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The hitchhiker's guide to the organizational galaxy: overcoming challenges of data aggregation over time and space

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ABSTRACT

The relationship between researchers and organizational data has evolved in the digital era. Despite the abundance of high-quality time-series data, consistency for comparative analysis across time periods and geographical locations remains an issue. We propose a study on cooperative historical data as a methodological blueprint to guide the analytical steps involved in comparing and aggregating organizational data across time and space, particularly when drawing from diverse sources and record-keeping environments. Bridging archival sciences and historical critique, we consider the layers of meaning acquired by data from sources' creation to the moment these sources reach the researchers as archival records. We also consider how the research process dialectically adds a new layer of meaning linking research objectives and data interpretation across sources and investigative endeavors. We demonstrate the degree of informed pragmatism required to interpret the sources' meanings, taking into full account their inherent limitations and the constraints imposed by the investigative process. We consequently underline the relevance of aligning standards of data collection, aggregation, and FAIR datafication related to past, present and future organizational data.

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Introduction

The relationship of researchers with organizational data has evolved strongly in the wake of the era of digitization. While researchers once had to 'stitch together datasets in incompatible formats from disparate sources', such data now appear readily accessible, emerging from 'a Home Depot of cheap and plentiful [digitized] information' (Davis 2010, 694). It is the case, for example, for data on organizations, from accounting and finance (Davis 2010), management data (Payne, Finch, and Tremble 2003) to organizational features at large (Jebb and Tay 2017; Payne, Finch, and Tremble 2003).

Yet, the abundance of available quality time-series of data does not offer *as such* guarantee data coherence, especially for long timespans (Jebb and Tay 2017). Over the course of space or time, a set of data may evolve under the influence of 'conceptual

changes in the constructs and changes in calibration of measurement' (Bliese, Chan, and Ployhart 2007, 557). Additionally, from the time of their creation to the moment they reach researchers, digitized datasets are not dissimilar to any other source. They go through a life cycle of archival recording, involving processes of (or lack of) preservation and classification that may vary over the course of space or time and influence their availability (Brothman 2006; Harris 2002). Diving below the surface of this apparent (over)abundance of data (Decker 2013), organizational researchers are likely to be confronted with blind spots: undigitized archival records, unavailable or missing data (Lipartito 2013; Payne, Finch, and Tremble 2003). This is the case, in particular, when organizational researchers look for data outside the realm of readily available traditional business analytics (Davis 2010). Archival records containing such data are available to them insofar as previous choices of archival classification offer proper leads to these archives. While researchers may initially assume a straightforward path to accessing organizational data, they are in fact bound to encounter substantial challenges in tracing and integrating datasets that have evolved over time and are dispersed across fragmented sources inconsistently classified as archival records.

These challenges stem from compounding realities that jointly influence the meaning a researcher may attribute to data collected in the framework of their investigation. Be it when engaging with descriptions, concepts or figures, there is an objective danger in conflating the information collected from various archival records regardless of the differing layers of meanings influencing the record creation, preservation, availability and mobilization for inquiry over time (Harris 2002). Archival systems themselves play a significant role in shaping these layers of meaning. Choices made during archival classification influence how (series of) records and the datasets they contain are dis- or re-assembled over time. These decisions shape their meaning for further consultation, e.g. through metadata attribution (Brothman 2006; Harris 2002; Hawkins 2022). In that sense, archival records may reflect paradigms of order and structure, disconnected from a more complex and possibly less preserved reality (Tennent 2020). When researchers explore unconventional research questions with innovative (inter)disciplinary heuristics, e.g. in the framework of sustainability studies, they access data through layers of attributed meanings: 'a sliver of a sliver' (Harris 2002) of existence, shaped by the creation of data sources and the rationales behind their preservation as archival records. In the search for meaningful information to apply their innovative heuristics, they may complement such data with materials serendipitously preserved and brought to them by individuals or organizations. This is often the case for organizations whose disappearance led to loss of organizational identity and diminished interest in keeping the sources they produced as archival records. Through investigation and a favorable hazard, the researcher may then become the first to shape the meaning of such sources for inquiry (Decker 2013). Both authors experienced this first-hand in their respective PhD investigations. They discovered, serendipitously, archival records of dairy cooperatives (De Herde 2021) and of a common-pool resource (De Moor 2003), informally preserved by individuals they interviewed as oral sources. As these records had not undergone any other formal archival treatment, their meaning for research was shaped primarily by the will of one or several individuals to preserve fragments of organizational heritage (Lipartito 2013), and was further influenced by their mobilization in the authors' investigations.

Before comparing or aggregating organizational data, researchers ideally need to understand the conceptual significance of the data across sources, including how and why these sources became available for investigation in the first place (Decker 2013). Researchers may mobilize data from archival records as reliable proxies, or surrogates, of a phenomenon under scrutiny (Payne, Finch, and Tremble 2003), possibly through data aggregation (Bliese, Chan, and Ployhart 2007). Proper assessment of the shifts in interpretative meaning of these data, including the fact that these data reached the researchers in the first place in a nonrandom way, is a necessary step in their mobilization (Heller 2023; Jebb and Tay 2017; Lipartito 2013).

In this paper, we use a case study based on historical data from cooperatives to illustrate the complexities of navigating time and space series of data derived from diverse archival record keeping environments. Drawing from our experience of identifying archival records containing data on cooperative development, the paper aims to illustrate the extent of 'sliver' piecing required to navigate organizational data from past and present, and the necessity to follow an adequate blueprint for robust data aggregation or comparison (Harris 2002). The relevance of robust data aggregation increases in current research endeavors aiming at comparing or aggregating data series over time (longitudinal analysis) or over space (transversal analysis). This paper, while outlining a heuristic blueprint in the mobilization of the archival records containing these data, illustrates the necessity to leave behind the paradigm of a-historicity and universalism of sources of data (Clark and Rowlinson 2004; Spector 2014) in the comparative analysis of time and space data series. From the moment these sources are created until the moment the researchers hold the archival records in their hands, they have gone through a whole life cycle of rationales impacting their content, integrity and availability. Their mobilization as research material lies under several influences: that of the – possibly shifting – rationale(s) conducing to these sources' creation, conservation and availability as archives, on the one hand; that of the rationale(s) underpinning the researchers' own investigative objectives, leading them to use, select, and give meaning these sources as research material on the other hand (Harris 2002; Heller 2023; Maclean, Harvey, and Clegg 2016).

