Integrated data management: New perspectives for management control

Antonella Paolini[*]

Abstract

The purpose of this special issue is to contribute to the international debate on novel approaches to corporate data management for the improvement of management control systems. The theme embraces the interdisciplinary relationships that management controls and the accounting function that it, increasingly, should have with other disciplines. These relationships are permeated by both quantitative and qualitative approaches. Quantitative models include those created through data science and those that refer to mathematics, statistics, and information technology. Moreover, corporate data management models combining qualitative and quantitative approaches are explored and discussed within disciplinary areas that, due to their consolidated history, are close to management control: e.g., legal, sociological, historical and other humanities areas. This theme embraces not only business data management but also knowledge management; it is not only about internal (accounting and non-accounting) data, but also about external data of a statistical, economic, and social nature, which are of interest from different disciplinary perspectives concerning the integrated management of accounting data and Big Data. With the development of new technologies, such as the 'Internet of Things', and the increasingly extensive applications of blockchain, social networks, and mobile devices, organizations are generating huge volumes of data in different formats much faster than in the past. In this sense, big data analytics techniques present opportunities to improve decision-making processes of both a strategic and an operational nature, due to their ability to extract knowledge from data, to facilitate problem solving, and to favor predictive and prescriptive approaches to business phenomena. From an organizational point of view, it is important to analyze the impact of Big Data on the professional profiles of actors typically involved in accounting and management control processes.

Keywords: Digital transformation, Data management, Digital technologies, Knowledge management, Blockchain, Big data.

[*] University of Macerata, Department of Economics and Law. E-mail: antonella.paolini@unimc.it.

Management Control (ISSN 2239-0391, ISSNe 2239-4397), 2022, 2 – Special Issue
Doi: 10.3280/MACO2022-002-S1001

1. Digitalization, data management and technological innovation

This special issue includes the selected papers presented at the Management Control Workshop organized by and held at the University of Macerata on 26 and 27 November 2021. The common thread that binds the selected papers concerns the following aspects:

- digitalization, which improves the expansion, transparency and relevance of company data, to transform data into entities that increasingly transmit information to management;
- the *blockchain*, as a tool of technological innovation, which relates positively with the use of traditional accounting tools to process company data;
- the approach to digitalization, which is not simple considering that investments in digitalization elicit different behavior from companies, especially smaller companies;
- the use of *Big Data* by companies, which is specifically applied to report on environmental sustainability;
- a production process "technically" adapted to digital innovation (the case of Precision Agriculture in this special issue), which could serve as a bridge to advanced management systems, being connected to integrated information systems.

The work of Centorrino *et al*., which applies the tools of content analysis to scientific articles, deepens the theme of accounting "treated" with new digital technologies, specifically with Distributed Ledger Technology and Accounting Information Systems. Their research results reveal a conspicuous body of literature on the issues. However, they do not provide unambiguous answers to the questions: "Is Distributed Ledger Technology pursuing a new meaning within Blockchain technology?" and "Does Blockchain have a specificity in Accounting Information Systems?" Nevertheless, the relationships between accounting and *blockchain* are undeniably the most studied aspects because the combination of these two tools allows the intelligent and digital processing of broad categories of data related to business operations.

Centorrino *et al*. arrived at the following conclusions:

- financial transactions can be "processed digitally", thus allowing the enhancement of information by increasing its reliability (trust), transparency, and security. The ledger working with the *blockchain*, being the most studied object, becomes an evolved tool because it is "distributed" (more users can access it) but not tamperable;

- accounting with the *blockchain* is regarded as an obligatory step for accounting systems: general, managerial, and auditing.

The vastness of the analyzed literature converges sufficiently and conspicuously on (and support) these conclusions. Accordingly, accounting (general and directional) – by basing its structure on the double-entry method – is seen as a flexible tool (as happened with the advent of information technology in the last century) compared to current technology. Indeed, as it continues to play an interpretation role in business operations, it can be enhanced by new knowledge on data processing.

To deepen the evolution of the company digitization process, Chamochumbi *et al.* conducted a case study (the Gino Girolomoni cooperative) in the agri-food sector. They analyzed the approach adopted by the company for digital transformation, the barriers and challenges it faced in the implementation of new technologies, and how the Covid-19 crisis affected the process. Their study shows that top management decisions are crucial in supporting digital changes and that the Covid-19 crisis had accelerated their implementation, which was already underway before the pandemic. In Girolomoni, although top management seems to be *aware* of the need for digital transformation to ensure the survival and growth of the company, the effects of the pandemic transformed this awareness into "a sense of urgency". In response, top management adopted an incremental approach *to change*, which occurred gradually and systematically ("step-by-step") for each digitization project: e.g., the pilot project that involved the farmers associated with the cooperative by introducing digital notebooks for farms.

