
Edinburgh Napier
UNIVERSITY
PlusEquals5
Report
2025

Executive Summary

The 2025 PlusEquals5 conference brought together professionals from across Scotland's tech ecosystem and beyond to explore how software engineering must evolve over the next five years. This report synthesises the key insights from industry leaders, academics, and public sector representatives who participated in the event hosted by Edinburgh Napier University. Six major themes emerged from the discussions:

AI as Transformative Partner

AI is reshaping software engineering from a code-writing discipline to one focused on workflow orchestration, human-AI collaboration, and ethical reasoning. Engineers must develop new literacies around prompt engineering and AI evaluation while maintaining critical thinking skills.

Essential Skills Evolution

The modern software engineer requires a blend of technical depth and broad collaborative capabilities. Communication, cultural awareness, and systems thinking have become core competencies rather than desirable extras.

Technical Foundations in Context

Cloud infrastructure, cybersecurity, and legacy system integration demand not just technical knowledge but understanding of financial, human, and organisational success factors.

Human-Centred Design

Successful software systems must account for cultural context, user experience, and diverse needs. Engineers must develop empathy, cultural literacy, and inclusive design capabilities.

Educational Transformation

Software engineering education must shift from content delivery to problem-based learning, integrating communication training and socio-technical awareness throughout the curriculum.

Wider perspectives

Software engineers need greater awareness and familiarity with the wider context of their work including international, political, sectoral and environmental perspectives.

Introduction

The inaugural PlusEquals5 conference, hosted by Edinburgh Napier University, was conceived as a forward-looking forum to explore the future of software engineering over the next five years. Bringing together professionals from industry, academia, and the public sector, the event aimed to foster critical dialogue around emerging technologies such as artificial intelligence, cybersecurity, cloud computing and automation, and to explore their implications for the skills, roles, and responsibilities of software engineers.

PlusEquals5 is a response to the accelerating pace of technological change. As new tools and paradigms continue to reshape the digital landscape, the conference provided a timely opportunity to examine how software engineering must evolve to remain relevant, ethical, and impactful. The event combined keynote addresses, breakout sessions, and panel discussions to explore key issues from AI-driven development to the challenges of sustainability and inclusion in tech.

For Edinburgh Napier University, the conference represents a strategic step in strengthening its engagement with industry. By opening channels for collaboration and foresight, PlusEquals5 supports the university's broader mission to align education and research with real-world needs. It ensures that graduates are not only equipped with current competencies but are also prepared to adapt to future demands in a rapidly changing field. Looking ahead, the vision for PlusEquals5 is that it becomes a fixture in the Scottish tech calendar as a space where innovation, education, and industry converge to consider the future of software engineering in a five-year rolling window.

The purpose of this report is to capture the main lessons from the conference through a thematic synthesis that integrates perspectives across sessions. The insights reflect primarily the Scottish and UK context, drawing on speakers' experiences across sectors from local government to international markets. While many themes have global relevance, they are grounded in the specific challenges and opportunities facing Scotland's tech ecosystem. A list of speakers is provided at the end of the report and more information can be found on the conference website, https://plusequals5.napier.ac.uk, and YouTube channel, https://www.youtube.com/@PlusEquals5.

1. The Transformative Role of AI in Software Engineering

The conference's discussions on artificial intelligence revealed a fundamental shift in how software engineering work is conceived and practised. Rather than viewing AI as merely another tool in the developer's toolkit, speakers consistently described it as a transformative force that requires engineers to reimagine their roles and capabilities.

1.1 AI as Collaborative Partner

Tom McLaughlin described AI as a "disruptive coding partner", capable of producing thousands of lines of functional code at near-zero cost. This shift, he argued, requires engineers to move beyond writing code toward orchestrating workflows, managing context, and iterating alongside AI in real time. The implications extend far beyond productivity gains to fundamental questions about what skills define professional competence.

Lucy Batley focused on the creative and ethical implications of generative AI, illustrating how prompt engineering - knowing how to phrase a query or structure a request - has become a critical new form of literacy. While AI can support ideation and automate production, she stressed that human judgment must remain central, particularly in contexts involving meaning, ambiguity, or ethical trade-offs.

1.2 Embodied AI and Physical Systems

Ingo Keller introduced a hardware-focused perspective, drawing attention to “embodied AI" in the form of humanoid robots and physical agents. He argued that engineers must now learn not just to code systems, but to train them, developing adaptive behaviours, managing feedback loops, and ensuring safety in dynamic environments. This shift demands interdisciplinary knowledge, spanning machine learning, hardware integration, psychology, and ethics.

