Transformative learning in the sustainability transformation of the textile-fashion industry in Mexico

Faculty of Sustainability

at Leuphana University Lüneburg, submitted as a requirement for the award of the title of

Doctor of Philosophy

(Dr. Phil.)

Approved thesis by

Jorge Gustavo Rodríguez Aboytes

Born 3 January 1991 in Celaya, Guanajuato, Mexico

Submitted on: 09 February 2022

Thesis defence on: 08 July 2022

Main supervisor and reviewer: Prof. Dr. Matthias Barth

Second reviewer: Prof. Dr. Daniel Fischer

Third reviewer: Prof. Dr. Daniel Lang

The individual items in the cumulative thesis are or will be published as follows, if applicable with the accompanying papers:

1. Rodríguez Aboytes, J.G. and Barth, M. (2020), "Transformative learning in the field of sustainability: a systematic literature review (1999-2019)", *International Journal of Sustainability in Higher Education*, Vol. 21. No. 5. pp. 993-1013. https://doi.org/10.1108/IJSHE-05-2019-0168

2. Rodríguez Aboytes, J. G. and Barth, M. (2020). "Learning Processes in the Early Development of Sustainable Niches: The Case of Sustainable Fashion Entrepreneurs in Mexico". *Sustainability*, Vol. 12. No. 20. pp. 8434. https://doi.org/10.3390/su12208434

3. Aboytes, J. G. R., Barth, M., & Fischer, D. (2022). "Evolution of entrepreneurs' expectations using instagram as a business practice: A transformative learning perspective in the case of sustainable fashion entrepreneurs in Mexico", *World Development Sustainability*, Vol *1*, 100005. https://doi.org/10.1016/j.wds.2022.100005

Year of publication: 2022

Overview of articles included in the doctoral thesis

Article No.	Bibliography	Publication Status	Presentation in conferences
1	Rodríguez Aboytes, J.G. and Barth, M. (2020), "Transformative learning in the field of sustainability: a systematic literature review (1999-2019)", *International Journal of Sustainability in Higher Education*, Vol. 21. No. 5. pp. 993-1013. https://doi.org/10.1108/IJSHE-05-2019-0168	Published	(Poster 12) "Transformative Learning in the field of Sustainability: A Systematic Literature Review". Presented at the Virtual Higher Education Summit 2020 31 August – 02 September. https://www.higher-education-summit-2020.com/
2	Rodríguez Aboytes, J. G. and Barth, M. (2020). Learning Processes in the Early Development of Sustainable Niches: The Case of Sustainable Fashion Entrepreneurs in Mexico. Sustainability, 12(20), 8434. https://doi.org/10.3390/su12208434	Published	(ST 185) The relation between learning and sustainability niche formation: An exploratory multiple case study. Presented at 11th International Sustainability Transition conference held from 18-21 August 2020 http://ist2020.at/
3	Aboytes, J. G. R., Barth, M., & Fischer, D. (2022). "Evolution of entrepreneurs' expectations using instagram as a business practice: A transformative learning perspective in the case of sustainable fashion entrepreneurs in Mexico", *World Development Sustainability*, Vol *1*, 100005. https://doi.org/10.1016/j.wds.2022.100005	Published	-

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Acknowledgements

The culmination of this doctoral work was only possible with the support of my family, professors, friends, colleagues, funders and people who directly or indirectly took part in this journey.

First of all, I am very grateful to my parents, Lety Aboytes and Santos Rodriguez, and my sister, Ana Sofia Rodríguez, who always supported me in this endeavour from very far away in Mexico. When I told them that I had been accepted to take my doctoral studies in Germany, they always supported me in any preparatory step by providing me with the best conditions for my arrival in Lüneburg. Even though I live far away from Celaya (my hometown), they have always been there for me.

During my PhD journey, I have also fallen in love with my new family in Lüneburg: Julia, Leandro and our little *niñodinosaur* (to be born in June). I want to dedicate this work to them. Thank you Julia, for your incredible support during the last phase of my doctoral studies and for inviting me to be part of your life together with Leandro. I am looking forward to our baby and the family Winkler Rodriguez Gomez. Moreover, I want to thank Kerstin, Robert, Gerd, Marion, Richard, Erika, and Heiko for welcoming me into your life and supporting us.

I am also very grateful to Matthias Barth, who accepted me as his doctoral student and guided me through my learning journey and doctoral formation, as well as to my professors who have become essential figures in my academic formation at Leuphana: Daniel Fischer, Henrik von Wehrden, Julia Leventon, Daniel Lang and Klaus Kümmerer. Thanks to my colleagues and friends, with whom I shared more than three years of studies, research, games and dinners: Sadbhb, Maike, Charlott, Julius, Josie, Lisa, Karo, Lydia, Felix, Hanna, Steffi, and Stefan. Special thanks to Lisa and Toby, who hosted me at their home during my first week in Lüneburg.

I also want to thank all my friends in Celaya, San Luis Potosi, and Lüneburg. Despite the distance, you, Erik, Ximena, Diana, Luis Adrian, Paco, Lalo Piz, Marco, Eli and Dany will always be part of me; you are also my chosen family. To my friends in San Luis Potosi, I am very grateful to have you in my life: Itzel, Aketzali, Denisse, Alexis, JuanMa, Iram. Special thanks to Lucy Nieto, who always believed in me and pushed me to apply for the doctoral position. To my cherished friends that I met in Lüneburg, you came to my life to stay: Sadbhb, Anna, Stefan, Camila, Laura, Deepika, Natasha, Simon, Giovanna, Adrian, Aymara, Ali, Victor Hugo, Ana Mary, Constanza, Anna, Alex, and Lia. Moreover, I am dedicating this work to my friends in Cologne-Bonn, Berlin and Bogotá: Daiana, Martin, Diego, Marcella, David and Natalia, and my ex-flatmates in Lüneburg for living for some time together: Laura, Theresa, Mareike, Vanessa, Stina, Friederike, Caro, Laura, and Hsin-Yu.

Last but not least, I am highly thankful to Robert Bosch Stiftung for granting me the scholarship to conduct my doctoral studies with the research group Processes of Sustainability Transformation. I want to single out the help and friendship of Mireille Acquart, who guided me in exploring the textile-fashion sector in Mexico. Also, I want to acknowledge the help from people at Leuphana University, Christiane Fluche, Maire Grünewald, Fabienne Moreau, my german course teachers, and the salsa group with which I had the pleasure to share the dance floor.

Additional acknowledgements: I want to thank Ana Homs and Mayo Nieto for supporting my mental health. I also want to dedicate this work to my pets Jenny and Fidel, who unfortunately passed away, and to Molly. Pets are also essential to our humanity. Finally, thanks a lot to all the people, organisations and institutions for making science and research open to everyone.

“The bird fights its way out of the egg. The egg is the world. Who would be born must first destroy a world.”

Hermann Hesse, Demian: Die Geschichte von Emil Sinclairs Jugend

Abstract

Transformative learning is increasingly set to become an essential component in sustainability transformation. This type of learning attracts considerable interest in studying and impulsing a paradigm change to transform our world into a more sustainable one, yet its underlying learning mechanisms have remained overlooked. Although there is an apparent relationship between transformative learning and sustainability transformation, little has been done to systematically explore the contribution to sustainability transformation. This learning theory developed decades ago independently of sustainability discourses; however, it provides an analytical framework for understanding the learning processes, outcomes and conditions in individual and social learning towards sustainability transformation. Against this background, the following research question arises: To which extent can transformative learning lead to sustainability transformation?

This doctoral work aims to explore transformative learning processes, outcomes, and conditions occurring and advancing towards sustainability transformation of the textile-fashion industry in Mexico. Taking an exploratory approach, the methods employed were literature reviews to untangle concepts and to construct theoretical pillars to support the empirical research design and data analysis. For data collection, snowball-sampling techniques were used to explore the practice field of the textile-fashion industry in Mexico. Qualitative interviews were employed to gather data about the learning experiences of actors. Qualitative and quantitative methods were required to perform the respective data analysis, the qualitative codification of interviewees' responses through MAXQDA being the most remarkable one. Analysis of social media content was also utilised to understand the communication and business practices of projects involved in the transformation of the textile-fashion sector. As a result, this work comprises three articles, one a systematic literature review and two empirical research articles, investigating the transformative learning processes of entrepreneurs in the development of sustainability niches.

As for the findings of this doctoral work, the use of transformative learning in sustainability transformation requires a careful study of the theory and its conceptual elements. Regarding the case study, transformative learning is inherent in forming and developing sustainability niches as entrepreneurs venture into them: It is individual prior learning, expectations and actions that initiate the path of sustainability transformation while disorienting dilemmas, critical reflection, and discourse accelerate them. Through these stages, it is when individual learning turns into social learning. On the other hand, based on the multi-level perspective, the interplay between the niche, regime and landscape levels generates a space for sustainability transformation and transformative learning.

This work contributes to deciphering the black box of learning in sustainability transformations. The principal endeavour was to build the theoretical bridges between this emerging area of inquiry and transformative learning theory, as a significant part of this theoretical construction required drawing upon other research fields such as sustainability transitions and sustainability entrepreneurship. The crosscutting feature of learning in those fields enabled the development of an awareness of boundary objects between those fields (e.g., expectations). Furthermore, this study is pioneering in exploring sustainability transformation processes of the textile-fashion industry in Latin American contexts. The findings of this work can also be extrapolated to other sectors in which entrepreneurs participate, such as local food production, sustainable mobility, among others.