Prospective data in-the-making are future historical sources under the influence of the rationale underpinning their creation and conservation as archival record. In the realm of co-operative studies and of the social economy at large, researchers already stressed the necessity to align on principles and methods of data collection in order to illustrate the multiplicity of societal roles and impacts of this organizational segment (Artis, Bouchard, and Rousselière 2015; Novkovic, Puusa, and Miner 2022). On a broader scale, sustainability accounting and reporting is also a discussed matter on the topic of standards and guidelines of data collection (EFRAG (2023); Hahnkamper-Vandenbulcke 2021, Jayasiri, Kumarasinghe, and Pandey 2023, Nasreen, Baker, and Rezania 2023, Tiwari et al. 2023). Data available to researchers in the future will rely upon the 'theoretical and ontological underpinnings' of guidelines of data collection (Nasreen, Baker, and Rezania 2023, 1), on the ability of companies to practically compile the data in accordance with these guidelines (Tiwari et al. 2023) and on the conservation of the sources containing such data as archival records (Lipartito 2013). Any present or future mobilization of archival records containing organizational data cannot escape the necessity to consider the interpretative value of the data they contain, in light of these processes.

The paper bridges to this end the cautionary principles of archival sciences and historical critique. Drawing from a case study, the paper presents a stepwise heuristic blueprint of data interpretation that serves as a Hitchhiker's Guide (Adams 1980) to navigating the balance between research objectives, the time-intensity of the investigative effort, and the robustness of data comparison and aggregation. The paper links the insights of this practical exercise to the wider debate on the coordination of investigation and reporting practices that extend beyond traditional business analytics in the realm of cooperatives, the social economy, and beyond (Artis, Bouchard, and Rousselière 2015; Novkovic 2022).

The paper is organized as follows. It first outlines the extent to which the analysis of cooperative data can serve as a methodological yardstick for the broader treatment of organizational data. It subsequently introduces an analytical framework that bridges principles from archival sciences and historical critique, aimed at elucidating the layers of meanings that historical sources of organizational data acquire through their life cycle. This framework is then employed to outline how these meanings shape the interpretative potential of such sources, particularly in relation to their comparability and aggregability. The paper discusses these results by conceptualizing the sliver piecing of sources of data as a dialectic and pragmatic process of contextualized meaning attribution at the intersection of research aims and investigative constraints. The paper concludes by emphasizing the critical need for a coordinated approach to both the investigation and datafication of organizational data sources across past, present and future.

Cooperative data as methodological yardstick, from past to future

Cooperatives are member-owned organizations relying to varying degrees on cooperative values of solidarity among members and concern for community development (Novkovic 2008). Looking back in time, cooperatives and mutual organizations – as other ‘institutions for collective action’ (Ostrom 2010) – noticeably emerged and subsided in a series of waves over the past few centuries, with the most explicit period of dispersion in between 1880 and 1920 (De Moor 2015). Their development often anchors in social movements (Develtere 1996; Diamantopoulos 2012; Fairbairn 2001) and can subside in demutualization trends through mergers, acquisitions, and dissolution (Battilani and Schröter 2011; Chaddad and Cook 2007; Patmore, Balnave, and Marjanovic 2021; Sousa and Herman 2012). Because of their features of ‘associative economic organizing’ (Novkovic 2022, 315), proponents of these organizations stress their relevance as a ‘competitive yardstick’ (Novkovic 2022, 313) for promoting fairer and more sustainable economic practices (Defourny 2009; Dufays et al. 2020; International Labour Organization 2023; United Nations 2022). This competitive yardstick role also encompasses reporting and benchmarking practices (Novkovic 2022).

Aligned with the associative nature of cooperatives, cooperatives, and cooperatives’ federations at national and international level, have a rich tradition of reporting on their features and activities (International Cooperative Alliance 1898; International Labor Office 1934). Data available from historical records to the present focus not only on traditional profitability and input/output figures but also on membership characteristics. Understanding the cooperatives’ impact, beyond profitability alone, is engrained in these membership, input and output data, either at the level of the individual

organization, or at an aggregate level. When contextualized qualitatively, this data thus hold the potential to shed light on how cooperatives, as well as cooperative development on a broader scale, employ economic methods to address social issues, ‘using economic means to resolve a social concern’ (Novkovic, Puusa, and Miner 2022, 3).

The paper illustrates the stepwise thought- and investigation processes that guided us in our scientific aim to compare and aggregate cooperative data across different time periods and spatial locations. It draws from these processes a blueprint framework that may guide other scholars dealing with organizational data across space and time.

Analytical framework

We bridge, in the description of this stepwise process of data identification, insights from archival science (Kastenhofer 2015; Mills and Helms Mills 2011) and historical critique (Heller 2023; Lipartito 2013; Yates 2013). Both fields share the concern that working with archival records involves working with a research material that carries layers of attributed meanings, shaped at various stages of the sources’ life cycle, including creation, (lack of) conservation, archival classification, and mobilization by researchers.

Archival science highlights key principles for identifying archival records, namely the proper assessment of their authenticity, integrity, and usability. Authenticity refers to determining the record’s origin: author(s), time of creation, and the overall appreciation of its genuine character as historical source – ensuring that its origins can be assessed with certainty, as opposed to being a forgery. Integrity concerns the alterations a record may have undergone through its life cycle, from creation to the moment it reaches the researcher. These alterations relate to the notion of archival silence, which reflects the fact that only part of the material produced, or that could have been produced at a given time, ultimately reaches researchers as archival record (Lipartito 2013). Usability refers to the extent to which a record is accessible for consultation, either through the structured metadata aligned with FAIR principles (making the record Findable, Accessible, Interoperable, and Reusable) (Hawkins 2022; Kastenhofer 2015) or more randomly through serendipitous discoveries (Decker 2013).

Historical critique contributes to interpreting the content of a record by considering the context in which it originated as source (Lipartito 2013; Yates 2013). It emphasizes three tenets of source interpretation: validity, credibility and representativity. The notion of validity in historical critique aligns with the concept of authenticity in archival sciences. By identifying the producer and time of production, researchers can assess the record’s accuracy in representing the events under scrutiny. This accuracy may diminish, ‘the further they are separated from actors and events’ (Lipartito 2013, 289). Credibility refers to the author’s intentionality in creating the source and the rigor with which it represents reality. From an archival science perspective, the creation of a source reflects the author’s intent to document an event, shaping the future archival record (Brothman 2006; Harris 2002). Thus, the reliability of the record in accurately portraying reality becomes a central concern (Kastenhofer 2015). Historical critique supports this view and calls for assessing the extent to which a source was ‘created to make a statement, take a position, or advance a theory’ (Lipartito 2013 referring to Clark and Rowlinson 2004). While authorial intentionality may seem less relevant when dealing with figures used to track organizational development, as opposed to narrative primary sources (Lipartito 2013), even quantitative