The emergence of embodied AI highlights how software engineering is expanding beyond traditional boundaries into domains that require understanding of physical systems, human psychology, and social interaction.

1.3 From Code Writing to Workflow Orchestration

McLaughlin warned that while AI can be a powerful tutor and assistant, it can also suppress learning if it eliminates the trial-and-error cycles that promote understanding. To learn effectively with AI, engineers must actively push both themselves and their tools to the edge of failure. In a fast-paced environment where AI can be exploited to handle mundane tasks, the concept of the "personal learning rate" may become a means of judging the software engineer's competence.

A transition from code writing to workflow orchestration represents a fundamental shift in professional identity. Engineers must develop new skills in prompt design, AI evaluation, and human-AI collaboration while maintaining the critical thinking abilities that distinguish professional judgment from automated output.

1.4 AI in Critical Industries and Risk Management

Bruno Castro described the use of AI in process safety and digital simulation, showing how it enables risk modelling and operational foresight in critical industries such as oil and gas. These applications highlight the power of AI to augment human decision-making under pressure, provided that engineers understand the assumptions, limitations, and social context of their models.

Mark Jackson and the Future Engineers Panel pushed back against fatalistic narratives about AI replacing jobs. Instead, they proposed that the future belongs to "AI-augmented engineers" – those who can harness these tools thoughtfully, maintain foundational technical knowledge, and apply human judgment to complex, high-stakes problems.

2. Essential Skills for the Modern Software Engineer

The discussions around AI and technological change naturally led to broader questions about what skills will define successful software engineers in the coming years. A clear consensus emerged that technical proficiency alone is insufficient; engineers must develop a broader range of capabilities that enable them to work effectively in complex, human-centred systems.

2.1 Learning Agility and Adaptation

The modern software engineer must be as adept at learning as at coding. Chris Oldnall, Ceri Shaw, and Tom McLaughlin each offered perspectives on how traditional training models fall short. Oldnall argued that engineering education must be embedded in real workplace contexts, giving learners the chance to engage with uncertainty, messy data, and shifting requirements. McLaughlin suggested that the key skill for future engineers is the ability to learn fast and pivot across domains.

This emphasis on learning agility reflects the accelerating pace of technological change and the need for engineers to continuously adapt their knowledge and

2.3 Systems Thinking and Ethical Reasoning

Across the AI discussions, the emerging vision for the future software engineer was one rooted not in syntax mastery, but in systems thinking, ethical fluency, and human-AI co-creation. Lucy Batley's position was reinforced by the Plenary Panel, who cautioned that without intentional design, the integration of AI into society risks reinforcing inequality or automating harm.

The need for ethical reasoning capabilities is a consequence of the growing recognition that software systems have profound social and political implications that extend far beyond their technical specifications.

2.2 Communication and Collaborative Intelligence

The ability to communicate clearly and empathetically emerged as one of the most consistently valued skills across the conference. Ceri Shaw made the case that communication breakdowns rather than technical flaws are the root cause of many software project failures. Her call for communication training within engineering degrees was grounded in both theory and practice: she pointed to the prevalence of neurodivergence in tech and the need to design inclusive environments where everyone can contribute effectively.

Chris Oldnall added that communication is not just about clarity but about confidence and context. Apprentices in his programme are taught not only to code, but also to explain their choices, reflect on their process, and connect their work to wider business goals. This meta-cognitive layer of understanding not just how to do something, but why it matters was presented as a hallmark of future-ready engineers.

2.4 The "Tree-Shaped Engineer" Profile

The Future Engineers Panel echoed views on adaptability and contextual awareness. Panel member Andrew Spratt proposed the image of the "tree-shaped engineer" - a professional with deep technical roots and a broad canopy of adjacent capabilities, including ethics, communication, and strategic thinking.

This metaphor captures the balance between technical depth and broad collaborative skills that speakers identified as essential for future success. It suggests that engineers need both the deep technical knowledge to solve complex problems and the broader awareness to understand how their solutions fit into larger human and organisational contexts.

3. Technical Foundations in a Connected World

While the conference emphasised the importance of broader skills, speakers also highlighted how traditional technical domains are evolving to require new forms of expertise. The discussions revealed that success in areas like cloud computing and cybersecurity increasingly depends on understanding not just technical architectures but also human, financial, and organisational factors.

