, sometimes across multiple sensory modalities (e.g., somatosensory and visual). While augmented reality boosts the involvement of the citizens, the analysis of big data generated by websites, social media, et cetera, allows an understanding of the attractiveness of the NPOs. Lastly, the aim of the indicator 'digitised art and archaeological finds' is to encourage the creation of a database of artistic assets accessible everywhere.

Three new perspectives have been included in the new PMMS to control the impact of the activities on the inter-organisational relationships, the accessibility to services and buildings and the environment to value public value generated.

The relationship perspective aims to determine the inter-organisational relationships to assign value to the assets managed by NPOs. It introduces measures regarding the number of research projects, publications, conferences and workshops (online and offline), scientific agreements and learning projects. The relationships developed outside the network represent a set of activities to be monitored according to the managerial control need. The dissemination of NPOs' studies through conferences and workshops enhances the dissemination of culture. Moreover, the promotion of NPOs' activities through publications, research projects, and the like increase both the attractiveness of the NPOs and the capacity for self-financing (e.g., through funded research projects).

The accessibility perspective aims to promote accessibility to the community. The indicators identified in the agreement with public and NPOs managers refer to accessibility for visitors who are blind (e.g., tactile multisensory cards, text translated into Braille, QR code for audio content) and deaf (e.g., QR code for videos in sign language) and accessibility for people with disabilities (e.g., architectural barriers). The set of indicators referring to disabled and temporary disabled people favours accessibility according to national and international policies (Decree of the Ministry for Cultural Heritage and Activities, 2001). Moreover, to disseminate culture to the community, according to national policies, municipality monitors free aid for economically disadvantaged people.

Finally, the environmental perspective aims to promote the accessibility of the green policies adopted. The creation of this perspective for the PMMS makes citizens aware of the environmental value that the NPO is generating. Although national policies and guidelines are motivating museum and art organisations to develop green strategies for energy savings, today, not all of the involved NPOs are doing so. Thus, the definition of indicators to suit the level of development of green strategies for the organisations involved was complex. Currently, only the indicator related to kilowatt hours of energy consumed has been identified; however, this is significant for making organisations aware of their consumption levels.

Alongside the performance measurement dimension, action research develops the performance management dimension that, in line with the definition by Smith and Bititci (2017), regards how organisations and people use performance measurements. The system is incrementally evolving from command and control to participatory and democratic management. Table IV describes the evolution of the performance management dimension.

"Insert Table IV"

As described in Table IV, performance management practices before action research are based on fulfilling the governance constraints. The NPOs sent the required documentation annually and the municipality

retrieved the information to complete the scorecard. However, since the NPOs have been involved in the design of the new PMMS, they are aware of which data the municipality needs and its value for the NPO and for the community they are co-creating. Thus, the review of the objectives and other practices are needed to promote the relationships between the actors of the network (i.e., NPOs and the municipality) and to update the objectives based on the control needs.

5. Discussion

Current theoretical frameworks of PMMS for public and not-for-profit sectors are inadequate to address the specific needs belonging to the non-private sectors (Beer and Micheli, 2017; Kaplan, 2001; Ryan *et al.*, 2014), despite the fact that, in recent years, several authors sought to develop ad hoc systems (Bagnoli and Megali, 2009; Inamdar and Kaplan, 2002; Moullin, 2017; Moxham, 2013). Literature underlines that each NPO should identify its unique challenges and define appropriate solutions (Aulgur, 2015) because there is no overarching theory capable of addressing the challenges of NPOs. As highlighted by Aulgur (2015), theories such as agency theory, resource dependency theory, group/decision process theory, stakeholder theory, institutional theory, policy governance theory and contingency theory are inadequate to explain the entire reality of NPOs due to their heterogeneity in size, scope and mission. Mwenja and Lewis (2009) underlined that maintaining organisational performance is, ultimately, a social construct that makes the development of a single model of measurement and management of not-for-profit effectiveness impossible. Regardless of the theories, models or frameworks of governance deployed, each NPO must identify a customised PMMS (Mwenja and Lewis, 2009).