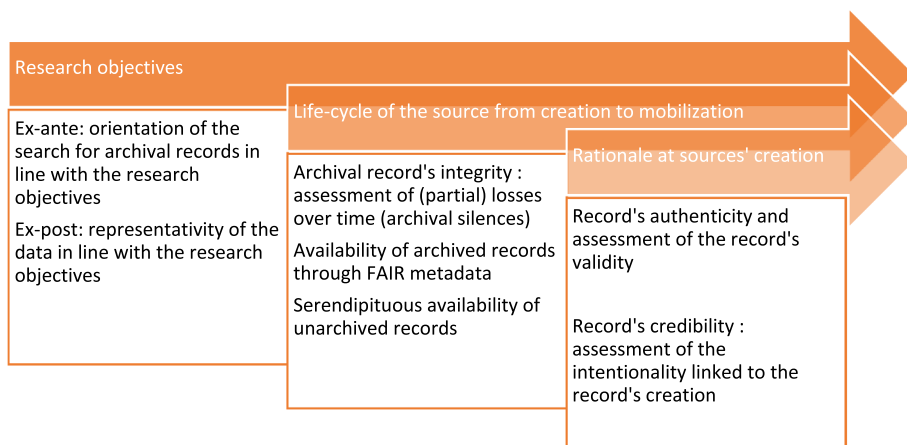


Figure 1. Illustration of the dive in the records' life cycle to understand how this life cycle participates to the meaning of data for inquiry (bridging the tenets of archival science and historical critique).

sources may be shaped by paradigms aligned with the author(s)' world view. Historical critique therefore requires that the motivations and processes underlying the creation of any source of data be assessed (Heller 2023; Rowlinson and Hassard 2013).

Finally, historical critique invites researchers to ask what the data represent in light of their investigative objectives, and to identify potential shortcomings in terms of comprehensiveness (Kipping, Wadhwani, and Bucheli 2013). This dimension – what the data represent – is fundamental for comparative analysis across time and space. Studying the evolution of organizations may require mobilizing a variety of sources in the form of archival records, some of which may have evolved over time and space, and some of which may provide duplicate information. Exploring their degree of mutual coherence and consistency is therefore a key concern (Kipping, Wadhwani, and Bucheli 2013). Ex-ante, what the data can represent also guides researchers in identifying which sources are available to them as archival records, before they assign meaning to these sources from their investigative perspective (Harris 2002).

Archival science and historical critique thus converge on the necessity of considering the interpretative value of data and sources of data in relation to the different stages of the records' life cycle, from their creation to their mobilization by researchers. We therefore propose an analytical framework, illustrated in Figure 1, that accounts for the influence of these stages on the interpretative value of the data contained in the records. Drawing on our own research endeavor, we present a retrospective dive in time into the life-cycle of archival records to show how this process gives meaning to data and to offer blueprint recommendations for robust assessment of the data's meaning for inquiry.

Ex-ante orientation of the search for archival records in line with the research objectives

Our search process of sources of data on cooperatives was driven by the goal of comparing and aggregating information related to cooperative development and its societal impact in Europe during the 19th and 20th century. We primarily sought

historical sources that included membership, input and output data. We began by screening both scientific and gray literature. We identified source-based investigations on cooperative development, indications of relevant sources to mobilize, and challenges linked to the comparison and aggregation of these sources over time and space.

The scientific literature we identified covers cooperative development from various perspectives: regional (Medina-Albaladejo et al. 2021), national (Henriques et al. 2020; McLaughlin et al. 2023), or cross-national comparative (Fernández 2014). These investigations rely on diverse sources, including regional or national compilations or registration data (Medina-Albaladejo et al. 2021), sector-specific sources (Henriques et al. 2020; McLaughlin et al. 2023), and datasets provided by international organizations (Fernández 2014). Researchers examining cooperative development across sectors and over extended time periods often supplement their datasets with a wide range of sources. These include screenings of national and local newspapers, sources from value chain intermediaries, and more (Patmore, Balnave, and Marjanovic 2021, 2023). Such efforts are frequently organized as multi-year, consortium projects (Balnave and Patmore 2019). One notable example is Co-operatives UK, which institutionalized this work through a long-term, multi-partner national database compiled from various historical sources (Co-Operatives UK 2021).

Drawing on these studies, thematic monographs (Cole 1944; Gide 1971), and additional published sources identified during our investigation (e.g. International Labor Office 1934), we categorized cooperative data into three main types that support comparative analysis across time and space: mandatory registration data and related national statistics; data and statistics produced by national cooperative unions and federations; and statistics and compilations issued by international cooperative federations and organizations.

Our literature review also highlighted several anticipated challenges in mobilizing these sources. These include evolving legal definitions of cooperatives across regions and time periods (Fici 2013), as well as inconsistencies in measurement and aggregation standards (Artis, Bouchard, and Rousselière 2015; Fauquet 1939; International Labor Office 1934, 1939). We also anticipated unequal access to the sources, depending on the institutional capacity and resources available to compile and preserve them archival records (Kipping, Wadhwani, and Bucheli 2013; Lipartito 2013).

These challenges are common to any research endeavor that seeks to mobilize organizational data across time and space, especially beyond conventional business analytics. Legal definitions of companies evolve over time and space, particularly for impact-oriented businesses (Serres, Hudon, and Maon 2022; Van Baelen 2021; Ventura 2023). Multiple analytical standards may co-exist, and their application often depends on available institutional resources and standardization efforts. Despite existing guidelines for extended reporting, limitations in technological and human resources can hinder both data collection and the preservation of sources as archival records (Lipartito 2013; Tiwari et al. 2023).

These issues underscore how the rationale behind the creation of sources of data, and their life cycle from creation to mobilization as archival record, can influence the meaning of the data for research purposes. The fact that data collection efforts are institutionalized through consortium-based initiatives, such as Co-operatives UK, suggests that sources can

only become truly representative for investigation when triangulated with other sources. The following section analyzes the identified cooperative data sources, showing how their respective life cycles shape their meaning. It also illustrates how this understanding informs the researcher's process of 'sliver piecing,' which is essential to achieving their investigative goals.

Meaning of data for comparison and aggregation

This section outlines successively the following sources identified in the previous section:

- (1) the registration data at national level;
- (2) the official statistical data at national level;
- (3) the registration data (or assimilated information) of national/regional federations/unions;
- (4) the statistics of national or regional federations/unions;
- (5) the compilations of data provided by international federation and organizations.

This section examines, for each source, the influence of its life cycle, from its creation to the point at which it becomes accessible to researchers, whether through FAIR-compliant disclosure or serendipitous discovery within the course of an investigation. While the focus here is on data sources related to cooperatives, our aim is to use this case as an illustrative example of broader relevance for similar types of organizational data. Each subsection successively examines: (1) how the source aligns with ex-ante considerations related to the research objectives (in our case, the study of cooperative development across time and space); (2) the archival silences that emerged throughout the source's life cycle; (3) how the rationale behind the source's creation informs its content; and (4) the interpretive insights that can be drawn from this analysis. [Table 1](#) summarizes the main findings for each source.