3.1 Cloud Infrastructure and Financial Literacy

The cloud is now foundational to modern digital systems, but its growing complexity has introduced a new kind of engineering challenge. As Ben de Mora explained, the flexibility of cloud infrastructure often masks its financial and architectural risks. Engineers who fail to understand how their deployments affect costs can inadvertently undermine sustainability, security, or service quality. De Mora made the case for introducing cloud financial literacy into software engineering education, including topics such as consumption models, commitment pricing, and usage forecasting.

Mark Jackson highlighted the evolution of cloud platforms from vendor-specific tools to open, collaborative ecosystems, often involving multiple providers and shared service models. This evolution requires engineers to think beyond individual technologies to understand how different services integrate and interact.

3.2 Cybersecurity as Human-Centred Design

Security was framed not just as a technical issue but as a human and organisational one. Jeff Watkins offered a compelling analysis of how most breaches stem from psychological manipulation rather than system flaws. He urged a shift from punitive awareness campaigns to compassionate, user-centred design that makes secure behaviour easy, intuitive, and sustainable. Rather than viewing users as liabilities, Watkins argued they should be seen as collaborators in a shared security ecosystem.

Jamie Mincher echoed this human-centric perspective, focusing on the industrial sector. He explained that as manufacturing systems become more connected, they expose previously isolated environments to new forms of cyberattack. Legacy systems that were never designed to face the internet must now be secured, often without disrupting mission-critical processes. Consequently, engineers need to understand cybersecurity as a design constraint rather than a last-minute add-on.

3.3 Legacy Systems and Modern Integration Challenges

Matthew Rowe brought a public sector perspective to infrastructure challenges, describing the transition from heavily customised legacy systems to configurable cloud-based solutions in local government. He noted that success depends not only on technical skills, but also on change management, user training, and long-term governance.

These examples from the Scottish public sector illustrate how technical transformation must account for organisational culture, user capabilities, and long-term sustainability considerations that extend beyond pure technical merit.

4. Human-Centred Design and Cultural Competence

The conference's emphasis on human-centred approaches reflected a growing recognition that technical excellence alone is insufficient for creating successful software systems. Speakers consistently highlighted how cultural awareness, user experience, and inclusive design have become fundamental engineering competencies rather than specialist concerns.

4.1 Understanding Context and User Experience

Several speakers warned that systems designed without regard for culture, context, and lived experience are destined to fail. Bruno Castro and Jamie Mincher both described how technical solutions were sometimes met with resistance not because the tools were flawed, but because they did not fit the working practices or expectations of their users. Castro emphasised the importance of UX and training in the successful adoption of simulation technologies, while Mincher described how rigid corporate tools often clash with factory floor realities.

4.2 Inclusive Design and Neurodiversity

Ceri Shaw focused on the human dimension closer to home, advocating for communication training that takes neurodiversity seriously and equips students to collaborate across difference. This insight connects to broader themes of inclusive design that ensure systems work for diverse users and teams and reflects the need to create environments where different types of thinking and communication can contribute effectively.

4.3 Cross-Cultural Engineering and Global Markets

Stuart Harwood offered a deeper cultural analysis, explaining that in countries like Egypt and Morocco, success depends as much on relationships as on architecture. Trust is built face to face, deals are negotiated over coffee, and business flows through informal channels like WhatsApp. Ignoring this context, he warned, leads to friction, delay, or outright failure.

Harwood described how his company's entry into North African markets revealed both the promise and the complexity of working across borders. He highlighted the need for local partnerships, cultural sensitivity, and flexibility in everything from procurement to project planning. While the UK has deep expertise in digital infrastructure, Harwood noted, it is often underrepresented in emerging markets due to media narratives, risk aversion, or lack of incentives.

This perspective from Scottish companies working internationally illustrates how cultural competence has become a practical imperative for engineers working in global markets, not merely a matter of social responsibility.

4.4 Building Trust Through Relationships

The Future Engineers Panel spoke about the importance of reverse mentoring and intergenerational knowledge exchange, highlighting how younger engineers can introduce tools and trends, while more experienced colleagues offer judgment and systems thinking. Ingo Keller added that as robotics and AI become more physically present in people's lives, the need for empathy, ethics, and social intelligence will only grow. The implication is that successful engineering teams require not just technical diversity but also different perspectives, experiences, and ways of thinking about problems.