To investigate the specific needs of local government and the NPOs for designing a customised PMMS in era 4.0, the authors conducted action research. In the 4.0 era, where there is an increased need for models and tools to monitor the efficiency and productivity of organisations on the one hand and the quality of public value for the community on the other, there is a growing need to create holistic and multidimensional PMMSs (Garengo and Sardi, 2021). In line with Smith and Bititci (2017) and Agostino and Arnaboldi (2018), the new PMMS includes both dimensions of management control – in other words, the technical and social dimensions – which favour a holistic and multidimensional PMMS (Garengo and Sardi, 2021).

The approach adopted (Sardi *et al.*, 2020a) for designing a PMMS allows researchers to identify, first, the control needs and, then, new control perspectives required to create a holistic PMMS. First, the study identified the motivation for the development of the PMMS in the control needs. The managerial and regulation control needs, in line with Sardi et al. (2020a), drive, on the one hand, the development of ad hoc financial measurements and controls for normative compliance, and, on the other hand, the development of control perspectives for enhancing the public value delivered (Figure 5). Second, the collaboration between the actors of the public network, in other words, the public and NPO managers, favour NPO engagement and

the discussion concerning the objectives of the PMMS. In line with Smith and Bititci (2017), the performance measurement dimensions, such as what to measure, and the performance management dimension, such as how to use the measures, need to evolve together to reach performance and employee engagement. Thanks to the managerial control needs, the social and technical components of control begin to do just that during action research.

"Insert Figure 5"

As depicted in Figure 5, the PMMS motivated by the control needs is moving from low maturity in the performance measurement dimension and management based on pure control to fulfil governance constraints, to high maturity in the performance measurement and democratic performance management. As explained in the findings, the previous PMMS (Figure 3) answers mainly to specific institutional, economic and financial, and social and cultural control perspectives, while the new PMMS (Figure 4) addresses new control perspectives to increase the value generated for the community. In line with Smith and Bititci's (2017) framework, the performance measurement process evolved from low maturity in performance measurement (e.g., fragmented set of measures, little awareness of the causal relationship, targets and incentives not linked to strategic objectives) to high maturity in performance measurement (e.g., balanced set of metrics, high degree of awareness of the causal relationship, targets and incentives linked to strategic objectives). In the same way, the new PMMS favoured the development of management practices that move the public network from a bureaucratic control based on the authority of the regulation and laws to a concertive control strategy (Barker, 1993) in which NPOs and the municipality share common values and collaborate to deliver value to citizens. This reflects both the performance management dimension (Smith and Bititci, 2017) and the socialising component of control (Sardi *et al.*, 2019). In Smith and Bititci (2017), indeed, the performance management dimension moves from command-and-control management (e.g., specialisation and demarcation of work, limited commitment to employees) to democratic and participative management (e.g., job enrichment and multiskilling, appreciating differences and being open to new ideas). Through the framework provided in Figure 5, the authors formulated the following conceptual proposition:

Proposition 1*. In era 4.0, regulations and managers' strong motivation prompt the development of a PMMS moving from low maturity in performance measurement and low participation in performance management to high maturity in performance measurement and strong participation in performance management.*

Technology 4.0, which includes big data analytics, augmented reality and the like, is beginning to drive the digital transition in both public and not-for-profit sectors (European Union, 2021). In the past two years, the use of digital technologies has been accelerated by the COVID-19 pandemic (Agostino *et al.*, 2021; Agostino and Costantini, 2021). Before COVID-19, literature on the use of Technology 4.0 in the public and not-for-

profit sectors sought to understand the readiness level of public organisations and NPOs to adopt new technologies; today, public organisations and NPOs need to use Technology 4.0 to deliver public services to citizens though innovative business models (Wirtz *et al.*, 2021). However, even in the private sector where the use of Technology 4.0 is widespread, there is a need for PMMSs to drive and control 4.0 technologies (Bourne, Franco-Santos, *et al.*, 2018; Nudurupati *et al.*, 2021).

Thus, framed in this context and accelerated by the COVID-19 pandemic, the use of Technology 4.0 by NPOs must be monitored by local governments. The public managers' motivation to include several indicators to monitor the use of technologies has been strengthened by the benefits they generate. For example, the use of big data analytics measured the level of attractiveness the NPOs are reaching, and the adoption of virtual tours ensures accessibility even during a pandemic.