Registration data at national level

Ex-ante considerations linked to research objectives

When examining organizational data, official registration often appears to be a relatively straightforward and reliable source of information, at least this was our assumption as historians confident in the overall operational performance of registration authorities. Cooperatives, like other organizational forms, are typically registered with institutions such as Chambers of Commerce. These registries generally contain key details, including the cooperative's name, date of establishment, principal address, sector of activity, membership structure, number of subscribed shares, and, where applicable, dates of creation and dissolution (International Labor Office 1934). Beyond registration data *stricto sensu*, additional sources complement these records. For example, organizations are often required to deposit foundational documents, statutes, amendments to statutes, and board appointments in official state gazettes (see, e.g. for Europe, European Forum of Official Gazettes 2009).

Life cycle of the source from creation to mobilization – assessment of archival silences

Researchers may access registration data and files, either as written or printed archival materials or, more recently, as digital open datasets. As official registers spanning the past two centuries, these sources would typically be expected to fall under formal archival conservation policies and be made accessible to researchers – barring accidental losses (e.g. destruction due to unforeseen events). However, this expectation rests on the assumption that robust public policies for record-keeping and FAIR (Findable, Accessible, Interoperable, and Reusable) data availability have been effectively implemented. In practice, researchers often encounter a more complex and uneven landscape of data preservation and accessibility, which varies significantly across temporal and geographical contexts (Decker 2013). Contrary to our initial expectations, in the case of cooperatives, the most compelling example challenging our assumptions emerged from the more recent digitized registration datasets. A discussion with the Belgian administration responsible for managing the open dataset on cooperative registrations (SPF économie 2023) revealed that these datasets are updated annually, with previous versions not systematically archived. Consequently, any attempt to trace the year-to-year evolution of cooperatives is only feasible if researchers have proactively downloaded and preserved each dataset over time (see e.g. Dufays and Mertens 2017; Staessens, Dufays, and Billiet 2021).

Any uncertainty regarding the state's capacity to enforce registration requirements or to fulfill its responsibilities in maintaining registration records should be critically examined, as such factors may compromise the integrity of the registration record series.

Rationale at source's creation – content assessment

It may seem self-evident, but cooperatives can only be registered as such if a legal framework exists that formally recognizes them as a distinct organizational form. The definition and legal recognition of cooperatives vary across jurisdictions and historical periods (Fici 2013; International Labor Office 1934). Typically, this recognition is established through 'a general or special Act concerning co-operative societies' (International Labor Office 1934, 868). Within such legal frameworks, cooperatives may be recorded alongside other business entities or listed in a dedicated register specifically for cooperative societies. (International Labor Office 1934). Our initial assumption was that the registration records' authenticity, validity, and credibility are beyond doubt, as they are mandated by the state for administrative purposes. Nevertheless, any doubt about the ability of the state to enforce this requirement and/or uphold their registration duties, e.g. in terms of control, ought also to be investigated as potentially influencing the meaning of the data contained in the records.

Organizations themselves as record creator may influence the record's validity and credibility, by neglecting to register dissolution, or keeping the governance structure as empty shell in occurrences of inter-organizational coordination leading to mergers (International Labor Office 1934).

Representativity of the data – meaning in line with the research objectives

The representativity of registration data is contingent upon the researcher's accurate identification of the legal act(s) under which cooperatives, or the organization being

studied, are registered. If these acts – or the associated registration practices – do not clearly distinguish cooperatives, or the organization under study, from other organizational forms, assessing the representativity of the data becomes more complex. Moreover, the way in which these acts define organizations, and the extent to which these definitions align with contemporary understandings, is equally critical. This implies that each record accessed by researchers must be carefully contextualized in light of the legal and conceptual framework that underpins the recognition of the organizations under inquiry, even prior to their formal registration in public records.

Even when registration records are deemed authentic, valid, credible, and representative of organizational development within the framework of the relevant Act(s), practical considerations may still affect the degree of representativity researchers can attribute to these sources. Compiling such records can be time-consuming, especially when researchers must integrate both registration data and mandatory filings from official gazettes. The digitization of records offers potential improvements in this regard, facilitating more efficient access and compilation of relevant data.

If researchers suspect, additionally, that the organizations under study have not been updating their registration data properly, they may need to resort to complementary sources, like newspapers, to crosscheck whether the registration data make sense, looking out for otherwise artificially inflated numbers on organizational development. For instance, in the case of cooperatives, some recent investigations advise caution on membership data recorded at registration: these data capture the situation at registration only and cannot identify the multiple-counting related to simultaneous membership in different cooperatives, if aggregated (Staessens, Dufays, and Billiet 2021).

National statistics based on registration datasets

Ex-ante considerations linked to research objectives

In comparison to registration data, statistics produced by central statistical offices or sector-specific ministries and administrative bodies offer the added value of providing aggregated data. These secondary statistical datasets are, in most cases, derived from primary registration records. In addition to statistics based directly on registration data, administrative bodies responsible for specific sectors may also publish relevant statistical information. Regarding cooperatives, researchers can typically expect to find data on the number of cooperatives, as well as aggregated figures on membership and economic output (Fauquet 1939; International Labor Office 1934).

Life cycle of the source from creation to mobilization – assessment of archival silences

Statistical data on cooperatives and other organizations are often published in statistical bulletins and preserved in libraries rather than in archival repositories. Sector-specific statistics may also be discovered serendipitously through the review of publications related to particular industries or administrative domains. This has been our experience, for instance, with statistics on dairy cooperatives, which we located not only in specific editions of statistical bulletins (Institut National de Statistique 1976), but also in periodicals published by the Ministry of Agriculture in Belgium (Ackerman 1971; Verkinderen and Ackerman 1964a, 1964b), and in publications from sectoral parastatals such as the Office National du Lait (1977). While archival silences may result from the lack of

preservation of such publications, they also stem from the inconsistent production of statistics over time or the application of varying methodological standards. For instance, a historical analysis by the International Labor Office highlights that the content and scope of cooperative statistics differ significantly across countries and historical periods. Early statistical records often limited themselves to aggregate counts of cooperatives, with membership and output figures frequently absent or inconsistently reported across years (International Labor Office 1934).

Rationale at source's creation – content assessment

Provided that researchers can verify the authenticity of the published sources containing statistical data, these datasets may be considered valid, particularly when they are derived from official registration records. However, questions may arise regarding the credibility of the statistics on two main fronts: first, the extent to which the data accurately and comprehensively capture the organization under study as a distinct organizational form; and second, the methodological robustness of the statistical aggregation processes employed.

Ideally, organizational statistics should encompass all institutions that conform to specific legal requirements, including those registered under various legislative acts, while excluding entities that do not meet the definitional criteria associated with these acts (International Labor Office 1934). In the case of cooperatives, for instance, this means ensuring that statistics include all cooperative organizations while excluding noncooperative entities that may be registered under the same legal provisions. Estimations of the credibility of national statistics in translating these provisions adequately range from an acceptance that these sources 'conform on the whole with the standards universally accepted by co-operators' (International Labor Office 1934, 869) to the consideration that these statistics 'are very uneven in value, even if comparison is limited to countries where the co-operative movement is already highly developed and of long standing' (Fauquet 1939, 454).

