

Mapping Knowledge Needs of Hospital Estates and Facilities Management Teams: Insights from a Delphi Study

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Abstract: The role of Estates and Facilities Management (EFM) in the healthcare sector is often overlooked despite its crucial contribution to the efficient delivery of clinical services. This paper explores the knowledge needs of EFM professionals at different job levels within the National Health Service (NHS) in the UK. Using a modified Delphi-technique approach, we collected data from three rounds of online questionnaires with a total of 152 EFM professionals. With the use of content analysis and descriptive statistics, we identify the most commonly reported knowledge needs across different organisational levels. Hierarchical clustering heatmaps visualise these varying knowledge needs of different job roles and their priority levels, allowing for easy identification of target areas for professional development. We identify four key categories of knowledge areas, illustrating evolving needs as professionals progress in their careers. Within these areas, four trends emerged across various hierarchical levels. Firstly, a reliance on external Authorising Engineers (AEs) for *Technical Expertise & Experience*, *Benchmarking & New Technologies*, and *Professional Development* was evident, raising concerns about aligning organisational expectations with top management expertise. Secondly, the skills required for the sustainability and digitalisation agenda lack emphasis, highlighting a crucial gap between organisational strategy and practical focus. *Collaborative Proficiency* surfaced as important for Managers and Heads of EFM, underscoring the importance of interdisciplinary collaboration. However, at the Director of EFM level, there is a lower emphasis on networking and collaboration, which is in contrast to the current restructuring of the NHS towards Integrated Care Systems. Furthermore, the Directors of EFM have a strong focus on *Financial Management* skills, possibly influenced by the prevalent Board reporting structures. This focus, paired with the lack of focus on *Technical Expertise & Experience* and *Benchmarking & New Technologies* could influence the ability to secure funding for cutting-edge technologies while posing a large financial risk of relying on legacy systems. These findings underscore the need for targeted training programmes addressing these disparities and emphasise the importance of aligning organisational structures with evolving knowledge needs for effective healthcare EFM management. The research contributes to the understanding of knowledge management in organisational hierarchies and offers a framework applicable to other sectors and organisations. To enhance understanding, future studies could delve deeper into the identified trends, aiming to uncover the underlying causes and intricacies shaping the identified patterns.

Keywords: Estates and facilities management, Knowledge needs, Delphi study, Organisational hierarchy

1. Introduction

The healthcare sector operates under tight budgets and faces significant structural challenges, including workforce shortages, funding pressures, and service reconfigurations (House of Commons, 2021). While the majority of attention is typically devoted to clinical services, the crucial role of Estates and Facilities Management (EFM) in enabling the delivery of these services is often overlooked. EFM, comprising people, processes, and physical spaces (Alexander, 1996), must be effectively orchestrated to ensure the efficient utilisation of the built estate and enable clinical staff to deliver the highest possible level of clinical services.

In the context of the UK's National Health Service (NHS), EFM is responsible for 1,200 directly managed hospitals and 3,000 treatment facilities (NHS England, 2023) with a workforce of 100,000 staff (NHS, 2022). Alongside an annual cost of £11.1 billion, the NHS faces the challenge of a £10.2 billion backlog maintenance expense, all while pursuing the ambitious goal of achieving net zero carbon emissions by 2040 (NHS Digital, 2022). Addressing these challenges necessitates leveraging the collective capabilities and skills of the NHS workforce through enhanced collaboration and integration of fragmented services. However, there are several troubling aspects within the NHS EFM workforce, such as an ageing workforce (with 34% of EFM staff over 55 years), a high staff sickness absence rate, and a diagnosed skills gap (NHS, 2022). In light of these challenges, enhanced collaboration is proposed as a cornerstone of the new way of working. However, achieving effective collaboration depends on various factors, including the social, organisational, and cultural environment, and requires careful orchestration to foster widespread adoption within the organisation.

In this context, understanding the specific knowledge needs of EFM professionals at different organisational levels is imperative. Despite the recognised importance of this knowledge, there is a gap in the literature regarding the precise types of knowledge that are essential for EFM staff across various job roles within the NHS. This knowledge gap poses a significant challenge to effective workforce development and knowledge management strategies within the EFM profession, hindering its ability to formulate targeted training

programmes and KS mechanisms necessary for enhancing organisational performance and fostering effective career pathways. To address the gap in the understanding of the knowledge needs of EFM professionals at varying hierarchical levels, this study aims to identify and analyse the specific knowledge areas crucial for staff at different levels within the EFM organisational hierarchy.