Zusammenfassung

Transformatives Lernen wird zunehmend zu einem wesentlichen Bestandteil in der Nachhaltigkeitstransformation. Diese Art des Lernens stößt auf großes Interesse, wenn es darum geht, einen Paradigmenwechsel zu erforschen und voranzutreiben, um unsere Welt in eine nachhaltigere Welt zu verwandeln. Obwohl ein offensichtlicher Zusammenhang zwischen transformativem Lernen und Nachhaltigkeitstransformation besteht, wurde bisher wenig getan, um den Beitrag zur Nachhaltigkeitstransformation systematisch zu untersuchen. Diese Lerntheorie hat sich vor Jahrzehnten unabhängig von Nachhaltigkeitsdiskursen entwickelt; sie bietet jedoch einen analytischen Rahmen für das Verständnis der Lernprozesse, -ergebnisse und -bedingungen beim individuellen und gesellschaftlichen Lernen in Richtung Nachhaltigkeitstransformation. Vor diesem Hintergrund stellt sich die folgende Forschungsfrage: Inwieweit kann transformatives Lernen zu einer Nachhaltigkeitstransformation führen?

Diese Doktorarbeit zielt darauf ab, transformative Lernprozesse, -ergebnisse und -bedingungen zu erforschen, die in der mexikanischen Textil- und Modeindustrie stattfinden und zu einer Nachhaltigkeitstransformation führen. Mit einem explorativen Ansatz wurden Literaturrecherchen durchgeführt, um Konzepte zu entwirren und theoretische Säulen zur Unterstützung des empirischen Forschungsdesigns und der Datenanalyse zu schaffen. Bei der Datenerhebung wurden Schneeballsysteme eingesetzt, um das Praxisfeld der Textil- und Modeindustrie in Mexiko zu erkunden. Qualitative Interviews wurden eingesetzt, um Daten über die Lernerfahrungen der Akteur*innen zu sammeln. Für die jeweilige Datenanalyse wurden qualitative und quantitative Methoden verwendet, wobei die qualitative Kodierung der Antworten der Befragten mittels MAXQDA am bemerkenswertesten war. Die Analyse der Inhalte sozialer Medien wurde ebenfalls genutzt, um die Kommunikations- und Geschäftspraktiken von Projekten zu verstehen, die an der Transformation des Textil- und Modesektors beteiligt sind. Im Ergebnis umfasst diese Arbeit drei Artikel, einen systematischen Literaturüberblick und zwei empirische Forschungsartikel, die die transformativen Lernprozesse von Unternehmer*innen bei der Entwicklung von Nachhaltigkeitsnischen untersuchen.

Die Ergebnisse dieser Doktorarbeit zeigen, dass der Einsatz des transformativen Lernens bei der Nachhaltigkeitstransformation eine sorgfältige Untersuchung der Theorie und ihrer konzeptionellen Elemente erfordert. Was die Fallstudie betrifft, so ist das transformative Lernen bei der Bildung und Entwicklung von Nachhaltigkeitsnischen inhärent, wenn sich Unternehmer*innen in diese Nischen wagen: Es sind individuelle Vorerfahrungen, Erwartungen und Handlungen, die den Weg der Nachhaltigkeitstransformation einleiten, während desorientierende Dilemmata, kritische Reflexion und Diskurs diese beschleunigen. Durch das Durchlaufen dieser Phasen wird aus individuellem Lernen soziales Lernen. Das Zusammenspiel zwischen der Nischen-, Regime- und Landschaftsebene hingegen schafft auf der Grundlage der Mehrebenenperspektive einen Raum für Nachhaltigkeitstransformation und transformatives Lernen.

Diese Arbeit trägt dazu bei, die Blackbox des Lernens bei Nachhaltigkeitstransformationen zu entschlüsseln. Das Hauptbestreben bestand darin, die theoretischen Brücken zwischen diesem aufstrebenden Forschungsgebiet und der Theorie des transformativen Lernens zu schlagen, da ein wesentlicher Teil dieser theoretischen Konstruktion auf andere Forschungsfelder wie Nachhaltigkeitstransitionen und Nachhaltigkeitsunternehmertum zurückgreifen musste. Die Querschnittsfunktion des Lernens in diesen Bereichen hat es ermöglicht, ein Bewusstsein für die Grenzobjekte zwischen diesen Feldern zu entwickeln (z. B. der Erwartungen). Darüber hinaus leistet diese Studie Pionierarbeit bei der Erforschung von Nachhaltigkeitstransformationsprozessen in der Textil- und Modeindustrie im lateinamerikanischen Kontext. Die Ergebnisse dieser Arbeit können auch auf andere Sektoren übertragen werden, an denen Unternehmer*innen beteiligt sind, wie z. B. lokale Lebensmittelproduktion, nachhaltige Mobilität und andere.

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List of Abbreviations

- ESD - Education for Sustainable Development
- NAFTA – North American Free Trade Agreement
- RwL – Real World Laboratory
- SDG's – Sustainable Development Goals
- SNM – Strategic Niche Management
- STR – Sustainable Transition Research
- TL – Transformative Learning
- UN – United Nations
- US – United States
- USA – United States of America
- USMCA – United States Mexico Canada Agreement

Content

1 Introduction

1.1 Project context

Sustainability transformation provides a reference point to approach and intervene in structural changes of local and global systems, but it needs to be located in specific contexts and studied from specific intervention perspectives. This doctoral work is part of a larger research group called "Processes of Sustainability Transformation", which started on 2 October 2017. The overall aim of the superordinate project has been to investigate transformation processes through different research perspectives and placed in two sectors, i.e., food and textile. This particular research project falls within the perspective of "Individual learning and communication", focusing on the textile sector in the Mexican context.

1.2 Sustainability transformation from a learning perspective

Sustainability transformation is currently at the frontier of sustainability science as it represents crucial intervention points towards the achievement of a sustainable world (Abson *et al.*, 2017; Clark and Harley, 2020). Sustainability transformation can be defined as structural and fundamental shifts in unsustainable production and consumption systems (Scoones *et al.*, 2020). Specifically, the area of sustainability transformation entails: 1) understanding the complexity of human-nature-technology systems (Göpel, 2016a; Davelaar, 2021); 2) anticipating undesirable scenarios caused by unsustainable regimes; 3) creating shared visions towards a sustainable world (Clark and Harley, 2020); 4) implementing strategies and testing solutions (Feola, 2015); and 5) acting under collective leadership (Care *et al.*, 2021).

Sustainability transformation focuses on human intervention and the social management of these transformation processes (Patterson *et al.*, 2017; Linnér and Wibeck, 2021). Since individuals and societal groups will design, implement and evaluate interventions for sustainability transformation, it is necessary to consider changes within the human system, that is, changes in meaning structures or mental models which determine individuals' actions and predispositions. In close relationship with the learning dimension, sustainability transformation encompasses shifts in human mental models, paradigms or mindsets (Göpel, 2016b; Davelaar, 2021). In this sense, Davelaar (2021) argues that "a sufficient but necessary condition to achieve transformation for sustainability is to intervene at the root on the deepest level of mental models where the final intent of a human system lays consolidated" (p. 6). Therefore, a potential connection emerges between the area of sustainability transformation and a particular learning theory: transformative learning.

In the literature, there is a tendency in coupling adjectives of "transformative" or "transformational" to other terms and concepts used in the study of sustainability transformation processes (Feola, 2015), which in the case of learning, results in transformative (or transformational) learning, without necessarily referring to that specific learning theory. Although transformative learning has been recently acknowledged as a critical driver in sustainability transformations (Linnér and Wibeck, 2021), little academic and scientific work has investigated the connection between transformative learning theory and sustainability transformation processes.

From the learning field, Mezirow (1978) proposed a theory of transformation in adult education, differentiating it from other learning theories and approaches. He defined transformative learning as fundamental changes in individuals' frames of reference - meaning perspectives that determine our understanding and acting in the world - resulting in meaning perspectives that are more open, inclusive, flexible, and that guide future action (Mezirow, 2003). Even though transformative learning has had a theoretical development for decades (Kokkos *et al.*, 2015; Kitchenham, 2008; Calleja, 2014), little has been done in exploring how the theory of transformative learning

actually sheds light on the emerging area of sustainability transformation. Therefore, the general research question that constitutes the basis of this doctoral work is:

To which extent does transformative learning contribute to processes of sustainability transformation?

To answer this research question, it is essential to investigate the individual learning processes that are necessary for social transformations to occur (Hoggan, 2015) while also accounting for the larger systems that set the conditions for these learning processes and avoiding a reductionism on the individual learning (Bamberg *et al.*, 2021). This doctoral project does not intend to answer this research question at a mere theoretical level since the study of transformation processes needs to be located in specific sectors and contexts and grounded with empirical research.

1.3 Research objective and context

This doctoral work aims to explore transformative learning processes, outcomes and conditions occurring and advancing towards sustainability transformation processes, taking the textile-fashion industry in Mexico as a case study.