In terms of methodology, the statistics often result from a comparison between the number of organizations registered in previous years, and the number of newly registered and dissolved cooperatives in the year of compilation. This method 'does not take into account the societies which have begun to function but which have not yet been registered, those which have ceased to function but have not formally gone into liquidation, and those which are dissolved but have not registered the fact (a common case)' (International Labor Office 1934, 873–874).

Representativity of the data – meaning in line with the research objectives

It is advisable for researchers to critically examine the methodology underlying the compilation of statistics and, where possible, to consult secondary sources within the archival holdings of statistical offices. These considerations may provide essential insights into whether the statistics encompass all organizations registered under the relevant legislative acts, or only a subset, and whether they effectively exclude distinct entities that do not fall under the intended category. In our case, for example, this pertains to whether statistics on cooperatives include all cooperative organizations or also noncooperative entities registered under the same legal provisions.

Shifts in legal definitions over time and across jurisdictions can significantly affect the comparability of statistical data. Moreover, the methodologies employed in compiling these statistics may vary, further complicating longitudinal or cross-national analyses. Cooperative statistics illustrate these challenges particularly well. Typically, they are organized according to two main classification schemes: territorial (e.g. urban vs. rural cooperatives) and functional (e.g. credit, supply, purchasing, or processing cooperatives). However, some cooperatives may span multiple categories, complicating classification efforts. As a result, national statistics often reflect country-specific structures, with varying numbers of groups and sub-groups and differing levels of detail. In some cases, widely divergent types of societies may be grouped under a single category, while in others, more granular distinctions are made. Crucially, retrospective reclassification is generally not feasible, meaning that comparisons can only be made at the level of the broadest common subclassification. Concerns raised about the aggregation of membership data at the point of registration (Staessens, Dufays, and Billiet 2021) are equally relevant when considering aggregated data in official statistics. This limitation underscores the need for caution when interpreting aggregated data (Fauquet 1939; International Labor Office 1934).

Registration data of national or regional unions and federations

Ex-ante considerations linked to research objectives

Unions and federations are federative bodies common in organizational development, particularly within the cooperative sector. These organizations can have a representative role (advocacy, lobbying), a supply function (e.g. act as wholesale supplier), or combine both (Fauquet 1939). To identify these organizations, their sectoral and societal scope, researchers can rely on published sources (overviews like Cole 1944; Gide 1971 in the case of cooperatives), sources of some national federations (in the case of cooperatives, the yearbooks displayed at the Bibliothèque Nationale de France 2023 contain rich information on the federative situation in other countries), repertoires of international federations (in the case of cooperatives, International Cooperative Alliance 1910; 1926, Plunkett foundation for co-operative studies 1927), and scientific literature (Morales Gutiérrez, Atela, and Dueñas 2005; Patmore and Balnave 2018; Scholliers and Grauwels 1982 in the case of cooperatives). A good general knowledge of the socio-political landscape is of relevance, in particular if the organizations under study evolve within socio-religious segmented spaces, as is the case, for cooperatives, in Ireland, Belgium and the Netherlands (Colvin and McLaughlin 2014; Henriksen, McLaughlin, and Sharp 2015; Scholliers and Grauwels 1982). Fully aware of the extent of socio-religious segmentation in the Belgian landscape, we identified, for example, archives of cooperative federations within archival collections related to the socialist and catholic movements, respectively (AMSAB (2025); KADOC 2025). We also located a meaningful monthly bulletin published by a seemingly liberal-oriented consumer cooperative union in Brussels (KBR 2025).

Rather than registration data, researchers may find, as material produced by these organizations, annual lists of organizational members, associated to members' data (creation date, sales figures, volume of shares) and/or aggregated figures of business volume of federated organizations published in yearbooks (Bibliothèque Nationale de

France 2023; Gide 1971). Alternatively, annual reports, surveys or monthly newsletters are likely to contain relevant information.

Life cycle of the source from creation to mobilization – assessment of archival silences

The conservation of sources from national and regional federations may vary and generate archival silences. As with any organization, if a federation becomes defunct or isn't linked to a broader socio-political movement, researchers may face challenges in locating FAIR-compliant archives. Unless such sources are discovered serendipitously, they may remain inaccessible for use in a given research context. Another source of archival silence may arise from the means the federation could give to gathering information from their members, and from the willingness of the members to provide information. Researchers should hence scrutinize the material they managed to identify in terms of integrity, as to consider the partial losses of information over time.

Rationale at source's creation – content assessment

When available, the registration information available may encompass a scope that slightly differs from the official registration data discussed earlier. 'It may and should be considered that the manner in which (...) institutions group themselves and constitute federations for common purposes expresses their own affinities and reveals their essential character' (Fauquet 1939, 458). Cooperative federations, for instance, 'include only the societies which they consider to be genuinely cooperative and try to cover all of these' depending on their definition of co-operation. 'Some apply the name to a single category of societies only, while others are more inclusive' (International Labor Office 1934, 867). Considering the specific scope of the federations, the registration data, if available in the archives, may constitute a valid and credible complement of information to official registration data.

The authenticity of the records available to the researchers needs to be assessed on a case-by-case basis, scrutinizing whether the archival treatment of the records offers information on the records' life cycle asserting their authenticity. We did not encounter any warning as to the validity or credibility of these sources regarding cooperatives, which nevertheless needs to be scrutinized (who produced the source and for which purpose) on a case-by-case basis.

Representativity of the data – meaning in line with the research objectives

Secondary sources can help figure out how federations evolved over time, changed name, scope, merged, split, or dissented. This information is necessary to interpret the data researchers may extract from the federation archives. How federations define, include and exclude organizations, makes these data interestingly complementary to official registration data.

In the case of cooperative national federations, the yearbooks are rich in textual information. The extraction of the data from the lists of members requires, as for official registration data, a work-intensive translation effort from historical copies to exploitable datasets. If yearbooks are not available or only available for a limited time period, a search for annual reports, surveys or monthly newsletters may increase the investigative effort. Researchers may, additionally, need to identify various federations depending on the socio-political divides and the way

organizations group themselves. The cross-national comparison of the obtained data may become complex due to the varied and specific scope adopted by each federation within its own national context.

Statistics from national or regional unions and federations

Ex-ante considerations linked to research objectives

Statistics from national (cooperative) unions and federations offer aggregated data. If the federation does not provide an explicit statistical section in its yearbook or annual report, the statistics may be published on a regular basis over the timespan of existence of the federation. In terms of content, the federation statistics may contain more detailed sets of data than official statistics (International Labor Office 1934, 873).