The paper is structured as follows. Firstly, we summarise the existing literature on EFM, KS and knowledge types. Then, we review the methods that were used to collect, analyse, and present data for the research. Finally, we present and discuss the collected data and conclude by outlining academic and practical contributions, acknowledging the limitations of this study and highlighting further research opportunities.

2. Literature review

2.1 Estates and Facilities Management

Facilities Management (FM) involves integrating multi-disciplinary activities within the built environment and managing their impact on people and the workplace, as described by Alexander (Alexander, 1996). FM departments ensure that buildings, systems, and services support the core operations and strategic objectives of organisations, even in changing conditions. It encompasses both strategic and operational considerations and can be categorised into hard and soft FM. Hard FM focuses on the operation and maintenance of the built environment and utility infrastructure, while soft FM involves support services for an organisation's core functions, such as security or catering (Pitt and Tucker, 2008). The recent ISO 41011:2017 definition of FM emphasises its role in integrating people, places, and processes within the built environment to enhance the quality of life and productivity of individuals and the core business (Bröchner et al., 2019). This definition provides a foundation for understanding the evolving nature of FM and highlights the growing importance of creating workspaces that align with organisational objectives while promoting well-being and productivity.

In the NHS, FM is commonly referred to as Estates and Facilities Management (EFM) which reflects the comprehensive nature of the management practices employed within the healthcare setting. NHS Estates (1996) defined EFM as the practice of coordinating the physical workplace with the people and work of the organisation, integrating principles from business administration, architecture, and behavioural and engineering sciences (Keraminiyage et al., 2004). Nutt (2000) outlined four strategic directions for FM, emphasising the central resources of financial, human, physical, and information resources. The evolution of FM literature has seen a progression from (i) solely focussing on cost minimisation to (ii) integrating FM activities within organisations, (iii) focusing on resource management and supply chain processes, and (iv) ultimately emphasising alignment between organisational structure, work processes, and the built environment (Baaki et al., 2016). However, studies have highlighted the lack of KS among EFM teams in NHS Trusts, requiring improved communication and knowledge utilisation (Barlow et al., 2009; Pathirage et al., 2008). Recently, the lack of shared ownership and knowledge among multi-disciplinary teams has been identified as a barrier to effectively addressing patient safety concerns during the COVID-19 pandemic (HSIB, 2021). Overall, the FM literature emphasises the importance of strategic alignment, integration of knowledge and resources, and effective communication practices for optimising EFM operations in healthcare settings.

As visible in **Figure 1**, EFM can be broadly divided into three different management levels: (i) Directors of EFM on the strategic level, overseeing long-term planning and organisational vision, (ii) Heads of EFM and Managers on the tactical level, responsible for translating strategies into actionable plans, and (iii) Technicians on the operational management level, focused on the hands-on execution of daily tasks.



Figure 1: STO framework illustrating management levels (adapted from Anthony, 1965)

Each of these organisational levels has distinct responsibilities, and therefore, varying knowledge needs. Ensuring accurate and coordinated information flow among them is essential for effective planning, decision-making, and operational activities (Haugen and Klungseth, 2017).

2.2 Knowledge Sharing

Knowledge Management (KM) is a widely researched field in management literature that treats knowledge as a valuable resource and an opportunity to drive competitive advantage. Davenport and Prusak (1998) define knowledge as a fluid mix of framed experience, values, contextual information, and expert insight that becomes embedded in organisational routines, processes, practices, and norms. Knowledge and information are often used interchangeably, however, while information merely consists of textual or numerical data presented in different forms of media, knowledge encompasses the interpretation and application of such information within a specific context (Love et al., 2011). Research suggests that KM leads to improvements in various areas, including workforce satisfaction, efficiency, customer satisfaction, cost, and other intangible benefits (Alavi and Leidner, 2001; Al-Busaidi, 2014).

KM approaches can be categorised into the information technology perspective (often referred to as knowledge transfer) which focuses on explicit knowledge and IT tools for codification strategies, and the human resource perspective – or knowledge sharing (KS) – which emphasises tacit knowledge and personalised strategies. However, a purely IT-based approach is considered less successful as it overlooks the crucial human element in KS. The process perspective of knowledge, which considers the human element and experiences, emerges as more relevant for managing knowledge within the FM context (Pathirage et al., 2008). In the healthcare context, individual NHS hospitals require the capabilities to access and apply knowledge from other hospitals to solve tasks more effectively, efficiently, and economically (Holdt Christensen, 2007). However, when creating new knowledge sharing channels, understanding three essential elements significantly impacts the dynamics and success: (i) the type of knowledge shared, (ii) the member connection and identity, and (iii) the integration of KS with daily work (McDermott, 1999). Davenport (1998) echoed this, stressing the importance of carefully considering each significant type of information and process in the organisation. Therefore, to determine the most suitable KS system for NHS EFM, it is essential to (i) identify the intended recipient based on task similarity and context, (ii) understand the nature of the task in terms of its routine and frequency, and (iii) recognise the type of knowledge being transferred (Dixon, 2000).