5. Educational Transformation and Future Pathways

The insights around skills, technology, and human-centred design naturally led to discussions about how software engineering education must evolve. Speakers consistently argued that current educational models are inadequate for preparing students for the challenges they identified, requiring fundamental changes in both content and approach.

5.1 From Content Delivery to Problem-Based Learning

For software engineering education, this implies that curricula must shift from static content delivery to dynamic, enquiry-driven models such as problem- and project-based learning. Students should be taught how to ask good questions, not just give correct answers, and to navigate ambiguity with creativity and confidence.

Such a pedagogical shift acknowledges that in a rapidly changing field, the ability to learn and adapt is more valuable than mastery of specific technologies or frameworks.

5.2 Integrating Technical and Soft Skills

Several speakers called for education to evolve accordingly. Future programmes must include training in prompt engineering, AI evaluation, socio-technical systems, and collaborative design. These are not just technical skills; they are critical capacities for navigating an increasingly intelligent and interconnected world.

The Plenary Panel added that interdisciplinary skills are especially vital as engineers become responsible for increasingly complex, public-facing systems. Communication should be seen as a technical skill in its own right underpinning collaboration, design, documentation, and leadership.

5.3 Graduate Apprenticeships and Real-World Learning

Graduate apprenticeships and hackathons were cited as effective formats for developing the "tree-shaped engineer" profile, blending technical rigour with feedback, reflection, and human contact. Chris Oldnall's emphasis on workplace-embedded learning provides a model for how education can better prepare students for real-world challenges. It reflects the particular strengths of Scotland's apprenticeship system and the existing close connections between educational institutions and industry that characterise the Scottish tech ecosystem.

6. Global Perspectives and Societal Impact

While the conference drew primarily on Scottish and UK experiences, speakers consistently emphasised that software engineering today operates in a global context with significant societal implications. The discussions revealed how local technical decisions connect to international systems and global challenges.

6.1 International Collaboration and Standards

Software engineering today is a global activity technically, economically, and politically. Bruno Castro discussed how simulations and digital twins are being used in high-risk industries to forecast events across international boundaries. He introduced the idea of the "industrial metaverse", a shared virtual space that enables geographically dispersed teams to collaborate on complex, safety-critical systems.

The Plenary Panel rounded out this theme by calling for greater international cooperation between public and private sectors. They argued that truly sustainable and inclusive digital transformation requires shared platforms, open standards, and a willingness to invest in under-served regions.

6.2 Environmental and Social Responsibility

The discussions suggest that tomorrow's software engineers will need to understand infrastructure not just as code, but as policy, procurement, and environmental footprint. The Plenary Panel's emphasis on carbon impact and data sovereignty shows the growing awareness of technology's environmental and social consequences. These concerns align with broader Scottish and UK policy priorities around net-zero emissions and responsible technology development.

6.3 Geopolitical Considerations in Digital Infrastructure

Jamie Mincher spoke about the legal and operational implications of globalisation, particularly in manufacturing and industrial sectors. He described the challenge of complying with overlapping and sometimes contradictory cybersecurity and data regulations. His talk underscored the importance of engineers understanding legal and regulatory environments, not as abstract constraints, but as practical boundaries that shape what is possible.

Stuart Harwood brought a global dimension to cybersecurity discussions, sharing lessons from building cybersecurity infrastructure in North Africa. His team's experience of navigating unstable regions, working with nascent regulatory systems, and facing logistical hurdles highlighted the operational realities of deploying secure systems outside the UK. He emphasised that local context, political nuance, and trust-building are essential parts of any effective security strategy.

6.4 The Public Sector Digital Transformation

Matthew Rowe provided a real-world example from the Scottish public sector, describing how cross-functional collaboration is vital in local government. Engineers in his team must frequently explain technical decisions to non-technical stakeholders, adapt to changing political priorities, and support services that impact people's lives directly. Because of the heightened need for accountability, the public sector digital transformation in Scotland provides clear examples of the socio-technical role of software engineers.

7. Synthesis: The Engineer as Socio-Technical Bridge

The conference discussions revealed a clear consensus that the future of software engineering lies not in choosing between technical excellence and human understanding, but in synthesising them into a new form of professional practice. This synthesis represents both the greatest challenge and the greatest opportunity for the profession.

