Communicating Digitalised Supply Chain Transparency: Towards a Guide for Fashion SMEs

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Abstract. The digitalisation of fashion supply chain transparency has gained increased attention in recent years. Technology solutions that have arisen based on advanced technologies and Web3 include smart tags, forensic tracers and blockchain platformisation. Whereby current reports discuss supply chain transparency from the perspective of the data, technical solutions and policy [1, 2], little attention is given to the fashion firms that are to adopt these technologies. Finding themselves in the midst of the supply chain transparency polemic, small to medium brands are still at a loss as to transformation and communication strategies [3]. This paper examines the standpoint of the small-scale brand, its challenges and needs in the face of digital transformation and lays the groundwork for the development of Web3 technology adoption guidelines–that can ultimately form, not only part of their implementation but also their communication strategy. Applying the theoretical framework of organisational theory, it provides evidence of successful practice through case study methodology. The study contributes to knowledge of organisational theory in the context of adjusting to rapid and complex change triggered by both external and internal demands for adopting advanced technology.

Keywords: Supply chain transparency · Smart tags · Blockchain platformisation · Organisational strategy

1 Introduction

> "Digital transformation is a team sport that needs a gameplan to coordinate strategies in the face of change" [4].

Textile supply chains (SCs) are notoriously complex and remain stubbornly opaque. Yet calls for greater transparency are demanded through the adoption of digitalisation. Large scale fashion conglomerates have already approached the challenge, but small and medium sized enterprises (SMEs) are still grappling with the enormity of the task. New software programmes are exponentially entering the market but how the SME is to navigate all the options and integrate already complex operations remains unclear.

N. Sabatini et al. (Eds.): FACTUM 2023, SPBE, pp. 68–79, 2023.
https://doi.org/10.1007/978-3-031-38541-4_7

This study investigates the applications currently available and initiates a rationalisation of the process of onboarding digital tools that will improve a firm's environmental/social/governance (ESG) strategies, provide veracity to the data that is communicated, and advance supply chain transparency for the industry at large.

SCs customarily deploy paper-based, data systems that are fragmented and operate in silos. Typically, brands only have access to Tier 1 (garment manufacturers) and to an extent, Tier 2 (fabric suppliers') data. The lack of integrated data transfer systems has obscured extensive problems within the industry. Meanwhile, demand for more transparency has increased among consumers [5]. In response to these pressures, many firms have made unverified claims–which in turn has led to allegations of greenwashing. In the interests of meeting United Nations sustainable development goals (UNSDGs) and forthcoming legislation in many jurisdictions, it is essential that supply chains become responsible and accountable. An ideal way to do so is through transparency–and digitalisation offers a swift path forward. However, achieving SC transparency is a complex operation. Large firms enlist the assistance of consultancies–that either have in-house experts. or engage sub-contractors that can select, operationalise, and implement appropriate software systems. Small firms are unlikely to take this route because of lack of resources. As the experience of smaller firms is under researched (and yet constitute the majority of firms in the industry), the subject of this study is the SME. The objective of the study is to assemble knowledge that streamlines transformation to digital SC transparency and subsequently, openly facilitates the communication of that effort.

The paper first examines the academic literature as well as white papers produced by technology providers on extant Web3 technologies related to SC transparency. It discusses the business drivers for change including the need for compliance, forthcoming legislation, public relations, and communications (including the fear of reputational damage through greenwashing) as well as external pressures from both competitors and consumers. The study argues that SMEs are very willing to adopt SC transparency, but that adoption needs direction, governance, consistency, security, simplicity and ultimately a set of integrated principles to guide the onboarding of digitalisation.

2 Literature and Context

This review examines scholarly and grey literature that considers the business drivers for digitalising SC transparency including the need for compliance, forthcoming legislation, public relations, and communications arising from external pressures and internal values. Papers are predominantly selected from the UK and EU as these territories provide most relevance to SMEs in the region under examination. This geographic zone has been chosen because it is currently undergoing the most significant revision of transparency legislation globally. The study argues that despite the existing literature there are few comprehensive and effective guidelines that navigate the complex organisational task of adopting digital transformation. Few studies present key parameters to SMEs for onboarding technology in a consistent, simplified, and secure manner while guaranteeing compliance and ensuring that sustainability values are upheld, notwithstanding the subsequent communication to the consumer.