2.3 Knowledge Types in FM

Compared to many other built environment professions, in the FM literature, there is a lack of defined knowledge areas “required to structure a unified body of knowledge” (Hauptfleisch and Verster, 2011, p. 15). In this regard, Awang et al. (2014) reviewed the academic literature and various guides from professional bodies and FM associations, providing a summary of the core areas of knowledge for FM professionals in higher education systems. These encompass eight core competencies: (i) leadership and management, (ii) managing people, (iii) understanding the business organisation, (iv) operation and maintenance, (v) managing premises, (vi) managing services, (vii) managing resources, and (viii) managing the working environment (Awang et al., 2014).

However, these areas of FM knowledge are not directly transferable to hospital EFM, as the impact on patient care and safety requires a higher level of regulation. Therefore, we supplemented the eight areas of knowledge by reviewing hospital EFM guidelines published by professional bodies and the UK NHS. We compared Awang et al.’s (2014) review with general FM guidelines (IFMA, 2020), the Estate management competency framework (Department for Education (DoE), 2023) and specific guidelines for NHS EFM staff including (IHEEM and HefMA, 2021; NHS, 2023; NHS Employers, 2023).

While previous analyses did not provide a granular view of the varying knowledge priorities across organisational levels within EFM, we also reviewed the “Essential skills and competencies” of four job descriptions – spanning from operational to strategic level – which are listed in the Career Route Map developed for NHS EFM professionals (IHEEM and HefMA, 2021). To judge the required proficiency of certain knowledge areas across the managerial levels, we looked closely at the wording within the job descriptions and captured the levels of required proficiency using the Harvey balls, as visible in **Table 1**. From the analysis, we can observe three distinct patterns of priority for the knowledge areas. At the core of EFM competence lie foundational, cross-functional knowledge areas that possess universal relevance across all organisational levels. As EFM professionals progress up the organisational ladder, certain knowledge areas gain prominence specifically at the tactical and strategic levels. These progressive knowledge areas encompass specialised

domains such as Financial Management, which become pivotal for decision-making and strategic implementation. Conversely, there are knowledge areas that are more critical in day-to-day operational tasks and become less important as one advances within the organisational hierarchy. Of the 15 identified knowledge areas in the review of the literature, only *Environmental & Sustainability Awareness* is not mentioned in any of the job descriptions of the NHS Career Route Map.

Table 1: Knowledge areas mapped to organisational levels (grouped by patterns across organisational levels)

Organisational Level	Knowledge Area (ranking from ☺ = basic, ☹ = proficient, ☾ = experienced, ● = excellent)	Technician/ Tradesperson	Estates Manager	Head of EFM	Director of EFM
Cross- Functional	Communication Skills	☾	●	●	●
	Collaborative Proficiency	☾	●	●	●
	Legal & Regulatory Knowledge	☹	☾	●	☾
	Organisational Skills	☾	●	●	●
	Technical Expertise & Experience	☹	●	●	●
	Problem-Solving	☺	●	●	●
Tactical/ Strategic	Strategic Management & Planning		●	●	●
	Benchmarking & New Technologies			☾	☹
	Financial Management			☾	●
	Leadership & Team Management			●	●
	Human Resource Management				●
	Resilience & Risk Management				☾
Operational	Data & Information Management	☹	●		
	Professional Development		☹		
?	Environmental & Sustainability Awareness				

2.4 Research gap and Question

NHS EFM teams are facing significant challenges such as workforce shortages, budget constraints, and environmental sustainability goals. To address these challenges, EFM professionals require knowledge in a diversity of domains. Effective intra-organisational KS processes need to be aligned to the type of knowledge to be shared (Dixon, 2000). Previous research highlights general FM competencies (Awang et al., 2014; Hauptfleisch and Verster, 2011), but their translation to the specific, life-critical, and regulated context of hospital EFM remains unexplored. The analysis of the job descriptions in **Table 1** suggests differing knowledge requirements for strategic, tactical, and operational hospital EFM staff. To study the actual knowledge requirements as perceived by EFM professionals, this study addresses the research question: *What specific types of knowledge are important for staff at different levels within the EFM organisational hierarchy?* By exploring this question, our study contributes essential insights vital for informed workforce development and knowledge management strategies within the hospital EFM profession.