7.1 Essential Skills for Future Software Engineers

The Plenary Panel articulated the idea that software is never neutral. It shapes, and is shaped by, the people who use it. This fundamental insight drives the transformation of required engineering competencies from purely technical to inherently socio-technical.

- **Core competencies** must shift toward systems thinking and contextual awareness rather than just syntax mastery. The conference revealed strong consensus that adaptability, continuous learning capabilities, critical thinking, and creative problem-solving are no longer desirable extras but fundamental requirements. Engineers must develop the ability to navigate ambiguity with confidence, moving beyond traditional technical boundaries.
- **AI and human-AI collaboration skills** have become essential. Future engineers need prompt engineering and AI evaluation capabilities, human-AI co-creation abilities, and deep understanding of socio-technical systems. This represents a fundamental shift from viewing AI as a tool to understanding it as a collaborative partner.
- **Communication and interpersonal skills** must be treated as technical competencies. Communication should be seen as a technical skill in its own right, underpinning collaboration, design, documentation, and leadership. Engineers need structured reflection and dialogue practice, feedback management and conflict resolution capabilities, and leadership skills that bridge technical and human domains.
- **Cultural and ethical awareness** has emerged as fundamental to engineering practice. Future engineers must develop cultural literacy and sensitivity to diverse contexts, ethical fluency and awareness, understanding of how systems impact real human needs, and humility in design approaches. This reflects the global and interconnected nature of modern software systems.

7.2 Transforming Software Engineering Education

The conference speakers outlined a comprehensive vision for educational transformation that addresses both pedagogical approaches and curriculum content, drawing on the particular strengths of Scotland's educational system and industry connections.

- **Pedagogical approaches** must fundamentally shift from static content delivery to dynamic, inquiry-driven models. Students should be taught how to ask good questions, not just provide correct answers, with focus on learning how to learn rather than memorising facts. This reflects the rapidly evolving nature of the field and the need for continuous adaptation.
- **Curriculum integration** requires expanding beyond traditional technical training. Future programmes must include training in prompt engineering and AI evaluation, integrate behavioural science, ethics, and international standards, add structured reflection, dialogue practice, and communication tools, and incorporate human-centred design principles throughout the curriculum.

The vision that emerges is of engineers as socio-technical bridges, capable of translating between human needs and technical possibilities while working effectively in diverse, global contexts.

7.3 Moving Forward

The insights from PlusEquals5 provide a foundation for understanding how software engineering must evolve, but implementation will require sustained effort from multiple stakeholders. Educational institutions, industry organisations, and individual practitioners will need to evaluate how these insights apply to their specific contexts and develop appropriate strategies for transformation.

The conference established important themes and directions, but the work of translating these insights into concrete changes in curriculum, hiring practices, professional development, and organisational culture will be an ongoing process that individual organisations must undertake according to their own circumstances and priorities.

The success of this transformation will depend on continued dialogue between education and industry, sustained investment in new approaches to learning and development, and a commitment to viewing technical excellence and human understanding as complementary rather than competing priorities.

This report reflects primarily Scottish and UK perspectives on these global challenges, drawing on the experiences of speakers working across diverse

sectors from local government to international markets. While the insights have broader relevance, they are grounded in the specific context of Scotland's tech ecosystem and its connections to global markets. Individual organisations will need to evaluate how these insights apply to their specific contexts and determine appropriate next steps for implementation.

Speakers

Lucy Batley, Founder, Traction Industries

Bruno Castro, Technology Manager, Santane

Ben de Mora, Head of FinOps Advisory, UK & Ireland, IBM

Stu Harwood, Head of Professional Services, Siker

Geoff Huggins, Director of Digital, Scottish Government

Mark Jackson, Chief Technology Architect, Oracle

Ingo Keller, Head of Robotics, The National Robotarium

Simon Libby, Structural Geology Analyst | Digital Innovation Specialist, WSP

Tom McLaughlin, Applied AI Solutions Architect, Tomoro

Jamie Mincher, Managing Director, Arc Additive

Vicki Moir, Head of Talent, Firefish Software

Chris Oldnall, Consultant, Direct Tech Training

Matthew Rowe, Case Management Solutions Lead Officer, Fife Council

Ceri Shaw, Fractional CTO, Thistle Labs

Andrew Spratt, COO, FPSG

Jeff Watkins, CTO, CreateFuture

Andrew Williams, CEO, Fyne Labs and Chair, ScotlandIS

Sponsors

The organisers gratefully acknowledge the support of the organisations and companies who have contributed to the success of the inaugural PlusEquals5 conference, especially our Gold and Silver sponsors.