The *combination of digitalization and craftsmanship* means that Girolomoni constantly invest in innovation and technology without renouncing its founding values: preserving agriculture in rural areas and preserving the environment. In the agri-food chain, the choice of how to construct the pasta factory and the mill was, however, industrial (with digitization). Nonetheless, the industrial process is of such a nature that the machines allow a product quality that comes close to that of craftsmanship.

The company's management realizes that although the digital transformation of the production area – specifically of quality control, packaging, and the agricultural supply chain – produces good results, it does not fully exploit the produced data. Three barriers present challenges.

The first barrier is the *resistance of human resources to change*. An example is the inspection work conducted by agronomists in the field: whereas they previously recorded the data on a sheet of paper, they now have to do it

on specific software, using a tablet or a laptop – which is not an easy task for them.

The next obstacle, which posed a formidable challenge, is to train and broaden the background of people who *lack digital skills*. There is no point in introducing sophisticated equipment and ultra-powerful software if the employees are not equipped to use them.

The final obstacle to digital transformation, the *absence of an adequate organizational structure*, was addressed through three types of actions/investments. First, Girolomoni initiated special digital transformation projects and hired an IT manager (uncommon in a small company) to directly oversee a whole series of operations (previously almost completely outsourced). These included *cybersecurity, business continuity,* and a *Manufacturing Execution System* to control all production-related operations and to optimize the internal traceability process. Second, a partnership was established between the company and an IT provider (being the usual choice for small companies). It is easy to rely on external stakeholders but, when management complexity increases, it becomes difficult to find a partner who supports the change process. Third, Girolomoni made substantial investments in staff training and paid specific attention to the production workers (involved in the *Manufacturing Execution System* project) who were less familiar with the use of digital technologies.

Culasso *et al*., like Chamuchumbi *et al.*, question the role of Covid-19 in small businesses during the initial phase of digital transformation. The authors, who adopted an inductive qualitative approach, drew a sample of micro and small enterprises in Piedmont (Italy). Being a targeted sample, i.e., companies that were previously included in the digital transformation phase, it included 11 companies and a total of 49 interviews. The results, unlike those of the Girolomoni case study, show that the pandemic did not serve as a catalyst for the digital transformation of the sampled small and micro enterprises.

Although both studies identify the same digitization difficulties for small businesses, they produce opposite values for the *lack of motivation despite the presence of a positive attitude towards digital transformation*, as a first cause of delayed change. The entrepreneurs of the sample consider digitization "nice to have" but do not, as in the Girolomoni case. regard it as essential. In particular, small Piedmontite entrepreneurs, including younger respondents with a positive attitude toward social media, do not consider ("unprofessional or silly") social media-related digitization to be useful. Some respondents even reject digital transformation based on a mixture of spite

toward the new generation of entrepreneurs and a boast of pride in the old ways of running the business.

The delay in change is also due to *insufficient human resources to manage digital transformation*. The interviewed small and medium-sized enterprises show so many signs of staff shortages that they are unable to dedicate staff to website and/or social media management. In addition to the lack of time, entrepreneurs and managers are also aware of the lack of skills needed to implement digital transformation in their daily business processes. Digital technologies require specific skills to optimally use them. Many small businesses neither possess these skills, nor do they have the ability to access them.

A final cause is the *lack of financial resources*. Digital transformation is experienced as expensive and complex. Hence it is not seen as an investment, also because most of the surveyed small and micro companies struggle to survive. The renunciation of the outsourcing option of digital transformation to third-party professionals is commonly based on and explained by a lack of financial resources.

The empirical results obtained by Culasso *et al*. partially contradict the perception of Covid-19 as an accelerator of the digital transformation process of micro and small enterprises. A significant lack of financial and human resources, as well as an overall negative attitude toward digital change can lead micro and small enterprises to a state of digital stagnation, i.e., they opt for conventional management. Consequently, Culasso *et al*. send a pragmatic message to entrepreneurs, managers, professionals, experts, and policy makers: allocate the right resources (private and public) to promote digital transformation and address – through educational and financial initiatives – barriers to digital transformation. This will bridge the gap between small businesses with limited degrees of digitalization and those that have consolidated digitalization.

1. Data-driven and integrated data management

Galeotti *et al*. study the impact of *Big Data* and *Big Data* analytics in the management of non-financial information, including sustainability information. They do so through a review of the literature on the subject between 2010 and 2022. By adopting a qualitative approach, they draw a map that describes what has been done and what is expected to happen on the subject. Their results show that corporate reporting documents welcome the use of *Big Data*, also in relation to the 17 objectives (Sustainable Development

Goals) of the United Nations 2030 Agenda, as evidence that supports what, in summary, is reported below.