This case study is of relevance because much attention has been paid to other sectors (e.g., energy, food and mobility, etc.), but little to the textile, fashion and apparel industry, which is one of the biggest in size and greatest in complexity due to "its diversity in products, role in the global supply chain and continuous innovation" (Shishoo, 2012). The textile-fashion industry encompasses many complex (and wicked) problems that negatively affect the world, and for that reason, the transformation of this sector has been positioned in the United Nations' Sustainable Development Goals (SDG's) Agenda (Gardetti and Muthu, 2020). Nonetheless, much has been investigated regarding the dynamics of fashion companies in industrialised countries and manufacturing regions in South-Pacific Asia (Muthu, 2014), while little research has been carried out in the Latin American scenario, specifically in Mexico. In this country, the textile-fashion industry also faces several sustainability challenges towards transformation: a) There is a growing fast and mass fashion market, especially among young people (Carrillo-Fuentes, 2019); b) Mexico serves as a crucial commercial bridge between the US fashion market and Asian imports (Frederick and Gereffi, 2011; Deschamps *et al.*, 2017); and c) there is a tremendous amount of social and environmental problems due to the operation of textile factories and associated industries (e.g., chemical industry) (Vázquez-López, 2020b).

1.4 Research approach and design

The research approach taken in this work is exploratory because it seeks to provide initial but robust explanations to a phenomenon that has not been studied by specific theoretical perspectives and angles (Reiter, 2017). In this doctoral work, the exploratory research approach aims to explain sustainability transformations from a transformative learning perspective. Due to the complexity and diversity of sustainability (or wicked) problems, exploratory research stands as an essential mode-2 science attribute (Martens, 2006) in defining but also limiting the scope of this work: acknowledging uncertainty, exploring connections between disciplines and embarking on an interdisciplinary research endeavour. Moreover, this work pretends to be a pioneer in opening up the field of the sustainability transformation of the textile-fashion sector in Mexico.

This project began in autumn 2017 with the writing of the exposé, then three stages followed, and it concluded with the writing of the cumulative dissertation in winter 2021/22 (see Table 1). Since there had not been any systematic effort in connecting the fields of sustainability and transformative learning, *stage 1* comprised a purely conceptual work, from which a systematic literature review resulted. The first article then served as the conceptual basis for the following stages. *Stage 2* included fieldwork in Mexico to empirically explore the learning phenomenon occurring

in sustainability transformation processes. *Stage 3* entailed a more detailed analysis of crucial aspects of transformation processes and their influence on transformative learning.

This doctoral work followed a cumulative thesis format, that is, the three articles focused on answering specific research questions pertinent to the overall objective of this work. Each article represents the culmination of each stage, and the respective findings were published in specialised and recognised scientific journals. The table below only introduces the highlights of this doctoral work.

Table 1. Overview of the research design

Doctoral stages	Period	Doctoral Aims	Methods	Article title
Exposé writing	2017		-	
Stage 1	2018	Building up a robust theoretical base for transformative learning in sustainability transformation processes	Systematic literature review	1. Transformative learning in the field of sustainability: A systematic literature review (1999-2019)
Stage 2	2019	Approaching the case of the sustainability transformation of the Mexican fashion-textile industry. Exploring the learning processes that led entrepreneurs to intervene in transformation processes	Empirical qualitative case study	2. Learning processes in the early development of sustainable niches: The case of sustainable fashion entrepreneurs in Mexico.
Stage 3	2020	Understanding how processes of sustainability transformation influence entrepreneurs' transformative learning processes.	Empirical mixed methods	3. Evolution of entrepreneurs' expectations using Instagram as a business practice: A transformative learning perspective in the case of sustainable fashion entrepreneurs in Mexico.
Dissertation writing	2021/22		-	

The overall research design can be seen in Figure 1. Due to its exploratory nature, the research design remained open and flexible to changes, and it developed along with the progress of the project. After finalising the systematic literature review (*article 1*), the next step in the research design was to explore the field in Mexico (*stage 2*). Given that no connection was established with relevant stakeholders prior to the beginning of the project, case studies and stakeholders were searched by contacting scholars in Mexico and searching the web and social media. A consultancy start-up was contacted for collaboration. Several meetings with the founder of the consultancy start-up took place to become acquainted and build a base of trust (Lang *et al.*, 2012). A passive participation in talks, workshops and events followed and served as an immersive experience into the status quo of the textile and fashion industry. After getting a first impression of the field, a snowball sampling technique was employed to contact further entrepreneurs and projects to explore the learning processes that led them into the niche.

Taking the consultancy start-up as the initial seed in the snowball sampling procedure, seven entrepreneurs running six different projects were contacted, and qualitative interviews were conducted with them. After completing *article 2*, for *article 3,* specific business and communication practices in social media were considered as important aspects of sustainability transformation and transformative learning. Given the unexplored population of Mexican brands that operate under the tag of sustainable fashion, a snowball sampling using the social media platform Instagram was employed to estimate that population and get a respective sample. Two different methods were utilised to gather information about the content creation and the evolution of entrepreneurs' expectations, namely Instagram web scraping and qualitative interviews.

A detailed description of the methods used in each stage is presented in the respective section of each article. Moreover, it is essential to underscore that a deep conceptual work preceded every step taken in the research design in *stages 2* and *3*.

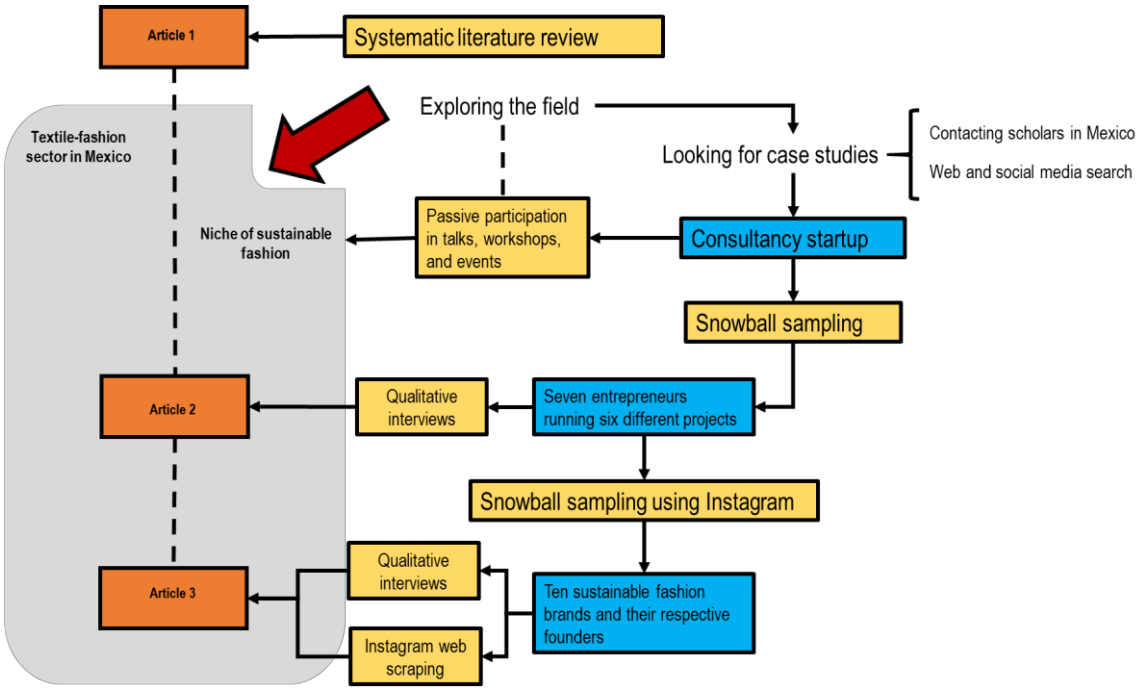

Figure 1. Research design of the doctoral project

1.5 Outline

This document is structured in six chapters (Chapter 1 being the introduction), of which Chapters 2, 3 and 4 function as building blocks. Because transformative learning is the central theoretical angle to approach the study of processes of sustainability transformations, Chapter 2 is dedicated to untangling the terminology of transformation in the field of sustainability conceptually. By presenting the theoretical basis of transformative learning, this chapter provides, through the results of the systematic literature review (*article 1*), a better understanding of how transformative learning takes place in sustainability contexts and how it is used and applied. In Chapter 3, the context of the sustainability transformation in the textile-fashion industry in Mexico is described, first by introducing the sustainability challenges of the global sector and then presenting the structural conditions that the Mexican industry faces. Chapter 4 is the core of this doctoral work as it contains the empirical exploration of transformative learning in the sustainability transformation of the Mexican textile-fashion sector. Drawing on the sustainability transitions research framework and specifically the multi-level perspective model, this chapter focuses on two aspects: the contribution of entrepreneurs' transformative learning to the formation and development of the sustainable fashion niche (*article 2*) and the influence of transformative settings on the entrepreneurs' individual

learning processes (*article 3*). Chapter 5 retrieves a summary of the significant findings from the three previous studies and discusses them in the light of the research questions and aims of this work, providing a characterisation of the processes of sustainability transformations in the textile-fashion industry in Mexico as well as a conceptual model to understand the interrelation between transformation processes and transformative learning theory. Moreover, a reflection upon the research design and specific methods employed is presented. Finally, Chapter 6 presents the main contributions of this work, its implications to practice, research limitations encountered, and further/ future research and recommendations.

2 Transformation, learning and sustainability

2.1 Diffusing the ambiguity of transformation in sustainability

The lack of a solid theory around transformation in sustainability results in vagueness and confusion with other concepts such as change, adaptation and resilience, which hinders the understanding and supporting action for social processes (Feola, 2015; Few *et al.*, 2017; Johnson *et al.*, 2018; Zanotti *et al.*, 2020). Although transformation functions as an umbrella concept for many disciplines, "no attempt to systematically characterise the concept has been made so far" (Feola, 2015, p. 378). Hence, transformation becomes a risky and unhelpful but fashionable buzzword to label any process where any change occurs (Feola, 2015; Few *et al.*, 2017).