Consequently, the authors were able to formulate the second conceptual proposition:

Proposition 2. *Regulations and managers' strong motivation move the PMMS adopted by local government for the control of investee NPOs from a fragmented set of perspectives and measures to a multidimensional and holistic set of perspectives and measures to additionally control the adoption and use of Technology 4.0 for community value creation.*

6. Conclusion

This research examines the evolution of the PMMSs adopted by a local government for the internal control of its investee NPOs in era 4.0. The PMMSs are evolving from low maturity in performance measurement and low participation in performance management to high maturity in performance measurement and strong participation in performance management.

The new PMMSs outline a change from a fragmented set of measures based on legitimacy and economic KPIs to a multidimensional and holistic set of measures based on regulations and the needs of a changing environment, such as Technology 4.0. Two main factors prompted this change: international and national regulations and the will of public managers to report the value generated in terms of economic, social and environmental impact.

The research shed light on PMMS adoption by a public network of investee NPOs and their local government in era 4.0. Through action research, the high complexity generated by the public environment and the set of technologies introduced by Industry 4.0 has been considered for the PMMS design in line with the findings of several scholars (Arnaboldi *et al.*, 2015; Garengo and Sardi, 2021; Martin and Mikovsky, 2010; Moustaghfir *et al.*, 2016). Moreover, the results reveal that the set of technologies driven by the Fourth Industrial Revolution has an impact on the PMMSs of NPOs, since local governments need to monitor the use of technologies in NPOs.

The research contributes to managerial practice by highlighting that control needs, such as managerial and regulatory needs, are essential to guide the development of a PMMS in a local government to achieve the expected or intended objectives. Moreover, the design process of the PMMS can be replicated for developing a customised PMMS based on the control needs of public governments and can be used to improve the transparency of administrations and as a basis for discussions with stakeholders.

Finally, the research reveals a limitation. It investigates only one local government and, consequently, a unique regulatory framework without comparison to other public contexts has been considered. However, the single case study, through action research, favoured the understanding of a specific problem that cannot be obtained in other ways (Coughlan and Coghlan, 2002; Garengo and Biazzo, 2012). Action research allowed the authors to deeply map the specific context and to involve public and NPOs managers in the research process.

Further research is needed to empirically investigate the outcomes of this study and to test, validate and improve the evolutionary trend of PMMS design adopted by local administrations for controlling their investee NPOs in era 4.0.

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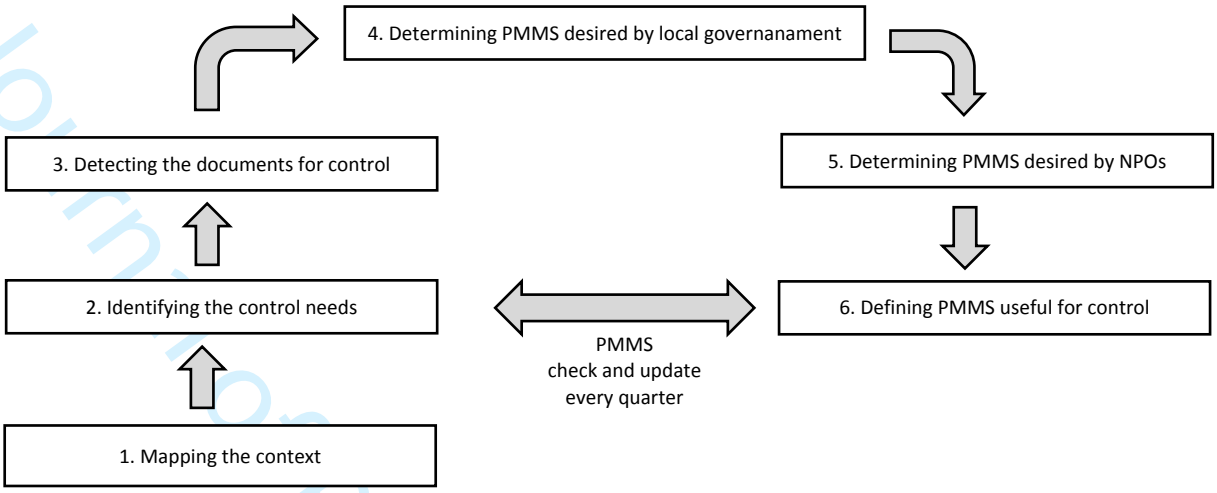

Figure 1. *The approach used for designing PMMS* (Sardi *et al.*, 2020a).