Call for Participation

The next PlusEquals5 will take place on Thursday 2nd April 2026 at Edinburgh Napier University's Craiglockhart Campus. We welcome early proposals for talks, panel sessions or workshops. Please send your session outline to plusequals5@napier.ac.uk.

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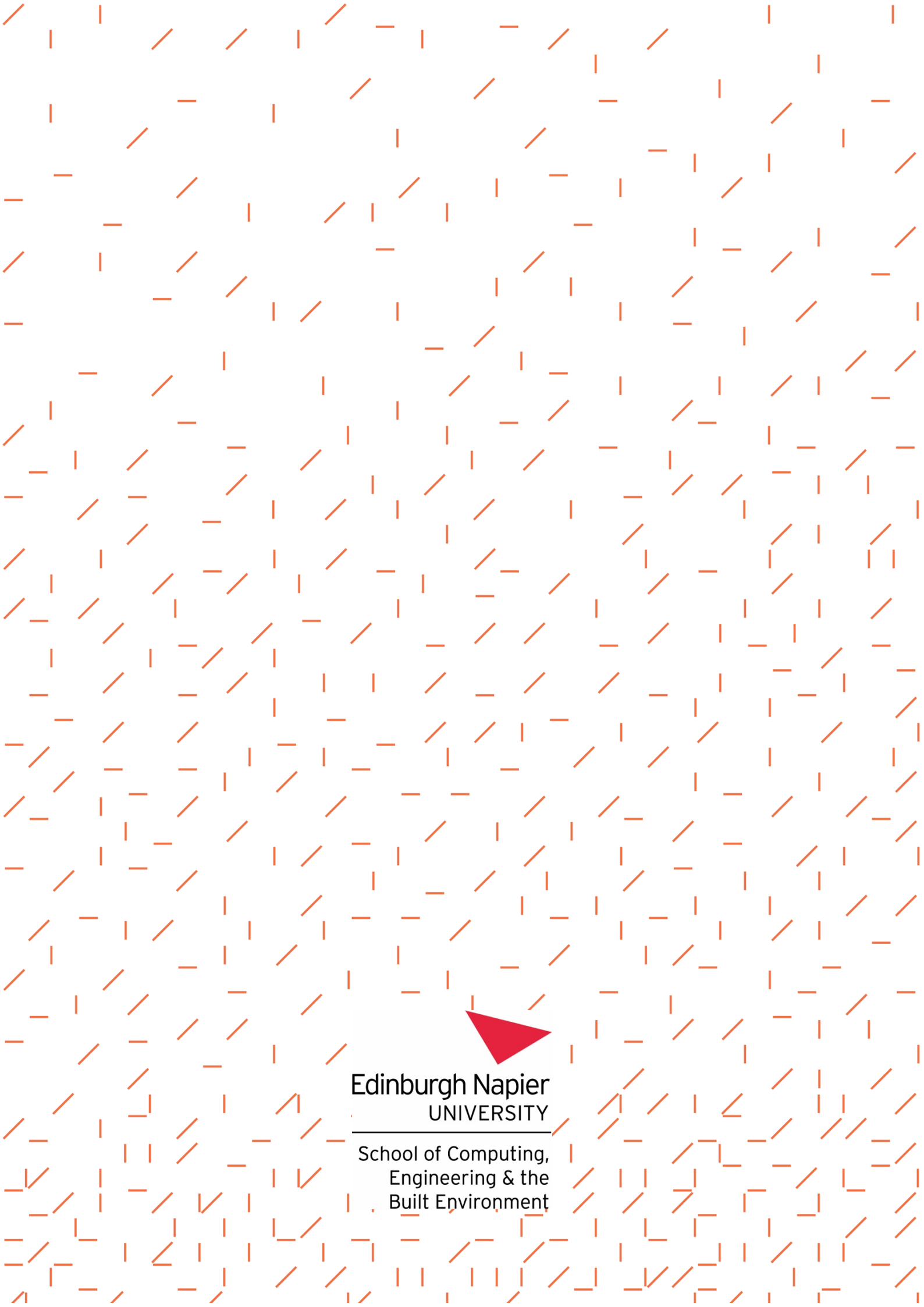

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