2.1 Compliance, Legislation, and Due Diligence

Various jurisdictions have been grappling with standardisations and regulations regarding SC transparency, due diligence, corporate responsibility, and textile waste management including France, The Netherlands Norway and the UK [6]. In 2007, France was the first territory to impose Extended Producer Responsibility (EPR) on producers of textile waste. France's Environmental Code (Code de l'Environnement) includes EPR projects and the new Anti-Wastage and Circular Economy Law, controlling textile and fashion waste [7]. The EU Strategy for Sustainable and Circular Textiles outlines the vision and concrete actions required to ensure that textile products placed on the EU market by 2030 are durable and recyclable, made from regenerated fibres to the greatest extent possible, are free of hazardous substances, and are produced with respect for social rights and the environment [8]. 'The specific measures will include Ecodesign requirements for textiles, clearer information, a Digital Product Passport and a mandatory EU extended producer responsibility scheme' [8].

2.2 Data, Public Relations, and Communications

As part of the proposal for an Ecodesign for Sustainable Products Regulation (ESPR), the concept of the Digital Product Passport (DPP) will be introduced with the intention of improving the traceability of products and providing consumers and manufacturers with access to all relevant product information [9]. A DPP is a textile product communication tool that facilitates the exchange of SC data between stakeholders such as brands and businesses, public authorities, consumers, NGOs, and the public. A DPP is defined as 'a set of data specific to a product that contains the information and is accessible via electronic means on a data carrier' [8]. By the end of 2022, it was expected that additional details regarding the EU Strategy for Sustainable and Circular Textiles would become available [1]. Data sharing is the most important step and can range from informing a customer on the origin of a product shared via the information contained in a QR code to communicating all stages and tiers of the SC [1].

2.3 External Pressures and Technology

Supply chain traceability solutions consist of Web3 (blockchain or cloud-based) platforms plus input and data readers (RFIDs, QR codes, forensic markers etc.) that offer digital mapping and visualisation tools, as well as material, batch, and product traceability, and facility profiling. The platforms are used to consolidate and verify chain-of-custody documentation (transaction certificates, scope certificates, and associated sustainability standards). Platforms like these, sometimes referred to as repositories or 'data lakes' (e.g., Microsoft Azure) are mostly hosted by tech giants and offer space to contain all the 'big data' that may be useful to the user. Big data refers to larger, more complex data sets, particularly from new data sources, that are so extensive that conventional data processing software is incapable of managing them. The platforms that hold the data also enable application programme interface (API) integration with organisations' internal systems. APIs are the programmes that can read and deliver selected information from a data repository to the user (in this case, supply chain stakeholders).

Constructing a Web3 ecosystem, choosing a Web3's entry point in the SC, articulating the value of the platform, constructing the governance and security model, exploring legal implications, and scaling the network are crucial activities when designing a digital SC system [10] –yet quite daunting to the SME without an IT department. According to Pedersen et al. [11], the most significant obstacles to launching a Web3 project are determining which advanced technologies to implement and how to customise them. Building on the observations of Zhi Lia et al. [12] some existing fashion management programs such as Product Lifecycle Management (PLM) and Enterprise Resource Planning (ERPs) systems (often already used by SMEs) could offer a head start. This study argues that the selection and integration of the capabilities and features must be dictated by the needs to be met. Building on observations by Casino et al. [13] - who state engagement, innovation, situational context, smart systems, and modification of the technology are additional factors to consider when applying technology appropriately - this study considers the increasingly complex operations that face the SME.

Finally, security, privacy and the safety of trade secrets is a primary consideration for brands. Web3 favours the sharing economy. By making data accessible to more parties, its value lies in its use and exchange. Its premise (like the Internet) is decentralising, and therefore may be viewed as undermining the competitive advantage that can be gained by guarding trade secrets [14]. However, a Web3-designed platform can also enable a reliable and controllable data-sharing protocol. It is claimed by the tech giants that host the platforms, that parties retain complete control over their data and the ability to grant access to their business partners, thereby not only ensuring security but creating new economic opportunities [15].