Perspective and Metrics	Municipality's Objectives
Institutional Legitimacy Perspective	
% Municipality Participation	
No. Councillors	*1. To be compliant with the NPOs' statute* *2. To be compliant with the legal norms applicable to NPOs*
No. Councillors representing public bodies	
No. Auditors	
YES/NO Control to Art.22 (Legislative Decree 33, 2013)	
YES/NO Control to Art.2-bis (Legislative Decree 33, 2013)	
Economic & Financial Perspective	
€ Final year result – i.e., profit (loss)	
€ Administration charges	*1. To achieve economic equilibrium and economic-financial efficiency*
€ Endowment fund	
€ Contribution in other forms	
No. Personnel	
Social & Cultural Perspective	
No. Tickets	*1. To assess the activity impact on society through organised events that spread culture and knowledge*
No. Events	
No. Educational tours	
No. Laboratories	

Figure 2. *The PMMS used by the municipality before action research.*

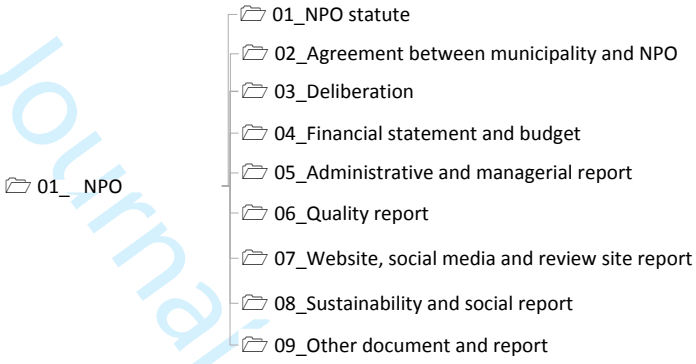

Figure 3. *The documents and reports useful for the PMMS development.*

Figure 4. *The PMMS used by the municipality after the action research.*

Metrics and Perspectives	Municipality's Objectives
Institutional Legitimacy Perspective	
% Municipality participation	
POSITIVE/NEGATIVE comments on auditor's report	
€ Real estate value managed	*1. To be compliant with the agreement between the municipality and NPOs* *2. To be compliant with the NPOs' statute* *3. To be compliant with the legal norms applicable to NPOs*
€ Movable value managed	
YES/NO Insurance policy	
YES/NO Scientific committee	
YES/NO Prevention of corruption and transparency (Law 190, 2012)	
YES/NO Organisation and management model (Legislative Decree 231, 2001)	
YES/NO Control to Art.22 (Legislative Decree 33, 2013)	
YES/NO Control to Art.2-bis (Legislative Decree 33, 2013)	
Economic & Financial Perspective	
€ Value of production, of which:	
Revenues from sales and services	*1. To achieve economic equilibrium* *2. To reach economic-financial efficiency* *3. To determinate self-financing capacity* *4. To understand the workforce numbers*
Other revenues from the municipality of Turin	
€ Production costs - of which:	
Service costs	
Personnel costs	
€ Operating margin	
€ Profit (loss)	
% Self-financing activity costs	
% Public financing activity costs, of which:	
% Municipality financing activities costs	
% Sponsorship financing activity costs	
% Others	
No. Personnel (sum permanent and fixed-term contract, outsourcing)	
No. Interns	
No. Volunteers	
Social & Cultural Perspective	
No. Tickets	*1. To be attractive, organise events and disseminate culture* *2. To reveal performance quality* *3. To enhance the impact of NPOs' activities on the community*
No. Guided tours	
No. Virtual tours	
No. Educational tours	
No. Events	
No. Followers (sum Facebook, Instagram, YouTube, Pinterest, Twitter)	
No. Sessions official website	
No. Digitised arts and archaeological finds	
Review Score (sum TripAdvisor, Facebook, Google)	
Relationship Perspective	
No. Research projects	*1. To enhance the inter-organisational relationships*
No. Publications	
No. Conferences and workshops, online and offline	
No. Scientific agreements	
No. Learning projects	
Accessibility Perspective	
YES/NO Architectural barriers	*1. To promote accessibility policies*
YES/NO Free aids	
YES/NO Tactile multisensory cards	
YES/NO Text translated into Braille	
YES/NO QR code for audio content	
YES/NO QR code for video in sign language	
Environmental Perspective	
Kilowatt hours consumption	*1. To promote green policies*