Life cycle of the source from creation to mobilization – assessment of silences

Similarly to official statistics, archival silence may come from a lack of preservation or from the fact that these (sectoral) statistics may not have been produced at certain times or produced with differing standards over time. Similarly to federation registration data, these statistics may reach researchers because they have been subjected to archival conservation and FAIR disclosure, or serendipitously discovered in libraries, or institutional or personal storage places. Researchers ought ideally to scrutinize the material identified in terms of integrity.

Rationale at source's creation – content assessment

The principles outlined earlier regarding the scope of federations apply also to their statistical practices. Federations often begin with national registration data or official statistics, but they may also compile new datasets using their own internal information (International Labor Office 1934). Co-operative federations, for instance, draw from different sources (Fauquet 1939). They aim to include organizations they deem 'genuinely co-operative' (International Labor Office 1934, 867). Their goal is to ensure comprehensive coverage, guided by their own criteria and understanding. Similarly to the registration data, the authenticity, validity and credibility of the records needs to be evaluated on a case-by-case basis.

Representativity of the data – meaning in line with the research objectives

Depending on the scope of the federations, their statistics can offer an interesting complementarity with the official national statistics. Differences in scope across various federations may render comparison hazardous. Similarly to official statistics, classification choices may vary, in line with the scope of the federation and the level of detail of the statistics (Fauquet 1939). Only wider order comparisons may thus be possible across space and time (International Labor Office 1934). In the case of cooperatives or similar organizations with membership figures, aggregation of membership data should be scrutinized just as carefully as the aggregated figures found in national statistics.

Compilations of international organizations and federations

Ex-ante considerations linked to research objectives

International organizations and federations range from international federations of organizations (in our case, the International Cooperative Alliance – ICA, the International League of Agricultural Co-operative Societies), multilateral organizations (e.g. International Labor Office – ILO, the League of Nations, the Organization for Economic Co-operation and Development – OECD) to private organizations (in our case, the Horace Plunkett Foundation).

Regarding cooperatives, specifically, the International Cooperative Alliance (ICA) was prolific in publications on cooperative development. As a global representative body for cooperative organizations worldwide, the ICA was founded with the aim of promoting the cooperative movement, advocating for the interests of cooperatives at the international level, and fostering collaboration and mutual support among cooperative enterprises across different countries and sectors. Besides periodicals, the organization published yearbooks and statistics on a regular basis over the 20th century, relevant for comparative analysis (International Cooperative Alliance 1898, 1910).¹ The content of these documents ranges from membership to business volume figures, with features adapted to each category of cooperative (e.g. inventory value for housing, consumer and producer cooperatives, number of granted loans for credit cooperatives, volume of milk collected for dairy cooperatives). Contrary to our assumptions, we found aggregated data both in the yearbooks and in the statistics, and data on individual cooperatives in the statistics.

The statistics on cooperatives by multilateral organizations such as the International Labour Organisation present the highest degree of data aggregation. The figures indeed appear in general comparative tables where each line refers to one country, summed up in continental or world totals (International Labor Office 1934, 1939).

In the search for relevant aggregated data, sectoral statistics from multilateral organizations (see e.g. the agricultural export data by the League of Nations, & International Labor Office 1926) or yearbooks from private organizations (Plunkett foundation for cooperative studies 1927) offered a relevant addition to the abovementioned resources. The yearbooks of the Plunkett foundation² provide statistics on agricultural cooperatives and reports on national cooperative developments in agriculture (Ajates Gonzalez 2018). In terms of geographical scope, editions preceding 1930 covered only the British Empire and since the 1930s European countries as well (Forrester and Foundation 1930). Statistics are not present in all yearly editions (Forrester and Foundation 1930). The yearbook contains chapters per country, written either by local correspondents or by British journalists (Ajates Gonzalez 2018).

Life cycle of the source from creation to mobilization – assessment of archival silences

The FAIR availability of these sources depends strongly upon the conservation and archival policies of international organizations and federations. Direct inquiry at federations' headquarters may lead researchers to serendipitous discoveries, as we ourselves experienced. While seeking access to ICA statistics and yearbooks, we were initially referred to the official ICA archives stored in New Delhi, India. However, a visit to the Brussels offices revealed the existence of a significant, previously undisclosed and

uncatalogued collection of these documents stored in Belgium. This experience illustrates how archival silence (from a geographical rather than absolute perspective) may stem not only from a lack of preservation but also from an unclear understanding of what is actually held in storage. In such cases, national libraries may offer alternative venues where (a partial set of) records are FAIRly disclosed.

Silence also arises from the fact that the documents may not have been produced on a regular basis over the years. In particular, the statistics by multilateral organizations have only been produced on an irregular basis.

Rationale at source's creation – content assessment

Each of these international organizations operate within a specific scope, which is reflected in the nature of the sources they produce. To contextualize the development of international cooperative federations, secondary sources (Cole 1944, 352–363; International Labor Office 1959, 541 and following), or recent monographies (Patmore and Balnave 2018) offered valuable insights. For instance, the scope of the International Cooperative Alliance (ICA) evolved significantly following internal dissent among agricultural cooperative federations between 1904 and 1912. This schism led to the formation of the International League of Agricultural Co-operative Societies, after which the ICA primarily came to represent consumer cooperative federations (Patmore and Balnave 2018).

The considerations regarding the authenticity, validity, and credibility of sources discussed in relation to national federations equally apply to those produced by international federations and multilateral organizations. Researchers must remain attentive to indicators related to a record's life cycle that can may suggest its authenticity, such as its inclusion in a national library catalog, while recognizing that such indicators can support, but not definitively confirm, authenticity (Kastenhofer 2015).

Assessments of validity and credibility must be conducted on a case-by-case basis, considering the specific context in which the data were produced and disseminated. The validity and credibility of these sources can be reinforced by possible comprehensive explanations provided in annex explanatory corpuses. In the case of cooperatives, for example, the statistics published by the International Labour Organization are accompanied by a critical corpus in which the agencies responsible for compiling the data explain how they sourced information from national bodies, what aggregation choices they made, and which sources they relied on. This documentation is a valuable resource for assessing the validity and credibility of the cooperative statistics (Fauquet 1939; International Labor Office 1934, 1939). Conversely, the credibility of the descriptions in the yearbooks of private organizations needs to be put into perspective with the intentionality of the writers. For instance, Ajates Gonzalez (2018) identifies occurrences, in the yearbooks of the Horace Plunkett Foundation, where the authors orient the description to increase the importance of some socio-religious organizations in cooperative development. Researchers hence need to look for additional secondary sources in national archives likely to enlighten them about the intentionality of the authors, the rigor of data collection, and the exhaustiveness of their national coverage.

Representativity of the data – meaning in line with the research objectives

Sources of international unions and federations, like the ones we could consult on cooperatives, reflect country-specific categorizations shaped by the developmental trajectories of the entities they represent in every country. Like registration data, compiling this wealth of information into usable datasets requires significant time and effort. However, the long-term availability of such sources (see footnote n° 1) makes them an adequately centralized source of longitudinal information over a variety of countries, within the specific scope of the involved federations.