Integration *of sustainability reporting with management control systems based on Big Data and Big Data analytics*. This line of study includes works that describe Big Data's integrated systems solutions for business reporting, specifically, applications for sales, production, and logistics, to supply monthly and real-time economic reports. Other papers describe sustainability reporting (particularly for emissions) and industrial management simulations. In addition, some Italian studies show the use of Big Data in public administration: health organizations, by using new tools, perform real-time planning and programming capable of taking economic, environmental (the efficient use of natural resources) and social (better access to care, regardless of socio-cultural differences) factors into account. In other studies, a strong connection emerges between Big Data and business decision-making, planning and control processes. These studies ask key questions and identify new research directions in this emerging field of study.

Development of a ***theoretical framework*** *for Big Data analysis in environmental reporting systems*. Several contributions build theoretical frameworks combining Industry 4.0 and 5.0 technologies and Big Data analysis, which can be adopted by companies (including SMEs). These contributions include proposals for reliable and effective Sustainability Accounting Reporting schemes that meet regulatory requirements, improve investor relations, and achieve the desired level of protection, often following the guidelines of the Global Report Initiative (GRI).

Exploration of the ***potential advantages and challenges*** *regarding the use of Big Data for Sustainability Accounting Reporting*. The work in this area is less numerous, so much so that Galeotti *et al*. propose that this line of research should be developed. A major requirement is the selection of relevant indicators and the learning of skills to manage Big Data. The authors dealt with the case of Italian chartered accountants who, as business consultants, ignored the Big Data generated by social media (texts, images, voice messages, or videos collected through Facebook, Instagram, or Twitter). This data present a critical source of control that enables companies to confront sustainability effectively. According to the authors, the main benefit of using Big Data is the correct drafting of the Integrated Report which should incorporate sustainability information in addition to traditional financial information. Integrated Reporting extenders also use or should use Big Data to develop performance and sustainability indicators.

Macchia's contribution forms part of Precision Agriculture (PA) which invests in technology for sustainability and ensures more profitability. This approach leads to a more *data driven* sector. The study, through a critical review of the literature, sheds light on the PA's information potential for the managerial processes of farms. This includes the impact of PA on profitability, the farmers' decision-making characteristics, and the specificities of decision-support systems for farms.

In general, there is evidence that PA positively affects the profitability of farms by increasing resource efficiency and improving quantitative-qualitative yields. However, the empirical results show that the extent of the financial benefits linked to the adoption of PA is determinate by several factors, including the size of the company. Farmers are inclined to use technology for technical processes but are less willing to base their decision making on the data provided by these systems. The use of accounting information to monitor financial performance is also low, as confirmed by the modest adoption of management accounting systems, especially in SMEs that are often the most widespread in agriculture.

These results present a paradox: on the one hand, the rapid development of PA's digital devices; on the other hand, the low-key attitude of farmers when utilizing the information potential of these new devices, being hampered by their limited technological knowledge. According to the author, a way of overcoming this apparent contradiction is to rely on Information and Communication Technology to support the transition from traditional agriculture to PA, thus helping farmers to familiarize themselves with the information provided by PA devices and to exploit their utility.

Although there are several Agribusiness Decision Support Systems (ADSS) on the market, it is noted that the most widespread ADSS do not include accounting information modules; enabling them to investigate the financial implications of technical operations would imply guiding the educational process of farmers toward managerial professionalization. The integration of different databases – e.g., internal production systems, external information systems (e.g., satellite GPS, GIS data, metrological data), management systems, and economic-financial accounting – would allow the extension of farm management and would increase the ability of farmers to act in different decision-making areas.

The added value of Macchia's contribution is that it encompasses different fields of research such as agricultural techniques, performance management, and information systems design. Through new data, these areas of inquiry influence the operation and performance management of next-generation farms in the field.

Boesso *et al*. deal with digital transformation in the field of nonprofit organizations, specifically nonprofit foundations. The focus of their research is the relationship between employees' increased participation in planning and control tools (enhanced by digitization tools) and their perception of the effectiveness of the foundations' grant processes.

The new element that emerges from the research is that foundations' highly motivated employees are enthusiastic to work on projects that have a positive impact on the target communities and that they tend to transfer their enthusiasm to their daily routines and performance evaluations. Top managers could benefit from this structural feature of their industry by accelerating digital innovation, increasing employee participation, and aligning the organization's most challenging goals with those of the most satisfied employees. Their results and findings support and justify the increased use of managerial tools combined with proper training sessions to adapt the tools to the reality of the nonprofit foundation as well as to the actual level of the corporate competence of the employees involved.

