Managing Records in Enterprise Resource Planning Systems

Dr. Shadrack Katuu
Research Fellow, Department of Information Science
University of South Africa
Pretoria, South Africa
skatuu@gmail.com

***Abstract*—Enterprise resource planning (ERP) systems are increasingly being used for the management of business processes and to integrate tasks within institutions in real time. While managing and integrating processes, ERP systems generate and are expected to manage enormous amounts of data and information that should be managed in trustworthy manner. This article draws from a multi-year ERP implementation project by the United Nations to highlight some recordkeeping challenges.**

Keywords—Archival Diplomatics, Enterprise Resource Planning System, United Nations

I. INTRODUCTION

Computational archival science (CAS) is a growing discipline that is enriched by continuing research in both archival science and computation thinking subject domains. In the past this research may have happened in isolation, but it is increasingly happening in concert, enriching CAS in unique and, sometimes, unpredictable ways [16]. Scholars are continually demonstrating various kinds of computational thinking practices that can be used in archival science research and vice versa. This includes recognizing personally identifiable information; leveraging enterprise architecture in recordkeeping; detecting and preventing fake videos; and context capturing framework for the functional classification of records [6, 11, 15, 18, 21]. Computational thinking practices consist of four components: data practices, modeling and simulation practices, computational problem solving practices, and systems thinking practices [29]. Using systems thinking as a framework this paper explores enterprise resource planning (ERP) and using archival science principles to highlight recordkeeping challenges. ERP systems, some the most ubiquitous enterprise-wide systems, are based on an integrated database that provides functional modules such as financial reporting and human resources management. They are increasingly being used to tackle core management and integration tasks within institutional processes in real time [3, 19]. While managing and integrating processes, ERP systems generate and are expected to manage enormous amounts of data as well as information in architecturally complex systems. For records professionals, this requires a consideration of archival science concepts and practices to ensure efficient and effective fulfillment of their mandate. This paper examines an ERP implementation project initially conceptualized in the mid-2000s by the United Nations (UN) Secretariat to highlight some recordkeeping challenges.

II. ENTERPRISE RESOURCE PLANNING IMPLEMENTATION

Discussions on ERP systems have been ongoing for several decades, tracing their genesis in the early years of computing through to their immediate precursors, integrated control packages of the 1960s and material resource planning systems of the 1970s and 1980s [12, 14]. According to Guay [5], ERP systems have undergone four eras: the first from the 1980s to the 1990s, the second from the 1990s to the 2000s, the third of the 2010s and the fourth of the 2020s, as shown in the Table I. Deloitte [2], a global professional services firm, identified ERP systems as being at the center of modernization within institutions facing "ongoing pressures that digital transformation, user expectations, and data-intensive algorithms put on core systems in the front, mid, and back office".

A. ERP implementation in the UN

Over the last three decades a considerable number of global institutions have implemented ERP systems. In 2012, the UN's Joint Inspection Unit published a review of ERP implementation, use, and maintenance in 28 UN entities [1]. Each of these entities had its own unique implementation experience [1]. For instance, the International Telecommunication Union began its initial implementation in the mid-1980s and underwent a reimplementation in the late 2000s. The Food and Agriculture Organization began implementing its ERP system in the mid-1990s, while the International Atomic Energy Agency began implementing its ERP system in the late 2000s, and the UN Industrial Development Organization began implementing its ERP system in the early 2010s [1]. The majority of the 28 entities had either implemented Oracle, PeopleSoft, or SAP, the dominant software vendors in the market [1, 14]. For the UN entities, ERP implementation added value in four ways: streamlining and integrating business processes, improving information management and reporting, making gains in efficiency, and creating built-in internal controls [1]. There

had been a consistent call from member states in the UN General Assembly for increasing collaboration between the UN Secretariat and other UN entities, arguing that ERP implementation would facilitate exchange and synergies [1]. This is critical, considering the vast and complex network of entities that make up the UN system.

B. ERP Implementation in the UN Secretariat

The UN aims to maintain international peace and security, develop friendly relations among nations, achieve international cooperation, and be a center for harmonizing the actions of nations [23]. In order to fulfil this unique mandate and on a global scale, the UN system has six principal organs:

- General Assembly - the main deliberative organ of the UN, where all member states participate in dialogue and where each state has one vote
- Security Council - maintains international peace and security and has fifteen members, five permanent and ten non-permanent
- Economic and Social Council - coordinates the work of the UN's numerous entities dedicated to sustainable development, including regional economic and social commissions, functional commissions facilitating intergovernmental discussions of major global issues, as well as specialized agencies, funds, and programmes
- Trusteeship Council – was until the mid-1990s instrumental in the decolonization and subsequent independence of territories in Africa and the Pacific but currently only meets as and where occasion may require
- International Court of Justice – settles legal disputes submitted by member states and gives advisory opinions on legal questions referred to it by authorized UN organs and specialized agencies
- Secretariat – the principal administrative organ of the UN providing services to other organs and carries out the work mandated by them [24]