3. Methodology

To identify the importance of knowledge areas to staff groups within NHS EFM, we employed a Delphi-technique approach. This consensus method enables us to effectively address complex problems by leveraging the collective opinions and judgments of individuals (Linstone and Turoff, 2002). Given the demanding schedules of EFM staff and the 24/7 operation of hospitals, the Delphi-technique proves to be a more suitable approach compared to in-person methods. To address the geographic dispersion of participants across various hospitals, we designed a modified Delphi-technique with three rounds of online questionnaires as visible in **Figure 2**. The study protocol was reviewed and approved by the University of Cambridge Department of Engineering Research Ethics Committee and the NHS Health Research Authority (REC: 22/HRA/1079).

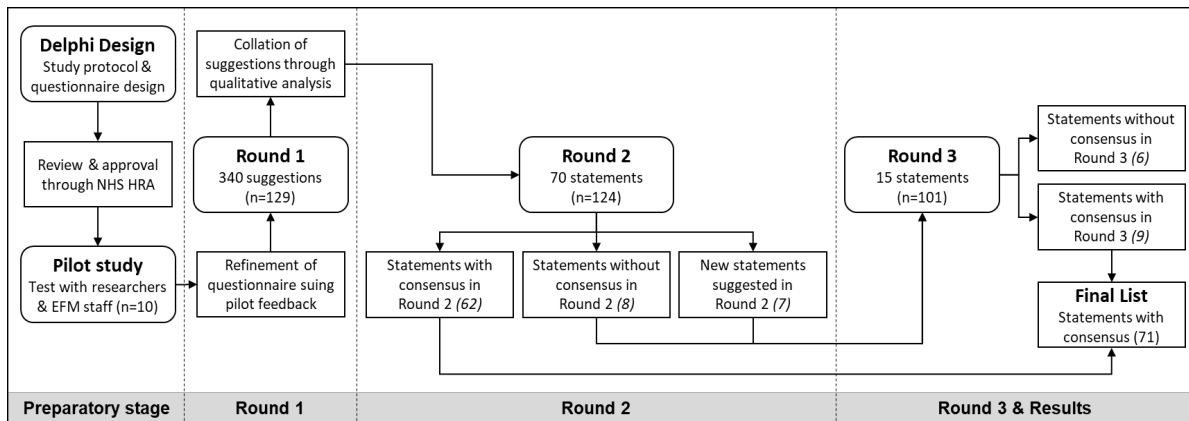


Figure 2: Flow chart of customised Delphi-technique across three rounds

3.1 Participants

Participants for the study were selected based on their professional roles, targeting NHS EFM staff by collaborating with NHS England, the Health Estates and Facilities Management Association (HEFMA), and the Institute of Healthcare Engineering and Estates Management (IHEEM). In total, 152 EFM professionals participated across three rounds. **Table 2** provides a breakdown of participant demographics and characteristics. In order to simplify the complex array of job roles and titles in the NHS, whilst still capturing the diversity of EFM job levels, participants were categorised into five sub-panels based on their NHS Band Level (BL) according to the Career Route Map designed by IHEEM and HEFMA (2021). To ensure accurate classification, participants were asked to select the sub-panel that best describes their current role in Round 3.

Table 2: Participant demographics in the Delphi study across three rounds

Category	Characteristics	R1 (n=129)	R2 (n=124)	R3 (n=101)
Gender	Male	78%	80%	78%
	Female	21%	19%	21%
	Non-binary	1%	1%	1%
Age	younger than 35 years	11%	7%	6%
	35-44 years	14%	12%	10%
	45-54 years	29%	35%	33%
	55 years and older	47%	45%	51%
Job level	Technician (BL2-6)	26%	21%	14%
	Manager (BL7-8a-b)	36%	31%	35%
	Head of Estates (BL8c-d)	10%	12%	11%
	Director of Estates (BL8d-9)	20%	27%	27%
	Authorising Engineer	9%	9%	14%
Trust Type	Acute Trust	51%	51%	45%
	Authorising Engineer	10%	10%	12%
	Combined Trust	9%	11%	12%
	Community Health Trust	12%	7%	10%
	Mental Health Trust	10%	11%	12%
	Contractors	5%	6%	7%
	Other (incl. ICS, CCG)	3%	4%	3%