A preliminary definition of transformation that guides this doctoral work is as follows: *Transformation is a greater and fundamental change in the system structure, altering its nature or essence* (O'Brien, 2012; Nelson *et al.*, 2007; Feola, 2015). Furthermore, it is necessary to stress the distinction between transformation and change. As Few *et al.* (2017) remark: "Transformation is about change, but it is not synonymous with change" (p. 2). In other words, all transformations entail changes, but not all changes are transformations. The precision in the terminology around transformation will ultimately help better comprehend the theory of transformative learning and its relation to sustainability.

2.2 Transformation + learning = transformative learning?

2.2.1 From learning to transformative learning

Learning is a process of human change; it is an essential process in human growth and development. Learning provides humans with knowledge about their world in order to act in it and satisfy their physiological and socio-psychological needs (Illeris, 2003). Nevertheless, learning is not a homogeneous phenomenon. In this way, according to Illeris (2003), learning encompasses "all processes that lead to relatively lasting changes of capacity, whether they be of a motor, cognitive, psychodynamic (i.e. emotional, motivational or attitudinal) or social character, and which are not due to genetic-biological maturation" (p. 397). Thus, learning is a vast phenomenon that entails outcomes, processes, and conditions (Pozo, 2008), and has broader social impacts, which can be studied through a neurobiological, psychological or social lens.

Learning itself is a process of change and is classified into different levels, transformative learning being one of them (Illeris, 2003):

- Accumulative - primary formation of cognitive schemes.
- Assimilative - addition of new elements to a previous cognitive scheme.
- Accommodative - a previous scheme ruptures to integrate new elements, consolidating a modified meaning structure.
- Transformative - a total re-shaping and reorientation of a set of core/fundamental meaning structures that had patterned the person's behaviour.

Besides the above classification, other approaches classify learning into different levels (Pahl-Wostl, 2009; Sterling, 2010; Barth, 2015): *Single-loop learning* or cognition change accounts for incremental changes, refinement of actions or improvement in performance without questioning assumptions and meaning structures. *Double-loop learning* or meta-cognition change calls into question and revises assumptions and meaning structures that shape values and norms. *Triple-loop* or epistemic change learning involves a critical reflection process upon the meaning structures, and how social factors and interactions have influenced them. Table 2 shows how these different approaches regarding levels of learning can be combined.

Table 2. Connection between approaches of levels of learning (Illeris, 2003; Pahl-Wostl, 2009; Sterling, 2010; Barth, 2015)

	Single-loop (cognition change)	Double-loop (meta-cognition change)	Triple-loop (epistemic change)
Accumulative	■	■	■
Assimilative	■	■	■
Accommodative		■	■
Transformative		■	■

As seen in the table above, the levels of learning are nested with an inherent increase in complexity (Sterling, 2010); however, single-loop and double-loop learning are not necessary conditions for triple-loop learning to occur (Barth, 2015). In this sense, double-, triple-loop and transformative learning entail fundamental changes in individuals' meaning structures. Therefore, it is possible to say that learning entails change, but not all learning is transformative. In the words of Taylor (2008): "It is transformative learning theory that explains this learning process of constructing and appropriating new and revised interpretations of the meaning of an experience in the world" (p. 5).

More than a mere level of learning, transformative learning is a learning theory that was initially introduced and developed in the field of adult education by Jack Mezirow (1978) through his work about perspective transformation. With the influence of Freire's Popular Pedagogy, Habermas' Communicative Action, and Kuhn's transformation of scientific knowledge (Calleja, 2014), Mezirow (1978) defined perspective transformation as a process of "[becoming] critically aware of the cultural and psychological assumptions that have influenced the way we see ourselves and our relationships and the way we pattern our lives" (p. 101).

In further work, Mezirow (2003) defined transformative learning as: "(…) learning that transforms problematic frames of reference—sets of fixed assumptions and expectations (habits of mind, meaning perspectives, mindsets)—to make them more inclusive, discriminating, open, reflective, and emotionally able to change" (p. 58).

2.2.2 Process of transformative learning

Mezirow (1991, 1994b, 2003) developed a framework in which he described eleven phases of the transformative learning process (see Table 3); nevertheless, his classical model does not offer a clear view of the learning process mechanisms. Although Table 3 may suggest a linear order of the phases, these are evolving, recursive and spiral instead (Taylor, 1997). Therefore, after a deep exploration of the literature, five core elements that group these elements are proposed: prior learning, disorienting dilemmas, critical reflection, discourse, and action engagement.

Table 3. Phases of transformative learning (Mezirow, 1994, p. 224)

	Phases of transformative learning
1.	A disorienting dilemma
2.	A self-examination with feelings of guilt or shame
3.	A critical assessment of epistemic, sociocultural, or physical assumptions
4.	Recognition that one's discontent and the process of transformation are shared and that others have negotiated a similar change
5.	Exploration of options for new roles, relationships, and actions
6.	Planning of a course of actions
7.	Acquisition of knowledge and skills for implementing one's plans
8.	Provisional trying of new roles
9.	Altering present relationships and forging new relationships
10.	Building of competence and self-confidence in new roles and relationships
11.	A reintegration into one's life on the basis of conditions dictated by one's perspectives

Frames of references – prior learning

The object of transformation in transformative learning is the mental structures that frame the life of individuals. These mental structures are called frames of reference, which are "sets of fixed assumptions and expectations (habits of mind, meaning perspectives, and mindsets)" (Mezirow 2003, p. 58). Frames of reference function as meaning structures that channel human energy "in the processes of human assimilation and socialisation: the former is the process in which humans acquire and use objects, and the latter is the process in which humans establish relationships with others and oneself" (Fromm, 1941, p. 78). The formation of frames of reference occurs via prior learning experiences that result from "the dynamic adaptation of human needs to the characteristic existent ways of a given society" (Fromm, 1941, p. 132).

Although the concept of frames of reference in transformative learning constitutes a core element in the theory (Schnepfleitner and Ferreira, 2021), it is little acknowledged in the classical model of transformative learning phases (Taylor, 1997). Frames of references are of utmost importance because they become available as objects of reflection and change (Dirkx, 2008); by identifying them, it is possible to follow the learning process and determine the extent to which transformative learning has occurred.

Disorienting dilemmas (phase 1)

Disorienting dilemmas are events in the life of individuals that challenge their frames of reference to the extent that they are no longer helpful to interpret these experiences. The concept of disorienting dilemmas is inherently related to the concept of cognitive conflict (Posner *et al.*, 1982; Kang *et al.*, 2004), which is the process of disequilibrium between meaning structures and internal/external experiences. Cognitive conflicts lead to moments of dissatisfaction, discrepancy or contradiction of individuals' initial conceptualisations (Posner *et al.*, 1982; Limón, 2001; Lee and Yi, 2013). Disorienting dilemmas are cognitive conflicts with higher emotional load, deemed as life crises, shocks, or even grief processes (Maikki, 2012) and accompanied by preceding conditions in individuals' prior learning (Laros, 2017).

From the model seen in Table 3, it seems that disorienting dilemmas are triggers for transformative learning; nonetheless, scholars have contested the importance of these events in transformative learning: Similarly to the debate around cognitive conflict, it has been contested that a cognitive conflict is a prerequisite for learning, yet it is an essential factor in the learning process (Kang *et al.*, 2004). In the case of disorienting dilemmas, they are not a prerequisite for transformative learning because individuals employ several psychological mechanisms when facing disorienting or conflictive events, i.e., rejection, rationalisation, exclusion (Limón, 2001).

Critical reflection (phases 2 and 3)

Central to the theory of transformative learning is the concept of critical reflection (Schnepfleitner and Ferreira, 2021). The two phases in the classic model of transformative learning fall short in explaining this learning mechanism. When disorienting dilemmas challenge the frames of reference and cannot be resolved by single-loop learning, the individuals have to engage in critical reflection, a highly cognitive abstraction process that examines meaning structures (Mezirow, 1998).

By arguing that not every act of critical reflection implies an assessment of personal premises, scholars have proposed different types of reflection (Mezirow, 1981, 1998; Lundgren and Poell, 2016): content reflection (thinking back about the actions), process reflection (thinking back about how the actions originated and about underlying factors) and premise reflection (thinking back about the personal-social assumptions that have led to specific interpretations). The last type of reflection is also referred to as self-critical reflection, i.e., the act in which "learners

examine their worldview in light of their own particular belief or value system" (Kitchenham, 2008, p. 116), leading to a transformation of their meaning structures.

Discourse (phase 4)

From the fourth phase in Table 3, it can be seen that critical reflection involves the participation of others, i.e., discourse. Mezirow's (1994) concept of discourse is a "special kind of dialogue in which we focus on content and attempt to justify beliefs by giving and defending reason and by examining the evidence for and against competing viewpoints" (p. 225). In this sense, while transformative learning occurs internally within an individual, discourse is triggered and enhanced through critical and self-critical reflection in a dialogical social process. Moreover, if transformative learning means a fundamental change in meaning structures, a key step is understanding others' perspectives through positioning oneself in the other's frame of reference (Mezirow, 2003).

