

# Using topic modeling and Computational Grounded Theory to understand collective leadership in digital transformation in a Hospital board in England

*Keywords: Topic Modeling, Grounded Theory, Collective Leadership, Digital Transformation, Executive Boards*

## Extended Abstract

**Introduction.** The NHS in England embarked in a phased, large-scale programme to improve digital maturity of Hospital Trusts since 2017 (Global Digital Exemplars - GDE and subsequent cohorts). Literature on collective executive leadership in digital transformation in the context of this programme is still emerging with only one study to date evaluating GDE [4]. This study contributes to the emerging literature by analysing extracts of a participating Trust's executive Board pack (noting only one other study reviews content of these packs [7]). By using computational topic modelling supporting human-enhanced thematic analysis, I provide a blueprint for corpus development and analysis of board level textual data. This is a preliminary study which will be enhanced further through additional validation across several NHS Trusts over the 2017-2022 period with enhanced topic modeling methods.

**Objectives.** I review the collective leadership arrangements surrounding digital transformation in a 'Fast Follower' NHS Trust in England with relatively high levels of digital maturity (as being in the 'Fast Follower', or second phase of the programme). My aim is to (i) Identify how collective leadership in digital transformation is expressed in NHS Trusts (including degree of 'divergence' or ambiguity, internal/external constructs and leadership 'turning points')[2, 6]. (ii) support and expand (currently limited) methodological advances in the use of text mining methods in leadership research [3] and Computational Grounded Theory [1].

**Methods and data.** Mixed methods, including document analysis (288-page PDF board pack), computerised text mining (through Latent Dirichlet Allocation) and grounded theory. To identify the sections more relevant to digital transformation I follow [5], who identify keywords and selects 400-word extracts from public bodies' reports and minutes to identify the relevant sections to undergo pre-processing based on [3]. I used Python© v3.11 including various libraries such as Gensim© v. 4.3.0 and Pandas© v1.5.3 to undertake topic modelling using Latent Dirichlet Allocation (LDA). I manually confirmed the results of the computational topic model by reviewing the top 20 topic words and the highest weighted document associated with each topic, adding human-centred interpretation, which is at the core of the computational grounded theory [1]. I then undertook a second, 'digital pass' to identify how data, digital, cyber technologies were referenced within the document most relevant to each LDA-identified topic.

**Results.** This Trust experienced two digitally-related collective leadership 'turning points': (i) the executive director of Finance (instead of the Chief Digital Information Officer) were set as board member in charge of digital and (ii) the establishment of a purely digital strategic

objective for the Trust for which all the organisation is collectively responsible. As reported in figure 1, LDA models identified 8 topics in the board pack and I was able to identify 'digitally related' themes. Topic analysis highlighted that (i) data and benchmarks are increasingly used to provide assurance and insight on clinical, operational and financial areas – including new, real-time dashboards; (ii) Tools of the digital age allow healthcare workers to work flexibly helping the organisation work towards the 'net zero' agenda, (iii) There is investment in software improvements to support corporate functions (such as estates).

**Discussion.** This 'Fast Follower' Trust has relatively limited public Board-level reporting directly focused on digital transformation, so the analysis of report packs provides a better approximation of the processes and impacts in clinical and corporate areas as well as their take up. Report packs highlight the leadership ambiguity emerging in terms of internally-driven objectives and reports and externally mandated discussions and how these can impact executive board membership. While this is preliminary research focused on a single hospital organisation, we postulate that more digitally mature hospitals would have higher degrees of collective leadership in digital transformation by having native, digital-related objectives, appointing a CDIO at board level position, and positively highlighting the role of information/data, digital systems and technologies to support assurance, reporting and other organisational objectives in Board discussions and reports. Further research in this space is ongoing.

Note: To protect the identity of the officials and individuals involved, the Trust is not named. Study did not require ethical approval.

## References

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Topic	LDA topic Keywords	Initial Theme (keyword based)	Digitally-linked theme (top document based)
1	reporting, patients, associated, performance, safety, healthcare, data, incidents, maternity, medicines, days, average, compliance, hospital, reported, safe, support, rates, care, cases	Performance data on maternity incidents and safety supports compliance reporting	Data quality processes (including validation and sign off) support reporting on key NHS standards.
2	digital, quality, place, systems, assurance, current, date, review, due, impact, clinical, committee, org, information, meetings, financial, controls, delivery, resulting, objectives	Digital systems support clinical and financial assurance in the delivery of organisational objectives	Established Sub-Board Digital Committee with Chief Digital/Clinical/Nursing Information officers as well as other digital senior managers have delegated responsibility to seek assurance over digital areas including strategic objectives, services, and cyber-threat protection).
3	business_continuity, organisation, policy, request, available, compliant, copy, group, management, senior_management_team, internal, system, review, bcms, scope, information, bc, following, developed, ratified	The Senior Management Team supported by an established Business Continuity Management System (BCMS) review organisational policies (a copy of which is available upon request)	IT, information and data are key components of the business continuity plan for the management of incidents in the Trust.
4	committee, assurance, digital, group, strategy, review, meeting, met, track, place, audit, reference, reports, digital_committee, plan, new, process, partially, completed, terms	Register of interests of the newly appointed executive director for digital (and finance) as well as review of the terms of reference of the digital committee.	Digital Committee working on mapping the Trust objectives to digital objectives, developing a prioritised digital roadmap and review of business case for electronic patient record systems.
5	covid, due, patients, review, impact, right, care, quality, place, date, delivery, service, current, deaths, workforce, risks, pressures, resulting, period, services	Covid impact healthcare workforce availability due to internal/external pressures impacting service quality	Winter plans supported by access to live clinical records through mobile devices for staff working in the community as well as Hospital at Home (virtual wards).
6	progress, care, work, review, data, information, actions, audit, discharge, digital, delivery, health, plan, services, learning, assurance, patients, number, service, ncepod	Review of data related to discharge services and care planning outlines elements of assurance and learning	Ensuring accessible information on mode of birth to all service users including all those digitally excluded.
7	staff, staffing, plan, data, work, ior, support, areas, health, nhs, care, winter, ics, development, ward, improve, workforce, actions, place, registered	Workforce winter plan uses data to improve ward staffing	Digital Transformation supporting Green Plan through Building Management System upgrades and remote working, with challenges in capturing and identifying data on procurement and mileage emissions.
8	performance, day, patients, cancer, care, integrated, standard, activity, indicative, data, levels, oversight, waiting, rtt, week, pressures, capacity, reported, national, risks	Referral to Treatment (RTT) data highlights cancer care pressures and reported risks	Real time performance dashboards support emergency care resilience, including forecasting and planning assumptions based on live data.

Figure 1: Topic Modeling results and themes