**Supply Chain and Logistics Sustainability Future and Opportunities – The Role of Integration of Diverse Knowledge**

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**1. Introduction**

The global sustainability agenda requires a systematic integrated approach to initiate and mobilise transformative knowledge and action. In this approach, we believe that knowledge and action-oriented knowledge for sustainability should be based on an integrated approach with many kinds of knowledge and actions involved in the pursuit and achievement of change (Fazey et al. 2018). Such integrated diversity of knowledge would complement much of the current almost exclusive focus on technology approaches. As a result of the complexity of the global sustainability challenge, we advocate for a systematic integrated approach of various research streams and research programmes in logistics, transport, and supply chain management (LTSCM) to help speed up the diffusion and adoption of sustainability-related innovation in logistics, transport, and supply chain operations (LTSCM).

We advocate that scholars, industry, grantors, governments, and research institutions devoted to sustainability should focus more on creating the conditions for studying human individual and collective behaviour in innovation adoption, and pilot-testing, and experimenting with various kinds of sustainability related innovation solutions to cultivate and nurture sustainability-oriented learning and adoption of sustainability induced new ways of thinking and doing. Hence, this article explains how a systematic integrated approach can be undertaken for LTSCM sustainability learning, knowledge generation adoption as well as diffusion of innovation in logistics, transport, and supply chain operations. First, we advocate for systematic approach in section 2 after which in section 3 we argue for a diverse and integrated approach to knowledge mobilisation and describe such a process, and in section 4, we highlight potential benefits of our idea, while in section 5, the article concludes with a summary.

**2. A systematic integrated approach**

Supply chain and logistics sustainability agenda come with many challenges, but also many opportunities. In this short article, we advocate that in order to meet those challenges, seize opportunities, and ensure a sustainable future for supply chain, logistics, and transportation, a systematic integrated approach is crucial.

Much of the available research on sustainability in logistics, transport and supply chain management (LTSCM) seem to have argued that LTSCM related sustainability challenges can only be solved through system-wide and transformative change. Hence, research findings should trigger interventions that result in such system wide changes. One example of such sustainability related research in LTSCM include the pursuit of alternative transport energy to replace transport energy based on fossil fuels and associated noxious emissions.

Much of the available research on sustainability in logistics, transport and supply chain management (LTSCM) also seem to have argued for diversity in research, research funding, and associated action to support diverse actors such as government and private organisations, non-governmental organisations, consumers, and even indigenous communities, in working towards sustainability transformations (Masson-Delmotte et al. (2018; Fazey, et al.2018). A corollary to this body of research demands that the global community of researchers undertake more of action-oriented research and deploy more of action-oriented knowledge for sustainability, particularly in LTSCM. For instance, meeting the Sustainable Development Goals (SDGs) demands action-oriented approaches that are diverse and integrated (Díaz et al., 2019). The diversity is required because the concept of sustainability on a grander scale has diverse elements to it such as social, economic, ecological, cultural, and political elements such as matters of justice, fairness and equity (Turnhout et al. 2020).

We argue that in LTSCM, a systematic integrated approach is required to address the interconnected nature of the challenges of sustainability. Hence, in this article we advocate in agreement with much of the research in sustainability science that LTSCM need a diverse range of knowledge based interventions beyond the current ‘narrow’ focus on technology in LTSCM (research). Hence, we advocate that diverse action-oriented knowledge should undergird and catalyse processes of action and capacity building for sustainability in LTSCM (Cash et al. 2003; Fazey, et al.2018).

Research in LTSCM can be used to generating knowledge in the service of action and capacity building in complimentary areas of sustainability such as the development of women in LTSCM. Furthermore, research programmes and projects in LTSCM can be designed to be transdisciplinary, collaborative, and action-oriented (Cash et al. 2003; Wyborn et al. 2012). For instance, LTSCM researchers can deploy collaborative approaches aiming to overcome gender inequalities in LTSCM, thus addressing non-discriminatory social norms, a key element of LTSCM sustainability given that LTSCM sustainability is not merely about technology deployment such as electric, solar, or gas powered trucks, and technical warehouse equipment (such as gas powered forklifts). Thus, we argue that research in LTSCM sustainability will require diverse knowledge to support processes of action and capacity building for sustainability within LTSCM (Lubchenco, 1998).