Action engagement (phases 5, 6, 7, 8, 9, 10, and 11)

More than half the phases of the classical model of transformative learning refer to the individual engaging in action. Since transformative learning is not a mere intellectual process and the individual cannot stay in the pure reflection phase; they have to negotiate or explore new relationships, roles, courses of action, and solutions, and ultimately integrate all of them into their lives (Calleja, 2014). These phases can be grouped into three categories: planning (phases 5-6), experimenting (phases 7-8), and connecting (phases 9-10). The last phase indicates an integration of the previous phases. However, the resulting changes may be deemed as learning outcomes after the reflection phase. In this sense, Nohl (2015) argues that learners do not always consciously attempt to implement their own plans (phase 7) but experiment and explore new actions, roles, activities through continuous social interactions.

2.2.3 Associated learning outcomes of transformative learning

Identifying learning outcomes informs whether a particular learning process has occurred. In transformative learning, learning outcomes should answer the query: Which learning outcomes can inform whether a transformative learning process has taken place or not?

Hoggan (2015; 2016) conducted a literature review of transformative learning research and created a typology to identify transformative learning outcomes. This author distinguishes six major categories (self, ontology, worldview, epistemology, capacity, and behaviour), which can be further grouped into the three domains that Sipos *et al.* (2008) proposed: experience (heart-emotions), conceptualisation (head-cognition), and interaction (hands-action). Table 4 presents a combination of both frameworks, with examples of learning outcomes for each category.

Table 4. Classification of transformative learning outcomes according to Hoggan (2015, 2016) and Sipos et al. (2008).

Domains	Categories	Description	Example of specific outcomes: The individual…
Experience (Heart-Emotion)	Self	The individual experiences and feels their self.	Changes their sense of identity and relation with others.
	Ontology	The learner experiences their existence in the world.	Lives more fully in the moment and with equanimity.
Conceptualisation (Head-Cognition)	Worldview	The learner understands the world and how it works.	Widens his comprehension of the world.
	Epistemology	The learner is aware of how they and others know the reality.	Engages in critical assessment of knowledge rather than passively accepting it.
Interaction (Hands-Action)	Capacity	The learner is able to perform, to act, is competent to do.	Increases his cognitive development.
	Behaviour	The learner engages with actions congruent with the new perspectives gained.	Develops new skills in order to put transformative outcomes into practice.

This typology is a systematisation of learning outcomes reported in transformative learning literature. It is a framework that guides the analysis and design of learning interventions. Moreover, this classification might not occur as such in reality since these learning outcomes overlap to a certain degree, i.e., emotion and action function altogether. Another consideration is that the manifestation of these learning outcomes depends on identifying prior learning or previous frames of reference.

From Table 4, it can be inferred that the ultimate learning outcome of transformative learning is the reintegration of new perspectives into one's life based on examined and fundamentally changed frames of reference; however, scholars have claimed that a total transformation of a whole individual rarely happens and that transformative learning is just an instance of better learning (Newman, 2010).

2.2.4 Learning conditions

Learning conditions refer to the external and internal factors upon which transformative learning occurs and provide a better understanding of the design, implementation, and evaluation of transformative learning interventions. Mezirow (1989) originally introduced these conditions as ideal conditions for discourse; however, these conditions encompass ideal conditions for the whole transformative learning process. Table 5 shows a compilation of different conditions that Mezirow (1989, 1997, 2003) has mentioned throughout his work.

Similar to the conditions described in Table 5, Limón (2001) identified factors that might induce cognitive conflict and, thus, learning. She also identified internal (related to the learning) and external conditions (related to teacher and social context). The former encompass mostly prior learning (motivations, knowledge, beliefs, etc.) and activated learning strategies to making sense of and coping with cognitive conflicts. At the same time, the latter include relationships between peers, learners and teachers, the field of knowledge, level of teaching, and teaching strategies.

Table 5. Transformative learning conditions (Mezirow 1989; 1997; 2003)

External conditions	Internal conditions
• Availability of accurate and complete information • Social space free from coercion • Equal opportunity to participate • Emotional external support • Models or mechanisms of communication and negotiation • Learning spaces that are problem-based and foster critically reflective thought	• Open to new and alternative perspectives • A well-developed frame of reference • Empathy • Willingness to seek common ground • Qualities of emotional intelligence

2.2.5 Other approaches and criticism

Other scholars have studied transformative learning, either parallelly or derived from Mezirow's work, and have developed specific approaches. For instance, Boyd (1989) proposed a framework for transformative education from analytical psychology, while Dirkx (2008) focused on the emotions in transformative learning processes. Other scholars such as Cranton (2013) have investigated the social component of transformative learning, Brookfield (2005) provided a better understanding of the role of critical theory in transformative learning, and Taylor (1994) approached transformative learning by studying intercultural competency. In the context of sustainability, O'Sullivan (2004) has approached transformative learning as an ecological consciousness.

Although Mezirow's (2003) classical model remains central to transformative learning theory, scholars have contested the lack of robust empirical research (Nohl, 2015). The same author calls into question the essential character of disorienting dilemmas in transformative learning processes and proposes that transformative learning processes have a non-determining start, where incidental, unnoticed, and casual events occur. In the same line, Newman (2010) argues there is no fixed period in which transformative learning occurs; transformative learning is not a finite experience.

Other criticisms arise in regards to the incorporation of spirituality into transformative learning without empirical and critical scrutiny (Newman, 2010), the implicit prevalence of the cognitive dimension over the emotional and social ones (Illeris, 2014), and the imbalance between the theorisation of transformative learning and its practical implementation (DeSapio, 2017). One of the significant criticisms of transformative learning is related to its evaluation. In this sense, Newman (2010) argues that transformative learning is entirely a subjective process, and the reporting of transformative learning outcomes relies on learners' self-perception and evaluation. On the other hand, other scholars argue that transformative learning is observable and identifiable (DeSapio, 2017), and different evaluation methods can be employed for its assessment (Cranton and Hoggan, 2012; Romano, 2018).

In sum, transformative learning is not only limited to Mezirow's model, but has also become a learning theory with its inherent theoretical debate resulting in a rich diversity of perspectives and alternative discourses. However, the appealing characteristic of the term 'transformative or transformational' has caused this theory to become a loose adjective for any learning experience (Tisdell, 2012). The purpose of transformative learning as a theory is not to label all learning phenomena as transformative; instead, it provides an analytical framework that allows studying phenomena to better comprehend how adults learn (Dirkx, 1998).

2.3 Transformative learning and sustainability

According to Mezirow (1987), transformative learning aims to change individuals' frames of reference and make them capable of coping and overcoming strange threatening situations. However, transformative learning goes beyond that as it ultimately allows individuals to become empowered and autonomous actors in their personal and social lives, impacting democracy, citizenship, and social and ecological action (Cranton and Roy, 2003; Cranton

and Carusetta, 2004; O'Sullivan and Taylor, 2004). In this regard, Mezirow (1997) mentioned that "thinking as an autonomous and responsible agent is essential for full citizenship in a democracy and for moral decision making in situations of rapid change" (p. 7), such as sustainability challenges.

Transformative learning has been slightly related to sustainability since its first years of development, for instance, ecological and environmental issues that affected nature itself and human life (O'Sullivan, 1999), yet without addressing specific topics such as climate change, global warming, pollution, loss of biodiversity, etc. O'Sullivan (1999) is one of the first scholars in relating transformative learning theory to environmental issues through his work of ecological consciousness. He argued that in transformative learning, the biotic elements of the natural world were not yet accounted for (O'Sullivan, 1999), calling, therefore, for a holistic approach to education that acknowledged ecological or planetary visions. This approach was either named an 'integral transformative learning' (O'Sullivan, 2004) or a holistic ecological framework (Clover, 2002), aiming to include themes such as ecological knowledge, quality of life, racism and classism, and ecofeminism.

Since Education for Sustainable Development (ESD) is a field of education that seeks to empower present and future generations to address and provide solutions to the world's environmental and social challenges, transformative learning has been growing as an area of inquiry in that field (Wright, 2007). Transformative learning resonates with the emancipatory approach of ESD as it encourages individuals to reflect upon the values of the status quo and adopt the ones based on sustainability principles and ethics (Sterling, 2010; Barth and Michelsen, 2013; Barth, 2015). In this sense, transformative learning attracts much attention as it provides insight into radical changes in individuals' perspectives.

Nonetheless, the same problem of looseness of the term transformative learning likely occurs in ESD since the adjective 'transformative' fits perfectly in many trends and discourses within the field of sustainability. In other words, any learning experience in sustainability settings is likely labelled as 'transformative' as scholars in the field of ESD have acknowledged the criticism and debate around transformative learning theory insufficiently.

Therefore, this doctoral work aims to understand how transformative learning has been conceptualised and operationalised in sustainability settings, in which learning is the object of the study. This chapter and the systematic literature review condensed in *article 1* constitute the conceptual basis for the following chapters and allow a better exploration of transformative learning in sustainability transformation, applied to the context of the fashion and textile industries in Mexico.

2.4 Article 1 - Transformative learning in the field of sustainability: A systematic literature review (1999-2019)

Transformative learning in the field of sustainability: a systematic literature review (1999-2019)

Jorge Gustavo Rodríguez Aboytes
Robert Bosch Research Group, Faculty of Sustainability, Leuphana University of Lüneburg, Lüneburg, Germany, and
Matthias Barth
Institute of Integrative Studies, Faculty of Sustainability, Leuphana University of Lüneburg, Lüneburg, Germany

Received 16 May 2019
Revised 20 September 2019
25 February 2020
13 May 2020
21 May 2020
Accepted 22 May 2020

Abstract

Purpose – This study aims to investigate how transformative learning has been conceptualised and operationalised in education for sustainable development (ESD) and sustainability learning and to collect evidence on how to support transformative learning in formal and non-formal environments.