Even when some sources may not cover extensive time periods, they can still serve as meaningful reference points in conjunction with other sources. These sources, however, are also subject to the challenges of cross-national comparisons already described in the previous points. Sector-specific publications (such as yearbooks of private organizations) tend to offer more homogeneous, and thus more comparable, datasets across countries. Nonetheless, researchers must remain attentive to the varying organizational dynamics that evolve over time and across regions, which can complicate comparative analysis. As for other sources, the data they contain should be contextualized to understand the specific organizational development patterns they reveal, whether in cooperatives or other institutional forms (Ajates Gonzalez 2018; International Labor Office 1934).

Table 1 hereunder summarizes the considerations of this section for each type of source.

Table 1. Summary of the influence of each source's life cycle, from its creation to the point at which it becomes accessible to researchers, on its representativity for inquiry.

	Ex-ante considerations linked to research objectives	Lifecycle from creation to mobilization – assessment of archival silences	Rationale at sources' creation – content analysis	Representativity of the data – meaning in line with objectives
Registration data at national level	Straightforward source of publicly mandated data, possibly complemented by other mandatory depots (statutes, annual accounts, board nominations in the official gazettes)	Inability of the state to enforce the registration requirements/uphold registration duties can impact the records' series integrity Initial assumptions on policies of record keeping and FAIR availability may be contradicted, including for digitized datasets	Content contingent upon legal framework and its evolution of space and time. Little doubt on authenticity. Inability of the state to control the registration requirements can impact the records' validity (delayed records) and credibility	Time-intensive effort of compilation (improved by digitization) Assess doubts on validity and credibility by resorting to complementary sources Caution on artificially inflated membership data in aggregation (multiple counting)
National statistics based on registration data	Straightforward source of aggregated data	Potentially unequal production/shifting standards over time and space (missing figures – impact on integrity) Expected FAIR availability when published sources, serendipitous discovery of sectoral statistics in published sources	Content contingent upon legal framework and methodology of aggregation. Authenticity (and related validity) assessment of published sources needed. Credibility depends upon rigor of data collection and methods of aggregation	Contextualization of the methods of aggregation needed

(Continued)

Table 1. (Continued).

	Ex-ante considerations linked to research objectives	Lifecycle from creation to mobilization – assessment of archival silences	Rationale at sources' creation – content analysis	Representativity of the data – meaning in line with objectives
Registration data (or assimilated information) of national/regional cooperative unions and federations	Complementary source to registration data at national level	Limited means in organizing and enforcing data gathering may lead to integrity losses FAIR availability contingent upon unequal archival policies, serendipitous discovery of archives possible	Conscious adoption of a scope that differs from legal frameworks Authenticity, validity and credibility to be assessed on a case-by-case basis	Time-intensive effort of compilation across various organizations Contextualization of the evolution of the federation/union over time needed Interesting complementarity with registration data at national level
Statistics from national/regional cooperative unions and federations	Complementary source to aggregated statistical data at national level	Unequal production/ shifting standards over time and space (missing figures – impact on integrity) FAIR availability contingent upon unequal archival policies, serendipitous discovery possible	Conscious adoption of a scope that differs from legal frameworks Authenticity, validity and credibility to be assessed on a case-by-case basis	Contextualization of the methods of aggregation needed Differences in scope and related aggregation methods may render comparison hazardous Interesting complementarity with national statistics
Compilations of international co-operative federations and organizations	Centralized source of (non)-aggregated information on a diversity of countries	Unequal production over time and partially missing information – impact on the integrity of time-series FAIR availability contingent upon unequal archival policies, serendipitous discovery possible	Scope, authenticity, validity and credibility to be assessed on a case-by-case basis Explanatory corpus on the aggregation methods available for some sources, of use to assess credibility	Practicality of the centralization of rich data over space and/ or time. Time-intensive effort of compilation Contextualization of the methods of aggregation needed – differences across sources and within sources may render comparison hazardous

Discussion

The findings from our analysis of cooperative data sources for purposes of comparison or aggregation across time and space underscore the importance of accounting for the full life cycle of records, from their creation to the point at which they are mobilized by researchers, for accurate interpretation. Even the most seemingly straightforward sources, such as official registration data, are not immune to archival silences that can compromise the continuity and integrity of time series analyses. Moreover, none of the sources examined could be meaningfully mobilized without a critical examination of the meanings ascribed to them at the time of their creation. These meanings are shaped by evolving legal frameworks, the specific scope and purpose of the data, methods of aggregation, institutional intentionality, and potential delays in data input, all of which bear directly on the validity and credibility of the records.

The practice of ‘sliver piecing’ together different sources is justified by both the complementarity of meanings embedded at the time of each source’s creation and the discontinuities that often characterize time-series data. However, for this approach to be methodologically robust, each source must be carefully re-contextualized using relevant secondary sources. Our analysis also highlights a broader methodological dimension that is often overlooked: the pragmatic nature of decisions involved in sliver-piecing. These decisions are shaped by the tension between available (temporal and material) resources for investigation, the representativeness of the sources for inquiry, and the evaluation of their complementarity. Importantly, the most effective compilation of sources may not be the most exhaustive. Rather, it is the one that constructs a representation of reality aligned with the research objectives and investigation constraints, while maintaining transparency about the limitations and interpretive layers associated with each source throughout its life cycle.

A practical illustration of such a pragmatic approach to sliver-piecing regarding cooperative data, one that takes into account constraints of time and resources, can be found at De Herde and de Moor ([forthcoming](#)). From the realistic perspective of limited resources in both workforce and time, we approached the integration of sources of cooperative data through a pragmatic, stepwise process of dataset enrichment. We began with datasets from multilateral organizations, selected for their broad geographical scope, relatively straightforward accessibility, and extended critical corpus, despite their unequal coverage over time. Building on this foundation, we then turned to sources that extended temporal coverage, each presenting distinct challenges: yearbooks and statistics from international federations, which required contingent identification of records, sectoral yearbooks from private organizations, which demanded careful handling due to issues of intentionality, and national statistics, which necessitated clarification of methodological shifts over time and across regions. As a final and most resource-intensive step, we considered the compilation of registration data from national or federation-level sources to further support the inquiry. This layered approach was conceived to strike a pragmatic balance between data availability, reliability, and feasibility, and to inform a robust framework for analyzing cooperative development across time and space.

This final point on informed pragmatism reinforces the understanding of meaning attribution as a conscious, dialectical process—one that links the researcher’s investigative aims with the evolving life cycle of the sources, both prior to and beyond the moment of their mobilization. [Figure 2](#) illustrates this process, expanding upon [Figure 1](#) by incorporating the investigative effort in relation to the complementarity of sources as a pragmatic dimension of meaning attribution. In inquiries into organizational development across time and space, the ex-post attribution of new meanings to sources does not occur in isolation. Rather, it reflects an interpretive process shaped by how researchers perceive the complementarity between records and their data, situated at the intersection of research objectives and the resources available for inquiry.