3.2 Study Procedure

As visible in Figure 2, the study encompassed three rounds of questionnaires conducted using the online survey software Qualtrics. In Round 1, 129 participants participated and were asked to suggest relevant knowledge types to their work, resulting in 340 suggestions. These were qualitatively coded and consolidated into 70 statements. In Round 2, the responses from Round 1 were presented to 124 participants, who ranked the different statements on a Likert scale ranging from 1 (not at all important) to 5 (extremely important). Given the relative heterogeneity of the participants, consensus was determined using a bespoke grading system informed by Haywood et al. (2021) and Stubbs et al. (2022). The three levels of consensus included overall consensus (median >3.5 and interquartile range (IQR) ≤ 1 across all participants), partial consensus (median >3.5 and IQR ≤ 1 among at least one sub-panel), and no consensus (no panel with median >3.5 and

IQR ≤ 1). Following this grading system, 61 statements achieved consensus in Round 2, while the remaining 8 statements without consensus, alongside 7 new statements suggested by participants in Round 2, were carried forward to Round 3. In Round 3, participants received a questionnaire containing descriptive statistical outcomes from Round 2 and were given the opportunity to reassess their opinions in light of the perspectives of the different sub-panels. The ranking and consensus procedures in Round 3 followed the same approach as Round 2. 101 participants voted on the 15 remaining statements, of which 12 statements achieved consensus. The Delphi process was concluded after three rounds.

3.3 Data Analysis

For this study, we considered 69 statements that reached at least partial consensus among the Trust-internal staff in Rounds 2 and 3. Due to the scope limitations of this study, we aggregated the individual knowledge statements into the knowledge areas synthesised in Table 1. The analysis focuses on the variations and commonalities in knowledge areas among the five sub-panels: Technicians, Managers, Heads of EFM, Directors of EFM, and Authorising Engineers (AE). Along median and IQR, we calculated the percentage agreement to enable a visual analysis of the descriptive data. The percentage agreement represents the proportion of participants within the sub-panel who rated statements as “very important” or “extremely important”. To aggregate the data into knowledge areas, we averaged the individual statements in each knowledge area. After that, heatmaps for the importance of the knowledge areas across the five Delphi sub-panels were created using the “Pheatmap” library in the R software (Kolde, 2019), as visible in Figure 3. The heatmaps provide a visual representation of the average percentage agreements of the different knowledge areas, utilising a colour gradient (red/amber/green) to facilitate the exploration of patterns and relationships. The heat map clusters rows (knowledge areas) by similarity – using the Euclidean distance (square root of the sum of squares of the differences between rows).

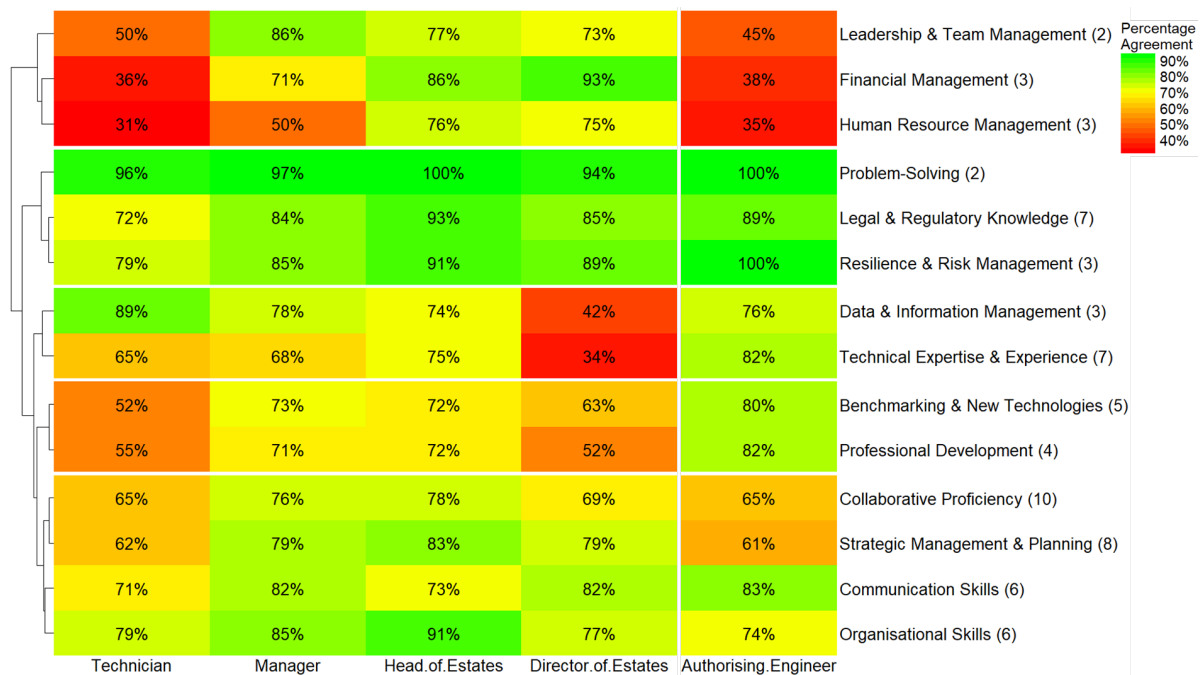


Figure 3: Hierarchical clustering heatmap showing the importance of 14 knowledge areas to five sub-panels