Design/methodology/approach – The authors conducted a systematic literature review to provide a structured and replicable search and analysis of the relevant literature to produce a bibliometric overview that combines a quantitative description of the body of literature and qualitative analysis of the learning processes, outcomes and conditions.

Findings – The convergence between transformative learning and sustainability has become an emerging field of inquiry, despite the superficial use of transformative learning theory in many studies. By examining the learning process, outcomes and conditions in the core sample of studies, this study demonstrates that transformative learning theory – if carefully studied – can contribute to the design and implementation of educational interventions and assessments of learning towards sustainability. Furthermore, the sustainability context provides an empirical grounding that highlights the fact that social learning, the role of experience and the development of sustainability competencies are inherently part of transformative learning.

Originality/value – To date, few attempts have been made to better understand how transformative learning theory has been used in sustainability learning and ESD research. This systematic review allows for a better comprehension of how concepts and mechanisms elucidated in transformative learning theory are operationalised in sustainability learning and ESD research and serves as a source of inspiration for those researchers and practitioners who aims to make sustainability education, teaching and learning more transformative.

Keywords sustainability, transformative learning, critical reflection, systematic literature review, education for sustainable development, learning outcomes

Paper type Literature review

We want to thank the reviewers for their constructive critics to this manuscript. This research was made possible within the graduate school "Processes of Sustainability Transformation", which is a cooperation between Leuphana University of Lüneburg and the Robert Bosch Stiftung. The authors gratefully acknowledge the financial support from the Robert Bosch Stiftung (12.5.F082.0021.0).

International Journal of Sustainability in Higher Education

1467-6370
DOI 10.1108/IJSHE-05-2019-0168

1. Introduction

In the field of sustainability, transformative learning is gaining increasing impetus and recognition and is considered critical to enhancing and catalysing social transformations towards sustainability (Boström *et al.*, 2018). Consequently, the field of education for sustainable development (ESD) has embraced transformative learning to overcome a conventional approach of ESD and to support learning that leads to the transformation of unsustainable mindsets and the adoption of a paradigm towards sustainability (Balsiger *et al.*, 2017; Sterling *et al.*, 2018). At the same time, transformative learning influenced through many other disciplines (e.g. psychology and sociology) has evolved from an alternative perspective of learning to a learning theory characterised by its diversity of perspectives and discourses (Kitchenham, 2008; Cranton and Taylor, 2012; Hoggan, 2015; Laros *et al.*, 2017). Thus, the question remains as to how transformative learning theory has been used and put into practice in sustainability learning and ESD research, and how research on learning and sustainability can contribute to the further development of the understanding of transformative learning.

To date, few attempts have been made to investigate these questions. By using a systematic literature review (SLR), we aim to close this gap in the literature and provide a reliable account and an accurate overview of how the theory of transformative learning is applied in the sustainability context.

2. Transformative learning theory

Transformative learning evolved from the concept of perspective transformation (Mezirow, 1978) into an established learning theory based on concepts from constructivism as well as humanist and critical social theory (Cranton and Taylor, 2012; Tisdell, 2012). Transformative learning can thus be defined as:

> [. . .] learning that transforms problematic frames of reference – sets of fixed assumptions and expectations (habits of mind, meaning perspectives, mindsets) – to make them more inclusive, discriminating, open, reflective, and emotionally able to change (Mezirow, 2003, p. 58).

Mezirow (1981) also described some key characteristics of such learning by focusing on learning processes (how people learn), outcomes (what they learn) and conditions (how to best support their learning). In this paper, we will refer to the above definition of transformative learning and use its structure of learning processes, outcomes and conditions for the exploration of the data.

2.1 Process of transformative learning

Based on Mezirow's ten stages of transformative learning (Mezirow, 1994), the learning process encompasses a series of elements that are evolving, recursive and spiral in nature (Taylor, 1997). Prior learning is considered to be the accumulation of interpreted experiences in meaning structures or frames of reference, which "selectively shape and delimit expectations, perceptions, cognition, and feelings. They set our 'line of action'" (Mezirow, 1997, p. 5). These structures are the result of a dynamic adaptation of human needs to the cultural and economic conditions of a society in a given historical period (Fromm, 1941). Situations in which meaning structures are challenged to the extent that they are no longer useful to fit the interpretation of some experiences are captured as *disorienting dilemmas*. A personal life crisis can trigger these disorienting dilemmas, or they can come from a series of circumstantial events (Laros, 2017).

A further element focuses on the act used to critically analyse an individual's unexamined meaning structures and how these structures were constructed when someone

tries to render meaning from a disorienting dilemma (Mezirow, 1998). This *critical reflection* can be differentiated according to its object of content, process and premise (Lundgren and Poell, 2016); moreover, it is also possible to distinguish whether the subject includes only the premises of the external world or also her/his own premises, the latter case being an example of critical self-reflection (Mezirow, 1981, 1998). Discourse is described as a:

> [. . .] special kind of dialogue in which we focus on content and attempt to justify beliefs by giving and defending reason and by examining the evidence for and against competing viewpoints (Mezirow, 1994, p. 225).

Discourse occurs as a dialogue between at least two people and is triggered and enhanced through critical and critical self-reflection reflection.

Finally, transformative learning is not merely an intellectual process, and individuals cannot remain in the pure reflection phase. They have to show *action engagement* by negotiating or exploring new relationships or roles, planning a course of action, testing solutions and integrating these solutions into their lives (Calleja, 2014).

2.2 Learning outcomes in transformative learning

The term "learning outcomes" refers to what learners are capable of doing and thinking by the end of the learning period after having been embedded in disciplinary and professional contexts (Caspersen *et al.*, 2014) – that is, it refers to the results of the learning process. In the case of transformative learning, learning outcomes are difficult to be determined as many learning experiences tend to be labelled as transformative (Hoggan, 2016). On the one hand, learning outcomes from transformative learning processes have been categorised and classified according to Mezirow's (1981) domains of learning framework (instrumental, communicative and transformative/emancipatory). On the other hand, Hoggan (2016) created a typology in which changes in an individual's worldview, epistemology, self, ontology, behaviour and capacity are the most common learning outcomes from transformative learning endeavours and introduced criteria of breadth, depth and relative stability to differentiate among these outcomes.

To identify and determine when transformative learning happens, researchers have reviewed ways to evaluate transformative learning outcomes in both research and practice (Cranton and Hoggan, 2012; Romano, 2018). They have analysed qualitative instruments such as observations, checklists, journals, interviews, self-evaluation and narratives, and quantitative ones such as surveys and questionnaires [e.g. the Learning Activity Survey (King, 2009), the Critical Reflection Questionnaire (Kember *et al.*, 2000) and Transformative Learning Survey (Stuckey *et al.*, 2013)].

2.3 Learning conditions

The learning conditions in transformative learning originally appeared as ideal conditions of discourse (Mezirow, 1991). Although these conditions are challenging to achieve in reality, Mezirow (1994) stated that a learner should have the capacity to evaluate arguments objectively, opportunities to participate, accurate information, and should also be open to alternative perspectives, free from coercion and able to reflect on presuppositions critically. Nonetheless, these ideal conditions of discourse overlap with the different phases of transformative learning and their potential learning outcomes, thereby rendering an analysis of the impact of the learning conditions in the whole learning process rather difficult. Further research in transformative learning has found more concrete conditions for transformative learning including learning environments with meaningful relationships, partner facilitation, purposeful work and supported action (Franz, 2005, 2010; Southern, 2007). In the present paper, we define learning conditions as the set of external and internal

factors, such as partner facilitation and openness to alternative perspectives, respectively, that influence the learner's capacity to engage in a learning situation.

2.4 Transformative learning and sustainability

Conceptualisations of transformative learning encompass different individual and social purposes, such as autonomy, individuation, empowerment, ecological consciousness, social action, citizenship and democracy (Mezirow, 1997, 2003; Cranton and King, 2003), and are applied in a diversity of contexts (Taylor, 2009). Research on transformative learning can be seen in many areas ranging from personal transformation to organisational change and includes (but is not limited to) intercultural learning, participatory processes, lifestyle, educational settings and social and community transformation (Taylor, 1997; Mezirow and Taylor, 2009).

The broad understanding and general aims of transformative learning are to contribute to a more significant social change (or transformation) through education, which makes it appealing to ESD and sustainability learning. ESD is considered to have a robust transformative approach as it seeks -contrary to to other instrumental approaches- to empower individuals by encouraging them to critique status-quo values and social norms and to adopt sustainable principles and ethics by addressing unsustainable practices (Barth and Michelsen, 2013; Barth, 2015; Schneidewind *et al.*, 2016). However, while the discourse around transformative learning offers a rich diversity of perspectives (e.g. planetary, race-centric and cultural-spiritual) (Taylor, 2008), the term "transformative" has simultaneously taken on a looser meaning because it is often used to tag any learning experience (Tisdell, 2012). This looseness has affected the understanding and practice of transformative learning in sustainability learning and the field of ESD. Although there is only one review in the area of participatory processes of resources and environmental management (Diduck *et al.*, 2012), there is no general systematic link between transformative learning and sustainability and ESD. We, therefore, investigated the extent to which transformative learning has been conceptualised and operationalised in ESD and sustainability learning and collected evidence on how to support transformative learning in these scenarios.