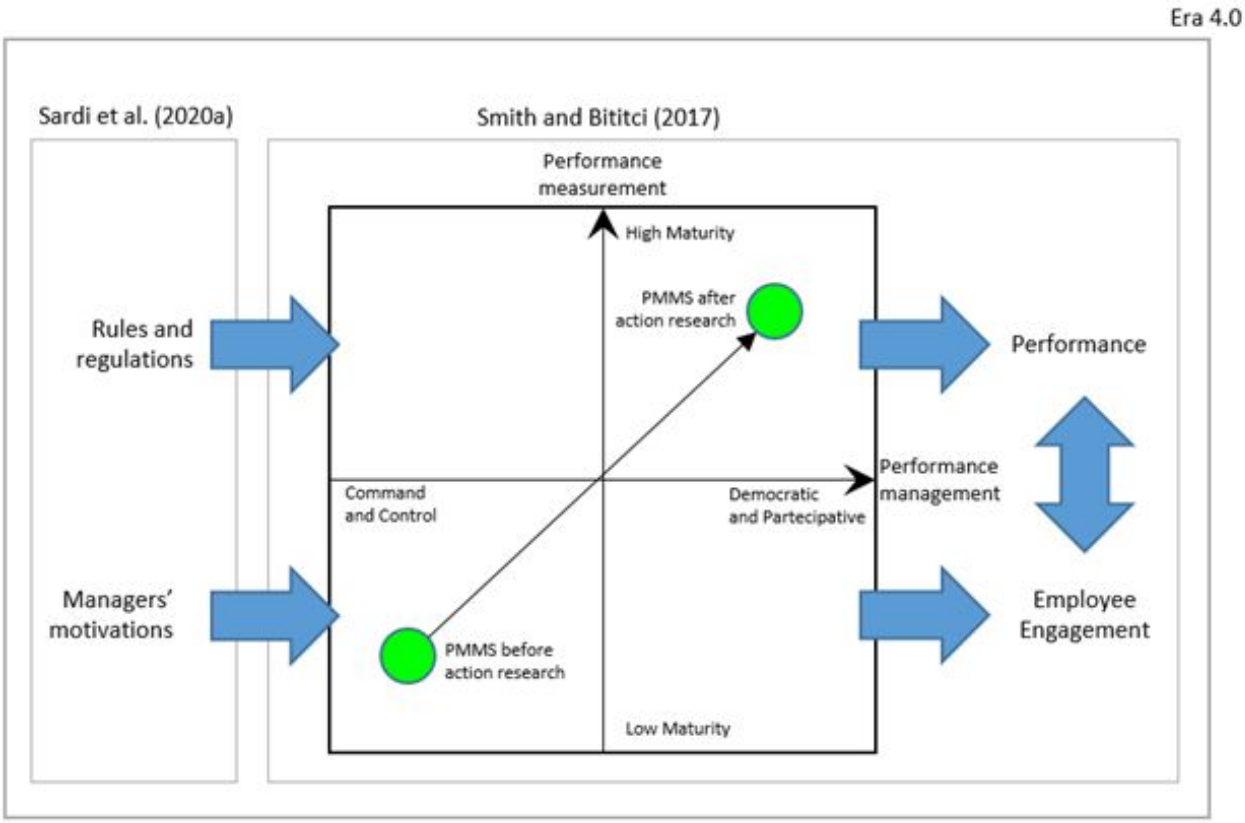

Figure 5. *Evolution of PMMS used by the municipality for controlling its investee NPOs.*