While acknowledging that barriers to sustainable LTSCM remain, if such barriers are left without solutions, the barriers may continue to limit researchers/practitioners’ ability to effectively address uncertainty, address changing dynamics, and address other complicated interrelated LTSCM sustainability challenges. Much of the LTSCM literature on sustainability has explored themes such as: sustainability benchmarking of supply chains (Dania et.al., 2019); green supply chain and logistics management practices (Cousins et.al., 2019); green supply chain performance or sustainability supply chain performance; green supply chain human resources management (Kumar et.al, 2019); consumer behaviour and its impact on sustainability supply chain management (Gong et.al, 2019); behaviour of supply chain decision-makers (Liu et.al., 2019); buyer-seller relationships impact on supply chain sustainability (Kumar et.al., 2019); and employee perception of and behaviour towards sustainability in supply chains (Dong et.al., 2019). However, it appears the fastest growing stream of research has been emerging technologies (Industry 4.0 technologies), and their potential application in the context of sustainability and sustainable LTSCM.

Recent research on emerging technologies has discussed: Blockchain (e.g. Fosso-Wamba and Queiroz, 2020); Artificial Intelligence (AI) (e.g. Dwivedi et al., 2019); Big Data Analytics (e.g. Kache and Seuring, 2017; Matthias et al., 2017); internet of things (IoT) (e.g. Islam et al., 2018); social media (e.g. Ramanathan, Subramanian and Parrott, 2017); and 3D printing (e.g. Roscoe et al. 2019) to name a few. While research on emergent technology and the other research themes have been valuable in deepening and expanding our understanding of the potential (and theoretical) contribution of technology to the advancement of sustainability within LTSCM; much of the literature has not addressed broader issues of diversity of knowledge, and human and collective behaviour, as well as psychology processes of innovation adoption decision making, and processes of innovation diffusion in LTSCM. We now outline an integrated and diverse approach to connecting the range of action-oriented knowledge highlighted previously as an example in LTSCM sustainability research. We introduce our idea of actions for LTSCM sustainability which provides the fundamental elements of an integrated and diverse approach to knowledge mobilisation.

**3. A diverse and integrated approach to knowledge mobilisation**

Most researchers and research institutions have identified a disconnect between research outputs and the knowledge needed to address global grand challenges such as sustainability (Ferraro et al., 2015; Etzion, 2018). As a result researchers are being asked to collaborate globally and engage with industry and communities to solve complex multifaceted challenges such as sustainability (Ravertz, 1999; Nowotny et al., 2001). This new view of research activity is often referred to as post-normal science (Ravertz, 1999; Nowotny et al., 2001). It is being used to reshape processes of knowledge production as socially distributed and subject to multiple perspectives. This perspective of research shows that research is not a one-way flow from researchers to society (Ravertz, 1999; Nowotny et al., 2001). It shows that plurality of perspectives is required to meet the needs of complex real-world challenges (Ferraro et al., 2015; Etzion, 2018).

We argue that action-oriented research in LTSCM sustainability can build knowledge in support of interventions and capacities for sustainability (Fazey et al.2018). For example, participant observation, feminist epistemologies, critical pedagogy, and transdisciplinary research through active iterative processes of knowledge co-production (Lang et al., 2012; Turnhout et al. 2020; Wyborn et al., 2012). In action-oriented approaches, researchers will work with diverse relevant societal actors and stakeholders to contribute to making a transformative change in LTSCM sustainability in various suitable contexts. Thus, nurturing change in economic, technological, social, cultural, ecological, and institutional systems towards more sustainable configurations and which encourage human agency and capacities necessary for change.

The relationship between knowledge, action and capacity is important. Action generates knowledge and knowledge supports and reinforces action as well as people’s capacity to navigate ever-changing situations. The search for knowledge is from a desire to enhance individual and collective learning about solutions to grand challenges such as sustainability. Hence, action-oriented research does not share the traditional perspective that researchers first generate knowledge through research, and then translate, or disseminate the knowledge into society. Instead, we argue that knowledge emanates naturally from the complicated processes of action, learning and capacity building through collaboration and co-production, and transdisciplinary involvement of diverse societal stakeholders (Lang et al 2012; Norström et al. 2020; Freeth and Caniglia, 2020). Hence, crucial questions involve how to create change in relation to individual and LTSCM industry learning. In this view, we argue that adoption of action oriented research embraces diverse perspectives, and enables contestation of prevailing perspectives, needs and interests amongst LTSCM stakeholders. Hence, sustainability-related change in LTSCM would need working with diverse kinds of knowledge that are context-dependent (based on action, capacity building, and knowledge generation) (Clark et al., 2016; Scoones et al., 2020).

