Thematic Analysis - report

This study employed a systematic theme analysis technique based on Naeem et al. (2023) framework to examine qualitative data acquired through semi-structured interviews. Thematic analysis is prominent qualitative research technique for detecting, evaluating, and interpreting patterns or themes in textual data. It helps researchers obtain valuable insights by categorizing difficult data. The six-step process in this study provided a rigorous interpretation of expert viewpoints on access control in digital product passports (DPPs), allowing for the development of a conceptual model based on real world experiences and stakeholder input. It enables the organization of complex statements into structured, understandable categories based on an interpretive constructivist research paradigm, this study took a structured method that included transcribing and familiarization, keyword selection, coding, theme development, conceptual interpretation, and model construction.

Step 1: Transcription and familiarization

The first phase involves complete transcription n of all six interviews. This manual technique allowed for deep contact with the raw data while also ensuring accuracy in gathering participant views. Each transcript was reviewed several times to ensure a thorough understanding of the subject. This introspective involvement resulted in the emergence of initial ideas, patterns, and important topics. This fundamental stage allowed for a better understanding of participants' perspectives on access control, data sensitivity, implementation issues, and trust in DPP systems.

Step 2: Keyword selection

The second phase includes the selection of keywords, were retrieved from the transcripts using Naeem et al. (2023) 6Rs model (Realness, Richness, Repetition, Rationale, Repartee, and Regal) to capture significant expressions, concerns, and contextual themes. The keywords reflected the technical, managerial, and ethical considerations mentioned by the participants.

Participant	Selected keywords
Participant 1	Confidentiality, interoperability, granularity, metadata
Participant 2	Unauthorized access, trust, fine grained control, complexity
Participant 3	Fake DPPs, insider threats, blockchain, dynamic roles
Participant 4	Stakeholder overload, traceability, market readiness, access layers
Participant 5	Governance, data sharing rules, transparency, validation
Participant 6	Digital twins, identity verification, context aware access, automation

Step 3: Coding

In this phase the keywords were organized into bigger conceptual codes that indicated recurring problems from interviewees. These algorithms were created to capture essential aspects of access control in DPP systems, and they were fashioned utilizing the security and relevance criteria proposed by Naeem et al. (2023).

Code	Related Keywords
Data Sensitivity	Confidentiality, Traceability, Metadata
Access Model Limitations	Coarse grained access, Static roles, RBAC
Flexibility and Granularity	Fine-grained control, Dynamic roles, OBAC
Implementation Barriers	Complexity, System integration, Automation
Security Threats	Fake DPPs, Insider risk, Unauthorized access
Governance and Trust	Stakeholder overload, validation, Transparency

Step 4: Theme Development

The codes were classified into higher level themes using Naeem et al. (2023) 4Rs model: reciprocal, recognizable, responsive and resourceful. These themes show cohesive patterns that convey stakeholders' main concerns about access control in DPPs

Theme	Constituent codes	Description
Theme 1: Sensitivity and control of product data	Data sensitivity, trust	Emphasizes the need for regulating access to proprietary or sensitive product data to ensure confidentiality and integrity
Theme 2: limitations of traditional access models	Access models limitations	Critiques rigid role-based models like RBAC and their inability to adapt to complex stakeholder environments.
Theme 3: Demand for flexible, context aware access	Flexibility and granularity	Highlights the importance of dynamic, ontology-based access mechanisms tailored to specific roles and contexts.
Theme 4: Demand for flexible, context aware access	Security threats	Addresses the risks of data manipulation, unauthorized access, and fake DPPs, underscoring the need for strong validation system.
Theme 5: Implementation and adoption challenges	Implementation barriers, Governance	Reflects concerns around technical complexity, low industry readiness, and lack of standardized practices in deploying advanced access controls.

Note: The themes identified from the thematic analysis is utilized for the conceptualization and model development through MOMo methodology. So, this thematic analysis for interviews is done to formulate only themes.

Reference

Naeem, M., Ozuem, W., Howell, K., & Ranfagni, S. (2023). A Step-by-Step Process of Thematic Analysis to Develop a Conceptual Model in Qualitative Research. *International Journal of Qualitative Methods*, *22*. https://doi.org/10.1177/16094069231205789