Table I. *Description of the six research approach steps.*

Step	Activity	Actors	Actions	No. of meetings	Output
1	Mapping the context	Researchers	Data collection through interviews	5	Case characteristics and the PMMS adopted
		Public managers	Sharing information on the municipality and the PMMS		
2	Identifying the control needs	Researchers	Data collection and analysis of the needs	4	Control needs
		Public managers	Sharing information and discussion about the regulation and their needs		
3	Detecting the documents useful for control	Researchers Public managers	Joint identification and document standardisation for management control	2	Documents needed for management control
4	Determining the PMMS desired by the public administration	Researchers Public managers	Definition of the main perspectives of PMMS and key performance indicators	3	Main perspectives and key performance indicators (according to the municipality)
5	Determining the PMMS desired by the NPOs	Researchers Public managers NPO managers	Definition of the main perspectives of PMMS and key performance indicators	7 1 for each NPO	Main perspectives and key performance indicators (according to each NPO)
6	Defining PMMS	Researchers Public managers	Standardisation and identification of the PMMS for the NPOs	1	Final PMMS

Table II. *Within-case analysis on investee NPOs of the municipality of Turin – data 2019.*

NPO	Fondazione Museo delle Antichità Egizie di Torino	Fondazione per la Cultura Torino	Fondazione Prolo Museo Nazionale del Cinema	Fondazione Teatro Stabile di Torino	Fondazione Torino Musei	Fondazione Camillo Cavour	Fondazione Film Commission Torino – Piemonte
Revenues	€ 13,359,735	€ 5,567,183	€ 14,499,654	€ 13,586,285	€ 12,222,605	€ 371,443	€ 3,609,587
No. Visitors	853,320	283,800	-	259,405	613,325	2,422	-
Sector	Museum	Art	Museum	Art	Museum	Museum	Art
Objective	To enhance, promote and manage the structural, functional and exhibition adaptation of the museum, of the cultural assets received or acquired for any reason, and of the museum's activities	To promote the dissemination and knowledge of musical art through live music events and any other events	To research and preserve materials and works that refer to the history and technique of photography, cinematography and new multimedia languages	To produce, distribute and host theatrical performances that are an expression of the best tradition of art theatre	To conserve, enhance and maintain cultural assets received or acquired for any reason, and to manage and enhance organisations, museums and cultural activities	To deepen the studies of Camillo Benso of Cavour, a famous statesman of the 19th century, to promote Cavourian studies and initiatives and to deepen the knowledge of Count Camillo Benso of Cavour and his teachings	To promote and support the production of cinematographic works and to promote cinema culture and art in the Piedmont Region

Table III. *Description of the identified control needs.*

Control need	Reference	Requirement	Description
Regulatory need	Art. 3 Law Decree 174/2012	Improvement of the internal control on the investee bodies of the municipality	The internal control system audits: - the reasons for being an NPO partner - the economic losses - the negative effects on public shareholders
Managerial need	Resolution 00928/064/2020 of the Municipal Council of Turin	To make explicit the value created by the investee NPOs	The internal control system audits: - the value created to citizens in terms of art and entertainment - the value created to citizens in terms of accessibility - the value created to citizens in terms of digital innovation - the value created to the community in terms of green policies

Table IV. *Description of the performance management practices before and after the action research.*

	Performance Management Practices	
Main activities	***Before action research***	***After action research***
Sending documentation	The NPOs sent to the municipality the documentation to fulfil the government constraints.	The NPOs send to the municipality the documents previously agreed for their monitoring in line with Law Decree 174/2012.
Compiling the scorecard	The municipality recovered the information required from the documentation and then filled in the scorecard.	Once the required information is collected, each NPO fills in the scorecard and then sends it to the municipality.
Review of objectives	Never. The NPOs sent the documentation once a year.	The municipality is scheduling meetings with the NPOs four times a year.
Access to documentation	The municipality could access the documentation that each NPO sent annually. However, the documentation was not standardised, thus, information was not easily available.	The municipality can access the NPOs' documentation thanks to the standardisation of the folders in the municipality's information system. Information is used to promote culture to citizens and to disseminate across the network the activities that NPOs are conducting.