2.4 Digital Transformation and Communication

Woven into the context of digital transformation is the deployment of eCommerce, social media marketing and social commerce, adding the public facing dimension to the communication of sustainability credentials. Kalbaska et al. [16] consider three distinct layers in which fashion interacts with information and communication technologies: 1.) design, production, and distribution of fashion products. 2.) marketing and sales. 3.) co-creation with stakeholders. This study encompasses layers 2 and 3 of this framework and extends the layers by adding details regarding the communication of supply chain information by means of digitalisation.

2.5 Research Question

The comprehensive, digital capabilities available for transparency, coupled with the proliferation of buzzwords used by the press, can be daunting and confusing to the fashion SME. Therefore, this paper aims to shed light on the following question: *What are the parameters needed to develop guidelines for the digitalisation of SC transparency for fashion SMEs - and the sub-questions: Where and how can the technologies be deployed within the firm? How do the technologies satisfy forthcoming legislative requirements and regulations? And how can the firm communicate this information to verify their transparency claims?*

3 Research Design

3.1 Theoretical Constructs

Organisational theory has a mature history and several branches. Organisational theorists consider the diverse array of organisational designs, their leadership, capabilities (such as the capacity to innovate, learn, and adapt), processes (such as decision making), and outcomes (including for whom), as well as the emergence and establishment of new organisational designs [17]. According to GreenwoodHinings et al. [17] organisational theory examines the relationship between organisations and their environment, and the effects of these relationships on organisational functioning. Organisational theory provides a suitable construct for the examination of SMEs adopting digitalised SCs because in recent years, organisational theorists have been applying their knowledge to 'grand challenges' and influencing practice [17]. This study will view the current and anticipated activities of the firms in relation to their SC strategies from an organisational theory perspective and its related foundations, that is, regulations, collaboration and communications.

3.2 Methodology

In research, the theoretical case study approach can be used to elaborate on a company's adoption of a new system, to explore management views and perceptions of a new initiative or process development, or to investigate management attitudes and experiences of a new initiative or service development [18]. Case study methodology enables in-depth, multifaceted examinations of critical topics in their actual settings [18]. In the fields of business, law, and policy, the value of the case study method is widely recognised, whereas in SC research, this appreciation is rather less prevalent. Taking a qualitative approach, the study analyses the current state of Web3 technology adoption by SMEs as well as mid-sized businesses[1] [19]. The participants have been selected because they are most prevalent in the region examined and have a significant effect on the local economy [19]–but also incline not to engage consultancies therefore have a need for impartial information. The purpose of presenting detailed critiques, typically of one or more firms, is to provide insights into aspects of the business and to illustrate that broader lessons are to be learned. This in turn supports the theoretical lens applied to this study, that is, organisational theory, which encompasses organisational design, governance, proficiencies, innovation, adaptation, processes, and consequences, as well as the emergence and establishment of new organisational models.

This study presents 5 case studies of fashion SMEs and mid-sized firms to enhance its analysis of common practices and actions. After documenting data from the 5 cases, themes and evidence began to repeat, which indicates a saturation point was reached.

[1] The definition of Mid-Sized Businesses is based on annual revenue ranging between £25 million and £500 million. The upper limit for the definition of a SME is set at £25 million, while £500 million was chosen as the threshold for these "smaller" large businesses. Note, however, that the definition of a small to medium-sized enterprise (SME) under the Companies Act requires two of three criteria to be met: revenue (less than £25 million), employees (less than 250), and gross assets (less than £12.5 million) (gov.uk, 2012).

Semi-structured interviews with CSR sustainability coordinators of small to medium fashion firms, technology start-ups and industry bodies serve as the primary source of data, complemented by conversations and observations made during industrial engagement events hosted by the authors. The fashion firm interviewees were selected from the regional Northwest of the UK. This region has a history of textile manufacture but has been in decline in recent years [20]. However, those that have 'survived' current economic downturns, plus political and social pressures, have been exemplary in their striving towards sustainable business models. For this reason, the firms were considered ideal for uncovering potential new insights into sustainable SC practices. In addition to 45-min personal interviews conducted post pandemic (from March - December 2022), secondary sources such as sustainability reports, corporate documents, and online analysis were accessed to collect data, thereby strengthening the overall findings. The most pertinent themes in the interviews were categorised based on observed common patterns. Accordingly, the content was divided into three main themes underpinned by organisational design theory, namely regulations, communications, and collaboration among enterprises.