In July 2006 the UN General Assembly approved a resolution to complete an ERP implementation christened Umoja, in the UN Secretariat, and in December 2008 approved another resolution for a governance framework and initial funding [28]. Umoja has radically re-engineered how the UN Secretariat manages its administration by transforming work patterns, how it conducts its business and how it manages its resources [22]. Beginning in 2009, the UN Secretariat deployed Umoja in three main phases,

- Foundation phase, including functions such as central support services, finance and budget, procurement and supplier relationship management, and project management.
- Extension 1, including functions such as workforce management, organizational management, travel management, time management, and payroll.
- Extension 2 including functions such as fundraising, supply chain management, conference and events management, as well as strategic planning, budgeting, and performance management [28]

By 2019 Umoja had 43,639 users, with plans to increase that to 46,500 users by the end of 2020 [26, 28]. These users work in headquarter stations as well as remote duty stations in political and peacekeeping field missions across 422 locations in over 150 countries [26]. By October 2020 the total project expenditure through the three implementation phases was 540,819,924 US Dollars, as shown in Figure I [28].

Considering the large amount of effort and financial resources invested in Umoja's implementation, it is natural to expect there have been extensive oversight activities through both internal and external audits. The external mechanism, known as the Board of Auditors, has prepared nine annual reports, documenting a total of 115 audit findings [28]. Its most recent report identified 18 audit findings in the areas of project governance and management, application controls, support functionalities, and the Umoja business case [28]. In addition, the report noted that, of the 45 recommendations pending from previous audits, only 18% had been fully implemented, with 82% under implementation [27]. Since Umoja's inception, the internal audit office conducted 14 activities and documented 65 audit findings, with 84% having been fully implemented and 16% under implementation [28].

III. UMOJA AND RECORDKEEPING CHALLENGES

While the internal audit findings are not publicly available, the external audit reports provide a glimpse of the challenges Umoja implementation faces, some of which have direct or indirect recordkeeping implications.

A. Application controls

One particular concern relates to the general area of application controls that includes the management of employee master data and delegation of authority, as well as quality of data [27]. With regards to employee master data, the audit found there were six different kinds of deficiencies related to incomplete information and errors in data fields such as names, dates of birth, and information about employees' beneficiaries [27]. This would require improving the "due diligence for cross-verification with employee documentation at the time of data entry by human partners, as well as the need to improve the effectiveness of input validation controls in Umoja" [27].

Umoja was seen as one of the key enablers of a new delegation of authority framework undertaken as part of management reforms in the UN Secretariat [25]. The delegation of authority framework would decentralize "decision-making, aligning authorities with responsibilities, strengthening accountability and delegating to managers the necessary managerial authority over human, financial and physical resources to allow for effective mandate delivery", as stated in the relevant UN rules [27]. However, there was a lack of "standard mapping of the type and level of

delegated authority, requiring the provision of user access in Umoja to carry out the delegated function with a particular Umoja role or combination of Umoja user roles" [27].

Of particular concern were the findings on user role provisioning. This is an identity management process that ensures user accounts are created and given the correct permissions based on individual staff member functions and responsibilities, permissions are changed when roles change, and permissions are disabled or deleted when users no longer have institutional responsibilities [4, 17]. The audit noted there were 366 types of enterprise roles with access to entities at the global level and 196 types of enterprise roles with access to all UN entities [27]. This means that users with such roles had access to perform the functions of the roles across all the entities, not just where they were domiciled. Further, 19,921 users had been assigned these roles, which translates to over 45% of all Umoja users having the ability to access information or execute transactions with respect to all the UN entities [27]. In some cases staff members who had left the UN a year previously still had access to their previous roles and could access information and execute transactions. Given the high risk related to such widespread access, it would be necessary to deprovision user roles of staff members that had either left the UN altogether or changed positions/roles and/or locations within the UN [27]. Using the example of the 294,219 user role requests, each of which had a start and end date to determine the validity of the role, there were a significant number with missing data or wrong information in just the start and end date fields, as shown in Table II [27].

The table demonstrates there were no validation checks in the system to prevent the entry of the wrong dates or incomplete information that should manage the provisioning of roles [27].

B. Recordkeeping implications

One of the expected benefits of implementing ERP systems in UN entities would be improved information management and reporting because the systems would facilitate data consolidation and allow users to retrieve data in a timely manner [1]. However, if there are problems in the accuracy or completeness of that data, as demonstrated in the preceding section, then the queried results would not be trustworthy. According to Archival Diplomatics, trustworthiness is conferred to a record by its degree of reliability, authenticity, and accuracy, as illustrated in Figure II.

Based on the limited information surmised from the audit reports, two aspects of trustworthiness cause concern: reliability and accuracy.