4. Findings and Discussion

This section examines how knowledge priorities change as EFM professionals progress through different job levels. We identify five overarching categories: (i) cross-functional, (ii) operational, (iii) tactical/strategic, and (iv) expert knowledge areas. To enrich the quantitative data and underline the observed trends, we use qualitative comments from participants.

Firstly, five knowledge areas emerge as pivotal across all organisational levels, called foundational knowledge areas – these include *Communication Skills*, *Legal & Regulatory Knowledge*, *Organisational Skills*, *Problem-Solving*, and *Resilience & Risk Management*. Across all organisational levels, the majority of participants (>70%) rated knowledge statements within these knowledge areas as very or extremely important to their day-to-day

activities. Within these knowledge areas, there are a couple of knowledge types that are less important on the operational levels. For example, less than half of the Technicians rated *Negotiation skills (Communication Skills)* as important for their work. This shows that despite the importance of communication skills for all EFM staff, there is a need for continuous learning for advanced skills which should be emphasised in training programmes, especially as individuals progress to higher seniority levels. *Communication Skills* “should be a core skill of any in-house estates manager [but are] not something taught on surveying/ estates-related courses” (Director of EFM).

Secondly, we identified five progressive knowledge areas that increase in importance as EFM professionals advance within the organisational hierarchy. Interestingly, four of those – namely *Strategic Management & Planning, Leadership & Team Management, Human Resource Management, and Collaborative Proficiency* – only increase in importance from the operational to a tactical level, but then drop off in the transition to the strategic level. *Leadership & Team Management* are most important at the Manager level and then decrease from Manager to Director of EFM level. A possible explanation for this could be that Managers have more day-to-day supervisory responsibility for Technicians compared to Heads of EFM. However, a Manager reported that they do not necessarily feel appropriately prepared for these responsibilities, stating “I often need to lead without being a line manager [...]. That is an area some people struggle with [and which] needs better understanding.” In contrast, *Human Resource Management* is most important at the Director and Head of EFM level, as they hold responsibilities for staffing budgets while only moderate proportions of Technicians and Managers perceive HR-related knowledge as relevant to their jobs. While some Managers feel that “it is beneficial to know [about HR planning], but it can be supported by [HR] specialists”, comments from a Head of EFM reveal a different perspective: “We [do HR planning] ourselves without HR involvement.”

Collaborative Proficiency stands out as a vital knowledge area for both Managers and Heads of EFM, reflecting the significance of inter-disciplinary and inter-organisational collaboration. A Head of EFM reflected that “to plan any strategy we need to link with colleagues in other fields not just restricted to ICT, Finance and HR but clinical colleagues, too.” Despite this importance, another Head of EFM emphasised that they often feel that collaboration is “more important to me than perhaps the team.” Managers, however, expressed challenges since there is “often limited time to network with [peers] and share learning.” This discrepancy becomes more striking at the Director of EFM level, where surprisingly, there is reduced emphasis on collaboration, despite the NHS's push for strategic alignment among regional Trusts through the Integrated Care System (ICS). Interestingly, *Strategic Management & Planning* does not have the highest perceived importance at the Director of EFM level but at the tactical level which was elaborated by a Head of EFM highlighting that “some top management wouldn't know how to write [reports], so it's easy to push responsibility to lower grade staff.” The fifth among the progressive knowledge areas – *Financial Management* – is the only one that is perceived as most important at the Director of EFM level. For example, all Directors of EFM considered *Constrained budget management* as very or extremely important.

Thirdly, there is one regressive knowledge area which has the highest importance at the operational level. As Technicians progress to Manager roles, *Data & Information Management* becomes less relevant due to less responsibility for manual data recording and organisation. In the NHS Long Term Plan published in 2019, the NHS puts a strong emphasis on technology and digital transformation, stating that “people, data and technology are crucial to the ongoing evolution of our NHS.” (NHS, 2019). To fulfil this vision, digital skills at higher organisational levels are imperative to leverage technology and data for the advancement of healthcare services.