4 Findings

The five case studies below evidence the basic organisational and operating details of the firms followed by their particular SC transparency issues. The firms are called 'Groups' as they are mostly overarching entities that represent a group of brands. Many themes in the findings were common to all firms. In the interests of clarity and significance, those that were unique to each firm are presented here.

4.1 Case Study Group 1

This fashion group is the largest digital retailer and financial services provider in the United Kingdom, with annual sales of £200 million and over 1.9 million daily website visits. The company sells over 1,900 well-known brands, has 4 million mid-market customers, and delivers 49 million products annually. The CSR coordinator discusses some of the challenges in documenting supply chain data:

> We have done our Tier 1 collection–but it is still hard to get to Tier 2. In addition, we have a due diligence procedure in place that examines self-assessments so that we can determine where the greatest risks are and what we need to do to ensure that we are observing those possible risks within the supplier base. We are using software, so we have an online platform that we use to map the supply chain and we also work with the Open Apparel Registry (OAR) which has been really helpful for us (CSR co-ordinator).

The open access OAR platform permits the company to share the information with suppliers, customers, and other retailers. This is a completely managed and independent centralised database, so they are keen to continue providing support. They expressed the need for an education piece - a set of principles is desired to help develop communications to a universally accessible level.

4.2 Case Study Group 2

This group designs, sources and wholesales own-range and branded fashion and homewares as well as providing financial services. Annual sales amount to £100 million across 10 brands. In recent years, the group has implemented a significant transformation programme to become a lean, digital organisation. Their Environmental, Social, and Governance (ESG) strategy was rebranded in 2021. The 'Our People' pillar focuses on colleagues, customers, and other business and supply chain stakeholders. The 'Our Planet' pillar focuses on products that are as sustainably sourced, produced, and transported as possible. Nonetheless the company faces challenges in furthering its transparency communications:

> What surprises us for an online retailer is that we've got all those systems that don't talk to each other - so there's not one central point that you could pull from and that's what we're working through at the moment. We're working through having a robust system that everybody can update within one place and all use. If someone could potentially offer a platform or collaborative open platform where everybody can upload their information and be able to share that resource - so that if we were dealing with Next or New Look or M&S all of our information would be there and almost like a universal platform that we could refer to (CSR co-ordinator).

The firm feels lifting the data is still going to be quite time consuming. They also question the accuracy and reliability of the data.

4.3 Case Study Group 3

Group 3 is a global outdoor clothing manufacturer/wholesaler that is owned privately and encompasses 7 brands. The brand sells via e-commerce, through its own stores and concessions, and through major outdoor retail chains. They associate with select business partners who share their guiding principles and values regarding modern slavery. This is reflected in the Supplier Code of Conduct. In addition, they encourage all collaborators to create their own CSR plans, which the group reviews annually with them to evaluate progress. As the group exports internationally, they are particularly concerned about forthcoming EU legislation:

> In the light of forthcoming legislation in France, Norway and Ireland we are interested in producing a digital passport for the garments we export to France and the EU. We need to show recycling information as well as fibre content. Recycled content claims should show the percentage of recycled content and the proof. Garment packaging will also require information on the product passport. We will need to generate reports particularly on data capture methodologies. There are 3 ways of thinking about this: Research data, LCA and specific factory info. The data points include IoT, diversity, water, CO2 energy and soil quality. How will we find and measure CO2 data? (Supply chain manager).

The appetite to consider digital solutions is apparent. They would be interested in reviewing any digital solution that captures all the specific data they might need for a digital product passport.