3. Methods

To better understand the relationship between transformative learning and sustainability, a SLR was carried out on all peer-reviewed articles available in English that focus explicitly on transformative learning and sustainability. Systematic reviews represent a typical method of mapping the field and tracing recent developments in both educational science (Petticrew *et al.*, 2013) and sustainability science (Spangenberg, 2011) and have become a systematic method of investigation in their own right (Light and Pillemer, 1984; Littell *et al.*, 2008) [see Foster and Hammersley (1998) for a meta-review].

In the present study, we followed the systematic review approach outlined in Fink (2014) to provide a systematic and replicable search and analysis strategy that is fully documented and transparent. Our steps include:

- data collection;
- data processing and coding; and
- data analysis, which yielded a bibliometric overview that combines a quantitative and qualitative analysis of the learning process, outcomes and conditions.

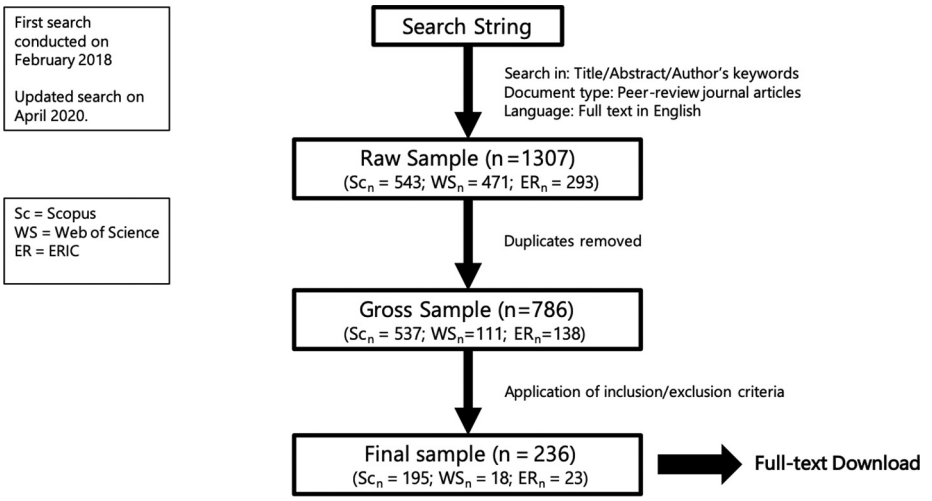

Figure 1.
Data collection procedure

3.1 Data collection

To provide a complete possible sample universe, we searched three databases (Scopus, Web of Science and ERIC) that broadly cover the social sciences and educational science, specifically. A literature search was conducted using the following search string:

(transformational OR transformative) AND (learning OR education*) AND ("sustainable development" OR sustainability).

Even though each database has different interfaces, settings and search engines, we applied the search string to all of them with the following initial settings (Figure 1): peer-review journal publications (article, review and article in press) and full text in English. The period of this research comprised all years until 2019.

We obtained a raw data set from each database consisting of 1,307 publications, which included numerous duplicates as the databases feature significant overlap. After eliminating duplicates, we retrieved a gross sample of 786 publications. The gross sample then went through an initial screening process with predefined criteria for inclusion and exclusion to ensure that the articles focused explicitly on transformative learning and sustainability. The inclusion criteria were papers, which either in their title, abstract or keywords, contained the terms of:

- "transformative/transformational learning/education"; and
- "sustainable development" or "sustainability" explicitly.

Some variations of these criteria included terms such as "transformative social learning" and "transformational sustainability education". This procedure led to a final sample of 236 articles, another 10 of which were removed because they did not meet the inclusion and exclusion criteria after full text screening.

3.2 Data processing and coding

The general research question was: What is the contribution of transformative learning theory in sustainability learning and ESD research, and vice versa? To answer this question, two specific research questions were posed (Table 1). *RQ1* allowed for a better

understanding of the types of articles in our sample universe and was a precondition for the subsequent in-detail analysis in *RQ2*.

For the analysis, a database was created out of the sample universe (n = 226) that included all available bibliographic data, the abstract and the full text. Additional variables were added to capture better the nature of the contributions (e.g. research area and application of transformative learning theory). Coding was done iteratively by screening the abstracts and then the full papers with an inductive coding approach, using Citavi 6 and Microsoft Excel software. Descriptors for each variable were assigned throughout the coding process and clustered according to patterns of similarity.

While the full sample universe in this way was captured for descriptive analysis, full text analysis was then carried out with the core sample of papers in which transformative learning theory is used in the argumentation, or it functions as the main framework (Table 3). These papers were coded qualitatively using MAXQDA as qualitative data analysis software. In an iterative coding process, the *a priori* established concepts of prior learning, disorienting dilemma, critical reflection, discourse and action engagement (Table 1) were applied to the full text body, and relevant themes were coded accordingly (Saldaña, 2013).

4. Findings

4.1 Understanding the sample universe

Transformative learning theory played a minor role in sustainability learning and ESD research from 1999 (the earliest year of articles published according to the search string and the databases used) to 2007, with less than five publications per year. From 2008 onwards, articles examining transformative learning theory and sustainability learning and ESD research began to increase, with an average of 18 publications per year (standard deviation = 11.7), and

Table 1. Research questions and elements of analysis for the SLR

Research question	Specific elements of analysis	*A priori* categories
RQ1: How has transformative learning been utilised in sustainability learning and ESD research?	Specific research areas	–
	Theoretical use of transformative learning	–
RQ2: How has transformative learning theory been operationalised in sustainability learning and ESD research?	Learning processes	Prior learning, disorienting dilemma, critical reflection, discourse and action engagement
	Learning outcomes	–
	Learning conditions	–

Table 2. Specific research areas in the field of transformative learning and sustainability

Research area	*N*	(%)
Higher education in general	88	39
Teachers education	24	10.5
Other formal learning	16	7
Non-formal and informal learning	58	25.5
Policy and guidelines	40	18
Total	226	100

reached its peak in 2019, with 41 published articles (see the link in the Appendix for the set of references within the sample universe).

The sample universe itself constitutes a heterogeneous field of articles on transformative learning and sustainability. Within the sample universe, we identified five distinctive research areas, as outlined in Table 2. A research area illustrates a domain in which a common topical focus best describes the various papers. Because of space constraints, all the citations provided henceforth in this section are only indicative, that is, they are only examples of articles.

The first research area – *higher education in general* – covers all contributions at the university level in either undergraduate or graduate programmes. Articles focus on the role of the curriculum (Winter *et al.*, 2015), teaching and learning in different settings (such as interdisciplinary environments; Noy *et al.*, 2017), field studies (Owens *et al.*, 2015) and study-abroad programmes (Ritz, 2011; Bell *et al.*, 2016). The second research area – *teacher education* – includes research on educational programs for teachers as such, as well as on the role of (pre-service) teachers as societal agents of change for transformative learning and sustainability (Iliško, 2007; Kostoulas-Makrakis, 2010). As teacher education played a significant unique role in a large body of research and as it also spans from pre-service education to in-service training, we singled out this area from *higher education in general*. *Other formal learning* refers to transformative learning and sustainability in settings other than higher education, such as K-12 (Goulah, 2011), for which the topics of ESD and curriculum figure prominently (E. Dyment *et al.*, 2015).

In contrast to formal learning, a fourth research area focuses on *non-formal and informal learning*. This area encompasses research in learning environments that are not directly linked to educational institutions and formal programs. Research in this area predominantly covers how learning processes unfold in experiences of public participation, such as in resources and environmental management (Diduck *et al.*, 2012), sustainable tourism (Coghlan and Gooch, 2011) and intercultural exchange (Lloyd *et al.*, 2015). The fifth and final research area – *policy and guidelines* – encompasses mostly conceptual elaborations on policy and general discourses on education and their links to ESD (Bell, 2016; Mochizuki, 2016), sometimes including more radical and novel perspectives (de Angelis, 2018; Lange, 2018) related to policy implications of specific topics, such as the role of technology education in ESD (Pavlova, 2013).

A closer examination of the role that transformative learning theory plays in the sample universe allowed us to further distinguish between publications. By analysing the understanding of the concept of transformative learning in the sample universe, we could cluster four different groups, as outlined in Table 3.

The first group – *buzzword* – (approximately one-third of the final sample) comprises articles that display an imprecise use of the term "transformative learning" by either not defining it at all or describing it superficially without direct bibliographic references to transformative learning theory. Almost 30% of the articles in this group have

Table 3. Classification of the sample universe according to the theoretical use of transformative learning

Research area	*N*	(%)
Buzzword	76	33.5
Supportive framework	52	23
Alternative approaches	15	6.5
Central framework	83	37
Total	226	100

transformative learning as a keyword and include highly cited articles that are relevant to the field of ESD (Wiek *et al.*, 2011).

The second group – *supportive framework* – is defined by articles that explicitly refer to transformative learning theory or some of its elements yet do not feature it as a central part of the narrative of the articles' main argument. Instead, transformative learning in these articles is part of the theoretical foundations of broader models, such as the INDICARE model (Disterheft *et al.*, 2016), or it serves to strengthen the theoretical rationale for different topics, such as innovative pedagogical models in ESD (Thomas, 2009).