Fourthly, *Professional Development, Technical Expertise & Experience, and Benchmarking & New Technologies* have the highest importance to AEs. This is partly reflected in the role description where the AE is described as the “independent professional adviser to the healthcare organisation” (Department of Health, 2014, p. 9). This was underlined by a Director of EFM stating: “Most Directors will have one specialist knowledge from the route they developed through [but they] cannot have operational knowledge of all services.” Therefore, Directors of EFM heavily rely on support from AEs. The time constraints faced by top management staff could be an explanation for the shifting focus: “I have done [training] in the past, but [have] less time to do so at my level” (Head of EFM). However, the data suggests a strong reliance on the *Technical Expertise & Experience* of AEs even though these are technically only required to “provide an annual audit” (Department of Health, 2014, p. 9). Heads of EFM tend to be the ones that perceive *Technical Expertise & Experience* as most important within NHS Trusts as they are often responsible for compliance and require specialist knowledge to provide assurance: “I need specialist knowledge for the topics I am responsible for [...] to have an understanding of what trade staff are doing” (Head of EFM). In the area of *Benchmarking*, EFM staff also rely on AEs who – with

large client portfolios of NHS Trusts – are perfectly positioned to compare the performance of clients. However, in their role as independent experts, they can be conflicted when advising NHS Trusts on *Future technologies & their availability* as well as *Appropriate suppliers & technologies*. Within NHS Trusts, there seems to be a lack of support for NHS staff seeking for new technologies, as highlighted by a Manager: “It is left to my own personal reading – I never see any guidance on [future technologies]”. Relying on outdated legacy IT systems poses a substantial financial risk, as emphasised in a recent analysis by Government Security. The study estimated a significant financial jeopardy, ranging from £13-22bn over the next five years for the entire public sector, with a considerable portion attributed to the NHS (Cabinet Office, 2021).

Lastly, as observed in **Table 1**, *Environmental & Sustainability Awareness* was not suggested as an important knowledge area by any participants. This is alarming since the NHS was the first healthcare system to commit to a net-zero carbon target, stating that an “upskilled workforce will be needed to drive and implement the interventions” (NHSE/I, 2020, p. 41). However, the sustainability agenda has not yet reached the priorities of EFM managers at any level, and the lack of guidance from the central NHS further exacerbates this disconnection between overarching organisational goals and on-ground focus. This critical area demands urgent attention and strategic alignment.

5. Conclusion

This paper has sought to answer the research question: *What specific types of knowledge are important for staff at different levels within the EFM organisational hierarchy?* The results of the study reveal interesting trends in the knowledge areas across hierarchical levels within the EFM profession. **Figure 4** presents four broader categories of knowledge areas that show distinct patterns in terms of their importance at different job levels, highlighting the shifting priorities of EFM professionals across organisational levels. In addition, *Environmental & Sustainability Awareness* was included to illustrate the absence of priority on this strategically important topic. In conclusion, our analysis of knowledge priorities within EFM has uncovered intriguing patterns and disparities.