4.4 Case Study Group 4

Group 4 has reintroduced cotton spinning to the United Kingdom. They use high quality cotton lint–Sea Island cotton from Barbados, Suvin cotton from India, Pima cotton from the United States, Giza cotton from Egypt and Australian cotton–to spin yarns for luxury fabrics and garment makers, enabling knitters, weavers, and designers in the UK to source home-spun quality yarns.

> Midway through 2016, our mill was outfitted with the most advanced and efficient cotton spinning equipment. We are keen to work with new innovations but how will you stop the media from cutting this down? All these new ideas and they stop them before they even get started! Which of the systems will survive? Our product is honest and transparent, and we can absolutely show any consumer that product and trace it back into the field it was grown (Founder and CEO).

The firm feels that the level of control they need to demonstrate the veracity of their claims is very difficult because they are not running other people's business. They have adopted a pragmatic approach–ensuring the control of their own brand and effectively keeping this information distinct from others. This may be difficult to reconcile in a 'data lake' scenario.

4.5 Case Study Group 5

This group is a foundation that was set up to support improvements across all areas of the leather value chain from farms to slaughterhouses, chemical companies, and manufacturers to consumers-across global geographies-and to connect the information from farm to finished product–a service that had not been available in the industry before.

> We are industry-driven and consumer-centric. Our innovative, integrated Transparency Dashboard™ is at the centre of the foundation. Our Dashboard is connected to an audit certification standard that evaluates the compliance and performance of companies operating within the leather value chain in relation to sustainability - cooperation among competitors and enhanced infrastructure between firms. Revised terms of cross-disciplinary communication drives the data collection so when we go out and deliver an audit, we can put the data in in one place and it will automatically update the dashboard (Founder and CEO).

The beauty of the dashboard is that this is a dynamic platform-this is not just a snapshot taken once every two years, which is often the case with audits and certifications. The information can update in real time but in order for this to occur, the data needs to work more efficiently with APIs.

5 Discussion

The study finds that firms are already conducting due diligence into their SCs, which implies they are ready for digital transformation. To optimise SC transparency, it is proposed that a roadmap to adoption should include information on cross-disciplinary communication, competitor cooperation, and improved arrangements between firms. To accomplish this, SMEs will need a pathway to technology adoption that is not onerous, but rather, readily accessible, easily deployed, and ensures success. Todeschini et al. [21] remark that small businesses that begin with low-stakes technology, invest in more sophisticated technology at a later point to aid their growth. Organisations can develop their Web3 capabilities by beginning with simpler applications and or adapting in-house applications such as plug-ins to PLM or ERP systems, and advancing to (or replaced by) increasingly complex, innovative, and transformative applications such as forensic tracers and blockchain. Rationalising legacy systems would also improve efficiencies and save resources. In answering the research question: *What are the parameters needed to develop guidelines for the digitalisation of SC transparency for fashion SMEs* this discussion returns to the themes of organisational design, and arranges this discussion under the topics of governance, proficiencies, innovation, adaptation, processes, and consequences.

Governance

Group 3 had been using the Higg index as this they felt was the best standard available to date. However, the Higg index is not scientific, as it is self-proclaimed. Unfortunately, the index offers only generic data on Life Cycle Assessments. With this flawed information source, they wonder how to educate or communicate with the consumer. The banking sector, investors and insurers also prefer to see supply chain transparency to avoid negative reputational exposure. The firm's supply chain and CSR coordinators feel they need easy, harmonised and globalised directives; sustainability information and benchmarks need to be in one place and standardised. They also are aware that they need to comply to the Triman logo[2]. This suggests that governance is required in two related areas: the level of transparency, privacy and security needed in the supply chain itself, as well as the governance of the data–in particular the 'big data' submitted to large data repositories that are subsequently to be shared with other businesses and then consumers.

Proficiencies and Processes

Group 1 has considered placing QR codes on labels to increase transparency and traceability throughout the process. They are collaborating with their label provider to determine the repercussions. This is significant as many forms appear to onboard IT systems without a rigorous evaluation and testing programme. Furthermore, labelling would only give them clarity as it moves through the production process, not from raw material to finished product, and they believe that is where the gap lies. According to the form's observations, platforms like SEDEX had tried to rectify this issue, but then retailers started imposing their own requirements which resulted in adapting the audit methodology and demanding slightly different parameters that would only work with certain

[2] The Triman logo is a mandatory, unified sign for end-of-life products that was mandated by French Decree No. 2014–15733 to harmonise the different collection systems in France.

audit partners. They feel there is a big piece of work that could be done in the retail space to rectify this, and that would be helpful in terms of the Tier 2 and Tier 3 due diligence process.