Pozzoli and Marcello measured the effect of non-financial information (Global Reporting Initiative [GRI] standards) on the level of stock market value measured by performance (Tobin's Q). They tested their analysis, for the first time, on Italian listed companies that submitted the 2019 non-financial statement (Non-Financial Statement) applying all GRI standards. The empirical results show that the variables examined are not correlated, even if they indicate that the adoption of recognized standards is considered crucial by stakeholders. Consequently, a substantial increase in the volume of information disclosed by companies on sociality and sustainability fields requires a digital communicative transformation, which also applies to the economic-financial field.

The examined companies' levels of compliance with the GRI standards, therefore, do not seem to affect their market value. This leads the authors to the conclusion that compliance with recognized sustainable standards seems to be a constraint rather than a choice. The adoption of GRI standards appears to be required by the market to guarantee stakeholders of the company's commitment to sustainability and of its attention to transparency on non-financial issues.

Finally, Vola and Gelmini investigated the relationship between the framework of the Task Force on Climate-Related Financial Disclosure (TCFD) – which addresses the impact of potential climate risks on a company's financial results – and the role of the Chief Financial Officer (CFO).

Subsequently, the TCFD's reporting requirements for voluntary disclosure on climate change were deepened and addressed by CFOs who were keen to acquire new skills (e.g., environmental-management metrics). What emerges is a weak relationship and, therefore, a scarcity in the dissemination of targets and objectives related to climate change and sustainability.

The authors propose what CFOs should include in corporate reporting documents. For example, they should adopt new financial analysis tools and methodologies, which allow them to better quantify the managerial Key Performance Indicators from an environmental point of view, e.g., the Life Cycle Assessment. Again, the ideal is to think in terms of a portfolio logic to group high-sustainability projects and high-profitability projects. Another possibility is to link the issue of carbon pricing to climate change and then include the cost of carbon emissions in the calculations. Still, CFOs should attend to communications (report building) and be in tune with the public's sensitivity to sustainability issues, such as climate change.

The results and findings that emerged from the papers included in this Special Issue confirm and support our initial hypotheses. Digitization, to treat *Big Data*, is imminent and companies reposition themselves to manage and organize the large amounts of data on the *web*, along with peaks of excellence in the presence of attentive and visionary operators, however there are many smaller companies in recessive situations that don't digitizatize.

A particular matter stands out among the obvious problems: making "the large amounts of data "useful", especially in the sense of making *Big Data* capable of being signals and by finding weak signals, but perhaps, more fundamentally, in the sense of applying effective strategic control. The treatment of *Big Data* is the most recent continuation of what the integrated information management systems already perfected with tools such as *data warehouses* and *data mining*, but also by utilizing the capabilities of *business intelligence*, *Customer Relationship Management* systems, and *business analytics*.

In management control, the use of *Big Data* is present in the reporting of environmental sustainability. Undeniably, this is a positive fact which, in its proper perspective, should condition and guide companies toward business models based on the circular economy. However, it is essential to link sustainability data to economic-financial data (through the integration of control systems), being required in integrated reporting.

References

Bellucci M., Nitti C., Chimirri C., Bagnoli L. (2019), Reporting on the social impact. Methodologies, indicators and three cases of experimentation in Tuscany, *Management Control*, 3, pp. 166-187.

Cappelli A., Cavallini I. (2021), The Potential of Big Data Analysis in the Shipbuilding Industry: A Way of Increasing Competitiveness. *Management Control*, 1, pp. 53-74.

Capurro R., Galeotti M., Garzella S. (2018). Real-traditional world and "digital world", business strategies and web intelligence: the future of control and information management, *Management Control*, 2 special issue, pp. 83-111.

Castellano N., Felden C. (2021), Management Control Systems for Sustainability and Sustainability of Management Control Systems. *Management Control*, 2, pp. 5-10.

Cupertino S., Vitale G, Riccaboni A. (2018), The impact of Big Data on corporate planning & control activities. Il caso di studio di una PMI agricola italiana, *Management Control*, 3, pp. 59-86.

Dicuonzo G., Dell'Atti V., Fusco A., Donofrio F. (2021), Big data and artificial intelligence for health system sustainability: The case of Veneto Region, *Management Control*, 1, pp. 31-52.

Lombardi R., Trequattrini R., Schimperna F., Cano-Rubio M. (2021), The Impact of Smart Technologies on the Management and Strategic Control: A Structured Literature Review, *Management Control*, special issue (1), pp. 11-30.

Mancini D. (2018), Evoluzione e prospettive dei sistemi di informazione e di controllo, *Management Control*, 2, pp. 5-14.

Marchini P.L., Davoli L., Belli L., Medioli A. (2019), Internet of Things and Industry 4.0: a successful case study of digital manufacturing, *Management Control*, 3, pp. 11-34.

Montemari M., Nielsen C. (2021). Big data for business modeling: Towards the next generation of performance measurement systems? *Management Control*, 1, pp. 5-10.