- The reliability of a record is established by the completeness of the record's form and the amount of control exercised on the process of its creation [8]. Table II illustrates the extensive nature of incomplete data, specifically on user roles' start and end dates being 72% and 86%, respectively. The reliability is further undermined by the lack of validation checks in the system, to prevent blank information being entered. [27].
- The accuracy of a record is the degree to which records are precise, correct, truthful, and pertinent [9]. Of these concepts, the most immediately evident concern from Table II relates to truthfulness, which is the quality of a record whose content is in accordance with the actual state of affairs [10]. Specifically, dates values were either long before the start dates (between 1900 and 1999) or long after likely end dates (29999 to 99999). An assessment using Archival Diplomatics could have gone further by examining the aspects of Umoja business processes, in particular, using the Chain of Preservation and Business Driven Records models [20]. However, this would require access to system documentation showing the solution's architecture, work processes, and integration with other applications.

IV. CONCLUSION

ERP systems offer organizations the opportunity to adopt good practices, operational efficiency, and organizational performance, resulting in improved information management and ultimately enhanced accountability [1, 13]. However, as demonstrated by the Umoja implementation, this requires multi-year, multi-faceted efforts in planning and training and copious resources. Beyond the obvious challenges of project governance and management, there are fundamental issues related to the trustworthiness of records that need to be examined. This paper, using audit reports from the UN oversight entities, has illustrated a few of the trustworthiness challenges in user provision records. While this is not a comprehensive assessment, it demonstrates the nature of recordkeeping assessments that could be done on systems such as ERP systems. And, considering how fundamental an ERP system such as Umoja is to the operational and administrative excellence of UN entities, it is critical to ensure that recordkeeping considerations are included in the discourse of system management.

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Table I: Four eras of ERP

	1980s to 1990s	1990s to 2000s	2010s	2020s
Architecture	Fragmented	Monolithic	Holistic and integrated	Multiple platform
Integration	Complex, point to point	Tight within the solution sets	Federated, loosely coupled and "differentiated" connecting technology	Business-owned, self connecting
Governance	Fragmented	IT controlled	Business controlled	Business and IT controlled

Source: [5]

Umoja project expenditures by phase (as at 1 October 2020)

(United States dollars)

Year	*Project phase*	*Staff costs*	*Non-staff costs*
2008–2009	Project initiation	3 974 084	274 017
2008–2015	Process design	31 468 527	76 495 544
2008–2020	Infrastructure hardware	2 655 881	33 368 146
2010–2020	Infrastructure software licences and maintenance	0	60 484 981
2012–2015	Foundation	12 178 343	51 274 054
2012–2020	Integration	71 568 760	47 149 962
2014–2020	Continuous improvement and production support	39 256 877	37 453 343
2016–2020	Umoja Extension 2	30 370 949	43 846 456
Total		**191 473 421**	**350 346 503**

Figure I: Umoja expenditure from 2008 to 2020
Source: [28]

Table II: Data quality in Umoja

	Start date	End date
Left blank	• 212,952 cases, i.e. 72%	• 253,172 cases, i.e. 86%
Wrong date entered	• 41 cases - the date entered was between 2026 to 2999 • 28 cases - the date entered was between 1900 and 1999	• 6,293 cases - the date entered is 31.12.9999, i.e. 2.1% • 4,121 cases - the date entered is 31.12.2999, i.e. 1.4% • 13 cases - the date entered is 1999, yet roles were requested in 2017 and 2018

Source: [27]

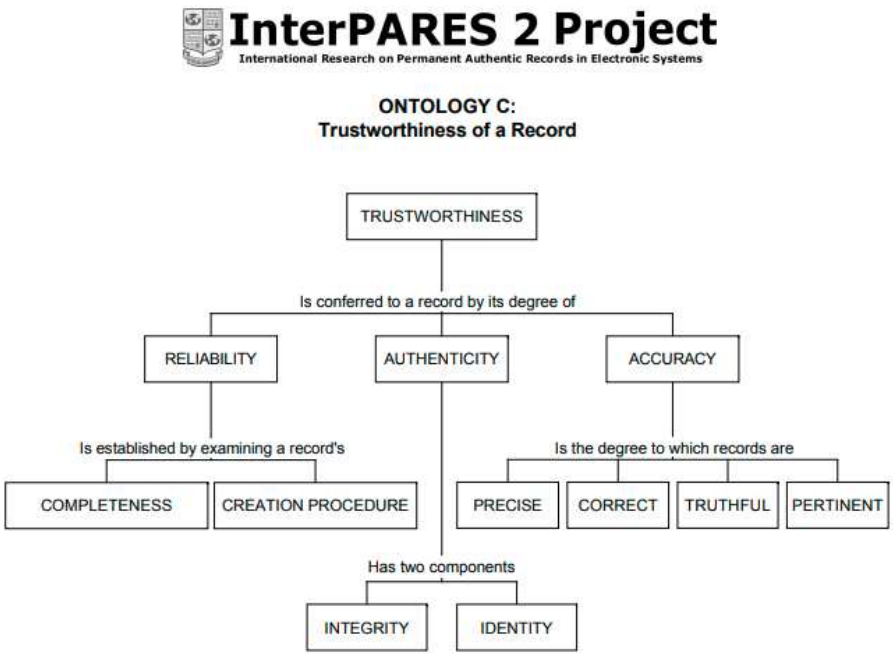

Figure II: Trustworthiness of a Record
Source: [7]