Actions towards sustainability are emerging and adaptive processes that facilitate learning and build capacity to initiate or reinforce paths towards economic, societal, ecological, and cultural re-structuring. For instance, curriculum reform in business schools to change values and beliefs in LTSCM. Similarly, gender inequity is common and this limits the capacity of women to contribute to sustainability due women having less power and less money than men. Potential sustainability solutions cannot just be copied across contexts or imposed on people. Diverse stakeholders must experiment together with new social reconfigurations, new economic models, alternative social norms and emerging technologies. Reports from continuous monitoring and evaluation can facilitate stakeholder ability to adapt plans as interventions unfold over time (Luederitz et al., 2017). For example, sustainability in mobility, have been addressed through experimentation, and contribute to collective and individual learning processes (Luederitz et al., 2017).

We also advocate that critical, empowering, co-produced knowledge can enhance shared agency by addressing differences in values, interests, views, and power amongst stakeholders. Thus, learning requires that research and societal stakeholders develop a capacity to work with diverse kinds of knowledge in a more collaborative, transdisciplinary and learning-oriented manner (Freeth and Caniglia, 2020). Also, working with diverse kinds of knowledge implies a range of ways of knowing as various stakeholders may have varying assumptions about the nature of reality, and what is valued as knowledge (e.g. spiritual beliefs in contrast to materialistic perspectives). These assumptions also impact whose knowledge is taken into consideration and whose is ignored. However, diversity can help identify that bias towards one dimension of action or knowledge might limit our understanding of how to facilitate change for sustainability.

Critical, empowering, co-produced knowledge encourages stakeholders involved in the above discussed processes to work in integrated ways with diversity of knowledge in contexts characterized by conflict of ideas and power, uncertainty, and political wrangling at policy making levels. Working in integrated ways may not mean consensus or agreement across conflicting interests and perspectives. Instead, it is about engaging with contestation and conflict in a collaborative and productive fashion during the evolving dynamics of action and LTSCM sustainability capacity building processes (Freeth and Caniglia, 2020). It should however be noted that there may never be an achievable an end-goal of enough knowledge when addressing complex grand challenges such as sustainability in LTSCM. This is because diverse knowledge and associated ways of knowing is always being developed through action and interactions in a network of iterative learning processes. Easy solutions such as technology-centric solutions from technology-centric research to complicated LTSCM challenges will not suffice until they are integrated into more sophisticated individual and collective processes of learning and knowledge co-production including behavioural and psychological components.

**4. Potential benefits**

The benefits of an integrated and diverse approach to action-oriented research and knowledge for LTSCM sustainability as described is that it can facilitate:

(1) An investigation of the role of knowledge in action processes. Thus, LTSCM industry and researchers may need to structure future research efforts to assess and evaluate how various kinds of knowledge support processes of change towards sustainability in LTSCM.

(2) In co-production of knowledge and processes of trans-disciplinarity, a diverse and integrated approach to action-oriented knowledge for LTSCM sustainability can support researchers and practitioners in the design, formative assessment and evaluation of interventions as well as further iterative development of interventions.

(3) Deploying a diverse and integrated approach would help to facilitate dialogue, understanding, and knowledge exchange across many stakeholders and highlight available knowledge, competences, and skills that could be canvassed, integrated and deployed. It would also help identify gaps in knowledge, competences, and skills as well as help identify those knowledge, competences, and skills that would be required for the design, deployment and execution of interventions.

(4) Our ideas take advantage of the multiple perspectives, viewpoints, and interests required to navigate contentious issues of unsustainability in LTSCM; and

(5) A diverse and integrated approach to action-oriented knowledge for LTSCM sustainability allows us to focus in factors that foster or hamper collaborative efforts to generate knowledge to address LTSCM sustainability challenges.

**5. Summary**

We have advocated for a more systematic and integrated approach to undertaking research in LTSCM. We have advocated for an integration of diverse streams of knowledge and knowledge generation processes for example by using action-oriented approaches to research, deploying transdisciplinary LTSCM research, and incorporating a broader range of perspectives such as from women into research programmes in LTSCM to help speed up the diffusion and adoption of sustainability-related innovation in logistics, transport, and supply chain operations (LTSCM).

In future research, we advocate that scholars, industry, grantors, governments, and research institutions devoted to sustainability in the LTSCM sector should focus more on creating the conditions for studying human individual and collective behaviour in innovation adoption. Researchers can also undertake more pilot-testing, and experimentation with various kinds of sustainability related innovation solutions to cultivate and nurture sustainability-oriented learning and adoption of sustainability induced new ways of thinking and doing. Hence, this article explains how a systematic integrated approach can be undertaken for LTSCM sustainability learning, and knowledge generation.

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