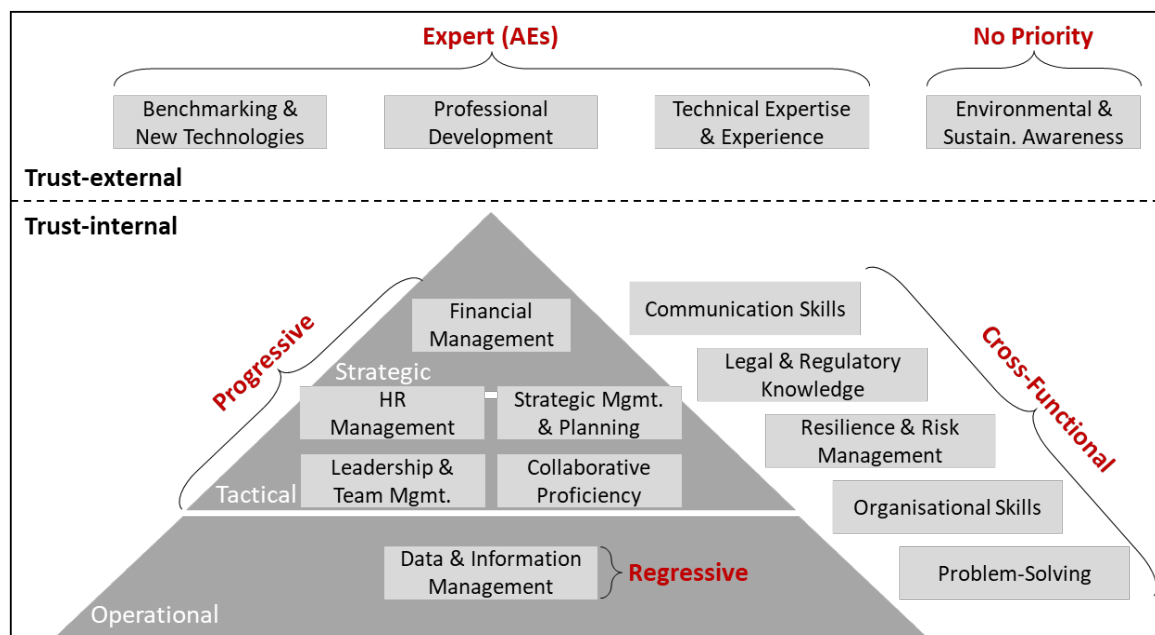


Figure 4: Summary of identified knowledge priority patterns (in red) across organisational levels of EFM

Reliance on External Experts

NHS staff heavily rely on external AEs for (i) *Technical Expertise & Experience*, (ii) *Benchmarking and New Technologies*, and (iii) *Professional Development*. In contrast to the trends observed in job descriptions, our study reveals a strong decrease in priority for *Technical Expertise & Experience* as professionals ascend from Head of EFM to Director of EFM level. This finding raises significant questions, especially considering the importance of technical proficiency and authority in advocating for crucial EFM issues at the board level. This shift in priorities warrants further exploration and understanding to align organisational expectations with the necessary expertise required at top management levels. The reliance on AEs regarding *Benchmarking & New*

Technologies needs to be addressed since it will be difficult to identify and effectively operate state-of-the-art technology if the organisation heavily depends on external experts or consultants who spend very limited time in the Trusts and also do not necessarily understand the local building context to the same degree as internal EFM staff. Especially at the Director of EFM level, there needs to be a better understanding and appreciation of the technologies and industry trends to make sure that appropriate funding budgets are allocated.

Lacking Focus on Sustainability & Digitalisation

Environmental & Sustainability Awareness is not a priority across all organisational levels, while *Data & Information Management* lacks emphasis on higher organisational tiers. Addressing these disparities between sustainability goals and on-ground focus is essential for strengthening the EFM workforce and bridging the skills gap. Furthermore, the findings confirm the sustainability and digitalisation skills gaps identified in the NHS Workforce Action Plan, reinforcing the need to develop “training programmes to develop [...] social, technical and digital skills, for example, Net Zero Carbon skills” (NHS, 2022, p. 9).

Need for stronger Priority on Collaborative Proficiency

Collaborative Proficiency emerges as crucial for Managers and Heads of EFM, underlining the necessity of interdisciplinary and inter-organisational collaboration; however, challenges in networking and prioritisation become evident, particularly at the Director of EFM level, despite the NHS’s emphasis on strategic alignment via the Integrated Care System. This will need to be addressed to turn around the “continued failure to embrace integrated care systems” (Stein et al., 2020, p. 2)

Strong emphasis on Financial Management by Directors of EFM

Directors of EFM appear to predominantly focus on financial matters, possibly because many Directors of EFM do not sit on the Trust Board but report through the Directors of Finance. These organisational structures can lead to a “conflict of interest since the Director of EFM is also our Finance Director” (Director). This can impede the ability of EFM teams to advocate for and secure funding for state-of-the-art technologies.

5.1 Contributions

This study makes a significant academic contribution to the field of EFM by identifying the varying knowledge needs across hierarchical levels within the profession. By uncovering these differences, the study provides a more nuanced understanding of the learning areas that are critical for career pathways in EFM. This contributes to the existing body of literature by enhancing our understanding of KM in the context of organisational hierarchies. Additionally, the evidence-based approach employed in this study offers a framework for designing targeted KS solutions that can be adapted and applied to other sectors or organisations, expanding the practical applications of this research.

The findings have important practical implications for KS and professional development. By clearly outlining the most important knowledge areas for specific staff groups, this research provides valuable guidance for designing professional development courses that address the specific needs of staff in diverse roles. This can guide managers and practitioners in designing tailored professional development plans for staff at various levels in the EFM domain, facilitating effective career pathways and enhancing organisational performance.

5.2 Limitations and Further Research

We acknowledge that the individual knowledge statements were condensed into overarching knowledge areas to align with the limited scope of the paper. While these areas were derived using extensive literature reviews (Awang et al., 2014; Hauptfleisch and Verster, 2011) and NHS guidelines for EFM, it might be valuable to reconsider these areas in light of the study’s findings to ensure their accuracy and relevance. For example, further research could employ hierarchical clustering techniques to analyse the individual statements, allowing for the identification of more nuanced trends and knowledge areas that hold specific importance for different EFM roles.

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