The insights derived from this investigation into historical cooperative data extend beyond the specific case at hand, offering broader implications for both retrospective inquiries into organizational data and the design of current data management practices

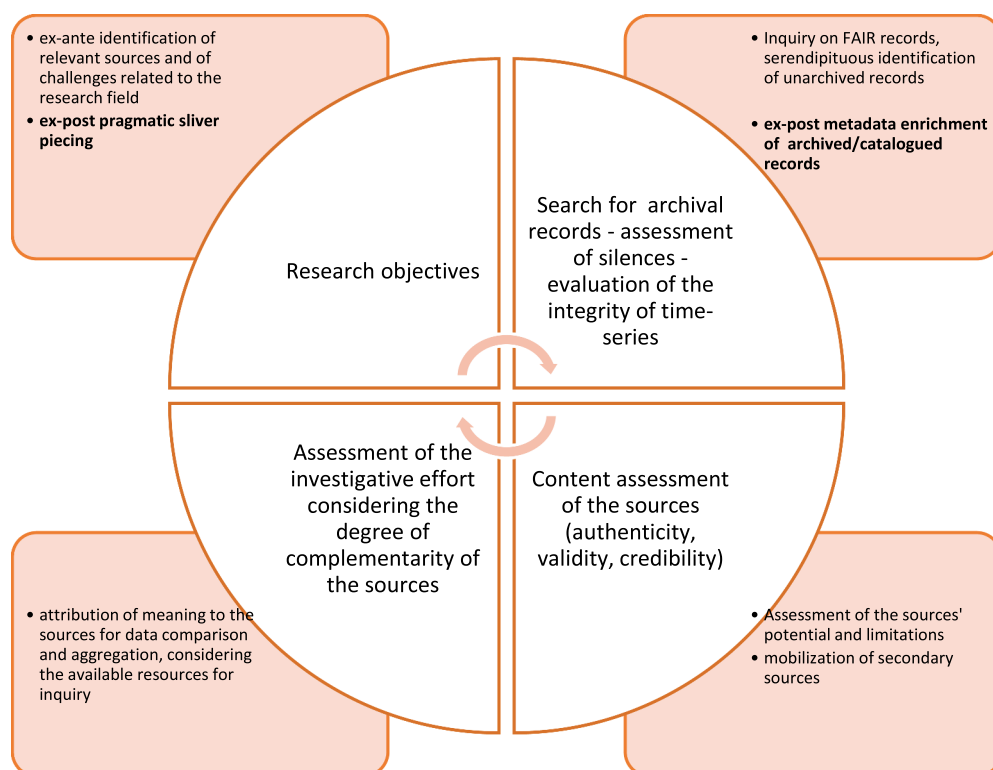


Figure 2. Illustration of the dialectic process of meaning attribution through inquiry, considering the added dimension of assessment of the investigative effort.

for future research. This study highlights a persistent tension between the level of analytical precision that can be achieved through the compilation of diverse sources and the constraints imposed by the time-intensive nature of such investigative efforts. While the extent of this tension will vary depending on the research context, it is likely to be a recurring issue, particularly considering how research projects are currently structured and financed within the academic landscape (Fowler, Lindahl, and Sköld 2015).

Previous compilation work, such as the digitization of written, printed, or scanned materials into digitized datasets, or the recontextualization of sources through secondary literature, can significantly facilitate and speed up the investigative process of researchers. Accordingly, comparative investigations of organizational data across time and space, no matter how straightforward they may initially appear, ideally require coordinated and long-term efforts among research teams, equipped with the expertise and resources necessary to recontextualize the archival records available. Such collaborative endeavors not only enhance the robustness of the research process but can also foster critical reflection on the adequacy of ex-post meaning attribution. For instance, if these datasets are to be released as Linked Data, their intrinsic limitations and complementarities can be made explicit through carefully designed recontextualizing metadata. This kind of metadata design does more than ensuring basic interoperability. It supports interpretive transparency and embeds historical nuance,

thereby reinforcing the methodological strength of collaborative data practices (Hawkins 2022).

Returning to the broader issue of data management for prospective investigative endeavors, this study reinforces a repeated recommendation, made by Fauquet (1939), Artis, Bouchard, and Rousselière (2015) in the realm of cooperatives and the social economy, and by Hawkins (2022) more generally, to engage with and align on standards of data collection, aggregation and FAIR datafication. Such engagement is essential to facilitate the ‘sliver piecing’ efforts of future researchers engaged in comparative and aggregative analyses. Organizations responsible for generating sources of data may also derive benefits from this alignment, provided the standards are compatible with their operational requirements, by enhancing their capacity for benchmarking, reporting, and participatory research. By placing scientific dialogue around production, preservation, datafication, and analysis of sources at the core of comparative research in organizational studies, we can lay the groundwork for more coherent, transparent, and effective research practices moving forward.

Conclusion

Bridging cautionary principles from archival science and historical critique, this study draws insights from a European source analysis of cooperative development across the 19th and 20th centuries. These insights highlight the heuristic challenges of comparing and aggregating organizational data across time and space. Navigating the extensive corpus of records containing these data, emerging from distinct record-keeping environments, requires a meticulous recontextualization of their life cycle, from creation to the point of access by researchers, whether through FAIR disclosure or serendipitous discovery. Each stage of this life cycle influences the meanings researchers may attribute to the data. Consequently, any investigation must begin with a thorough examination of this life cycle using secondary sources, followed by a carefully reasoned and pragmatically justified process of sliver-piecing these sources together, based on their complementarity. In practical terms, these findings emphasize the need to approach data collection and analysis in organizational development as a contextualized endeavor, one situated at the intersection of research objectives and the human and temporal resources available for inquiry. Whenever possible, collaborative scientific efforts should be encouraged. Research teams can coordinate their micro-level investigations to attribute new, interconnected meanings to sources, considering how the data complement one another. Finally, the findings reinforce the call for critical attention to the alignment of practices in data creation, collection, aggregation, and datafication of sources within organizational development, whether they concern the past, present, or future.

Notes

1. Starting 1910, we found yearbooks in the ICA archives (Brussels) for the years 1913, 1926, 1929, 1936. Starting 1898, the statistics are available in the ICA archives (Brussels) for the years 1929, 1933, 1949, 1958, 1960, 1962, 1964, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1974, 1975, 1977, 1978, 1979, 1981, 1982. The documents may have changed title over the years (e.g. the statistics), and the copies of the documents in the archives may alternatively be in French, German or English (for the yearbooks) or published right away in the three languages (for the statistics).

2. A random web search based on the title of the yearbook identifies regular editions ranging from 1925 to the 1970s.

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VDH: conceptualization, methodology, data curation, formal analysis, writing – original draft, writing – review & editing, funding. TDM: writing – review & editing, funding.

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