Innovation
Group 5 believes that the digital process makes people more accountable. They believe that when firms are considering innovation of process this helps them to identify where they can and need to make improvements. Group 5 states they now have real time data - but an extraction engine is missing in their suite of applications. The need for additional APIs (and apprehension about the tech) was a common theme among firms. The need for a digital adoption mindset was also identified–for both visionary leaders and the onboarding of users within the firm.

Adaptation and Consequences
Group 2 continue to be frustrated about all firms working in silos–despite the rhetoric on collaboration and transparency. They believe there is little evidence of collaboration as they are all using the same means for the same ends but on segregated platforms. The firm did experiment with a digital innovations project in which they laid out all of the specifications required, and priorities preferred. They felt disappointed that by the end of the (state funded) trial there were no tangible results. Another firm in the same trial has continued work with a data giant and is happy with their progress.

5.1 Building Alternative Values and New Business Models

In managing innovation, adaptation and processes, initial Web3 adoption expenditures could represent a substantial investment and a sizeable risk. However, there appear to be a number of strategies that have the potential to create sufficient value in the technology for it to 'pay for itself' once the initial research and development costs are covered (which appears to be taking place among the larger firms and tech giants). Now that open access platforms are available, smaller, more nimble businesses could begin experimenting to discover opportunities for value creation and gain. Web3 technology can now be adopted in stages, which makes digital transformation more acceptable. This improves the user experience and eliminates delays and fragmented and piecemeal solutions. By enhancing physical products with smartphone-accessible digital services such as information on product provenance, registration, and direct ecommerce, brands can increase customer lifetime value. Tokens (NFTs) can be attached to products to provide incentives, accrue value, and reward 'sustainable behaviour'.

5.2 Limitations and Further Research

In selecting this group of participants, we found that so-called mid-sized firms had more experiences to share than SMEs (in the strict fiscal definition). That is, the mid-sized firms were well underway with their due diligence and have enough resources to create centralised data repositories (moving beyond excel and using power BI applications, for example) and or had connected with some open source/decentralised platforms such as the Open Apparel Registry. While the study provides novel insights through empirical data, the use of a small number of case studies also has limitations. To increase

robustness of future research, a number of methods may be utilised. First, an investigation of multiple fashion companies, across jurisdictions, at several market sectors, and at various segments of the supply chain could offer a more holistic examination of supply chain transparency. Examining and comparing how various brands approach policy requirements, internal management, governance, traceability, and critical issues throughout supply chains could significantly advance the fashion supply chain literature–and ultimately lessons learned for practical applications. Finally, the communication of transparency initiatives will in themselves become a challenge for the firms and therein another area of future research.

6 Conclusion

This study aimed to investigate and outline the current and projected requirements for digitalised supply chains, and as a result, inform a transformational strategy. In doing so the study provides foundational material that streamlines and openly facilitates digital SC transparency adoption and success. The strategy should include consideration of digital expenditures, technology needs, participant training and mindset, and a coherent path for adoption, and operationalisation that can ultimately be used for communication of verified data to consumers. Several parameters were itemised, which imply the need to develop a strategy matrix to oversee digital initiatives, measuring returns on digital investments, as well as testing and identifying potential strategy weaknesses. A matrix approach would also address the complex issues while encompassing the need for a unified strategy for accelerating the various digital initiatives. Beginning with a preparedness mindset for digital transformation [22] and adapting legacy software (like LCAs, PLMs, ERPs), certifications, existing relationships and connecting to open-source platforms will rationalise the investment required. Despite potential complexity, the matrix would also show the various areas that can be individually developed as resources become available within the firm while seeking out, participating in, and leveraging a digital ecosystem to the long-term benefit of the firm - and ultimately, successful digitalised global fashion supply chain transparency.

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