In the third group – *alternative approaches* – the concept of transformative education is conceptualised as an approach opposite that of a transmissive approach in ESD, the latter having a more instrumental view (Lu and Zhang, 2014; Mogren and Gericke, 2017) that highlights the more radical and critical features of the former (Bell, 2016). This conceptualisation represents a different understanding than that of the classical stream of transformative learning (i.e. Mezirow and colleagues); however, links and similarities are used to underpin the authors' arguments.

The fourth and most significant group (with 37% of all contributions in this classification) is the *central framework*, in which transformative learning is the leading theory in the argumentation or the main framework of the article. Of the papers in this group, 73% are empirical and were framed either as qualitative case studies or as intervention studies in which some sort of change in the learner is the goal, sometimes supported by a specific instructional design.

4.2 Analysis of the core sample

In our further analysis, we focused on the group of key articles that used transformative learning as a *central framework*. Insights from these articles can be structured according to their description and explanation of the learning process, learning outcomes and relevant learning conditions. The themes that emerged from the analysis of the data (*a posteriori*) are compiled below (Table 4).

4.2.1 Learning process.

4.2.1.1 Prior learning. While only a few articles explicitly investigated the learners' prior perspectives and worldviews, the majority mentioned prior learning as part of learners' general background and sustainability-related experiences and thus as a general precondition for transformative learning. Learners' general background refers to expertise in a specific field or discipline and past experiences regarding the performance of specific tasks and socio-cultural interactions during educational interventions (Ritz, 2011; Lloyd *et al.*, 2015; Kalsoom and Khanam, 2017; Sims, 2017). Sustainability-related experiences encompass learners' previous related knowledge from a formal academic background or their work experience as manifested in conceptual literacy or practical skills (Bell *et al.*, 2016; Piasentin and Roberts, 2017; Cottafava *et al.*, 2019). Moreover, individuals sometimes bring along predispositions, expectations and attitudes for a change in sustainability because of their differing life experiences (Kerton and Sinclair, 2010; Burns, 2016).

4.2.1.2 Disorienting dilemma. In the reviewed articles, disorienting dilemmas can occur in three different ways:

(1) *Non-structured and unintended situations*: The disorienting dilemma is not contrived by the educator but occurs naturally. For instance, individuals may face an existential conflict or a difficult moral decision (Ball, 1999; Lange, 2004; Kerton and Sinclair, 2010), or they may have experienced socio-ecological problems in their own or foreign communities (Marschke and Sinclair, 2009; Quinn and Sinclair, 2016; Quang *et al.*, 2019).

Elements of analysis	*A priori* categories		*A posteriori* themes	
Learning process	Prior learning		Learners' general background	
			Sustainability-related experiences	
			Predispositions and expectations	
	Disorienting dilemma		Non-structured and unintended situations	Facing existential conflicts or moral decisions
				Having suffered socio-ecological problems in the past
			Structured and unintended situations	Entering new learning environments
				Forming new social relations
			Structured and intended situations	Presenting contrasting information
				Raising critical questions
				Designing educational programmes abroad
				Exposing students to unfamiliar methodologies
	Critical reflection	On content	Information, values and norms	
			Teaching practices	
			Resource management practices	
		On process	Participation in individual or group activities	
			Assessment of own performance and understanding	
		On premise	Thoughts, beliefs, attitudes, actions and behaviours in the context of:	
			Higher education	
			Teacher education	
			Environmental and resources management	
			Intercultural exchange	
	Discourse		Sharing of sustainability-related knowledge and practices	
			Commenting experiences of participation in community activities	
			Challenging others' assumptions	
			Making meaning together	
	Action		Adoption of sustainable behaviours	
			Development of new habits	
			Formulation of new plans of actions	
			Participation in decision-making	
			Initiation of group activities	
			Creation of community-based organisation	
Learning outcomes			Increase of new knowledge and practical skills	
			Reconstruction of values, norms and perspectives	
			Increase in the sense of, self-awareness, agency and empowerment	
			Development of critical, systems and complex thinking	
			Social learning (reinforcement of social relationships, social mobilisation and activism)	
Learning conditions			Power relations	
			Time and space for reflection and discourse	
			Social interaction among learners	
			Educational experiences beyond formal settings	
			Readiness and openness for a transformative experience	

Table 4.
Summary of themes found in the core sample

(2) *Structured and unintended situations*: They refer to planned learning activities in which the educators do not deliberatively trigger a dilemma but – because of the nature of the activity – the learners nevertheless experience such a dilemma. Examples include new learning environments – such as interdisciplinary settings

(Kokkarinen and Cotgrave, 2013; Noy *et al.*, 2017) – or learners being asked to participate in change processes and establish new social relations (Burns, 2016; Chao, 2017; Yeo and Yoo, 2019).

(3) *Structured and intended situations*: They refer to cases in which the disorienting dilemma is planned and induced deliberatively during educational interventions to challenge learners' frames of reference by either presenting contrasting information (Davis and Boulet, 2016; Piasentin and Roberts, 2017), raising critical questions (Kostoulas-Makrakis, 2010), designing educational programmes abroad (Bell *et al.*, 2016) or exposing students to unfamiliar assessment methodologies (Saravanamuthu, 2015).

4.2.1.3 Critical reflection. Three different types of reflections mentioned in the theoretical framework section could be identified. *Reflection on content* encompasses the analysis of information, concepts, values and norms (Sims and Sinclair, 2008; Quinn and Sinclair, 2016) or individuals' practices in teaching (Kostoulas-Makrakis, 2010) or resource management (Bull, 2013; Lankester, 2013). It also covers reflection on relationships within and among organisations and communities (Walker *et al.*, 2014; Young and Karme, 2015). *Reflection on process* refers to assessing the way learning experiences unfold. Examples include situations in which learners reflect on their participation in a particular individual or group activity (Wahr *et al.*, 2013; Chao, 2017) that involved a form of assessment of their performance and understanding (Quinn and Sinclair, 2016; Piasentin and Roberts, 2017). Finally, *reflection on premise* is the deepest level of reflection and occurs when learners assess the assumptions that underlie their thoughts, beliefs, attitudes, actions and behaviours in the context of higher education (Brunnquell *et al.*, 2015), teacher education (Feriver *et al.*, 2016), resource and environmental management (Sims, 2012) and intercultural exchange (Ritz, 2011; Young and Karme, 2015).

4.2.1.4 Discourse. Some authors refer to the stage of discourse as a process of sharing knowledge and practices related to sustainability (Sims, 2012; Lankester, 2013) or experiences of participation in a community activity (Chao, 2017). Discourse is also shaped in processes of conflict and problem resolution in which challenging others' assumptions and beliefs and meaning-making together form the key features that transcend the simple process of sharing information (Iliško, 2007; Vanasupa *et al.*, 2014; Davis and Boulet, 2016). An interesting example of the above is the conceptual tool of "making (non) sense" developed and applied by James (2019) in a South African urban context.

4.2.1.5 Action engagement. The transformation process is sometimes followed by adopting sustainable behaviours as part of designed experiments (Bentz and O'Brien, 2019) or implementing new behaviours that are consistent with the insights acquired in transformation experiences. These experiences include the development of new individual habits (Bell *et al.*, 2016) or to the formulation of new plans of action in the context of teaching (Kostoulas-Makrakis, 2010) and community-resource management (Marschke and Sinclair, 2009). Action takes place not only individually but also in groups of learners who engage in social action by participating in decision-making processes (Sims, 2017), initiating group activities to raise critical awareness regarding sustainability issues (Kerton and Sinclair, 2010; Quinn and Sinclair, 2016) or creating community-based organisations (Westoby and Lyons, 2017).

4.2.2 Learning outcomes. The most prominent learning outcome is the *increase of new knowledge and practical skills* linked to sustainability-related issues, which range from the understanding of concepts and technical information to the ability to implement environmental management practices (Diduck and Mitchell, 2003; Sims and Sinclair, 2008; Chao, 2017; Phuong *et al.*, 2019). Reflection and the *reconstruction of values, norms and*

perspectives represent another learning outcome in which learners become more empathetic and compassionate (Young and Karme, 2015), move away from self-interest to more collective concerns (Sims, 2012), give more importance to environmental resources and social justice (Moyer *et al.*, 2016) and sometimes gain a sense of unity and interconnectedness with their natural and social surroundings (de Angelis, 2019). The latter is also related to changes in life perspectives and worldviews (Feriver *et al.*, 2016; Papenfuss and Merritt, 2019).

Learners also experience self-awareness (Papenfuss and Merritt, 2019), gain personal confidence and develop a more integrated identity, which increases their sense of *agency and empowerment*, as manifested by a willingness to make a change in their communities, promoting sustainable actions (Iliško, 2007; Bell *et al.*, 2016; Piasentin and Roberts, 2017; Probst *et al.*, 2019), expressing feelings of responsibility towards climate change (Bentz and O'Brien, 2019), assuming active roles in communal and management activities and communicating change (Bull, 2013; Davis and Boulet, 2016; Sims, 2017). This sense of agency and empowerment is also complemented by the acquisition and improvement of different managerial related skills, such as business modelling, leadership and design thinking (Cottafava *et al.*, 2019).

A fourth learning outcome is the development of *critical, systems and complex thinking*, through which learners can see the interconnectivity of cultural, economic, social and environmental systems (Kostoulas-Makrakis, 2010; Kalsoom and Khanam, 2017) and thus comprehend the interdisciplinary nature of sustainability problems (Piasentin and Roberts, 2017). Learners are also able to recognise everyday situations, such as contested social constructs under the influence of power structures (Iliško, 2007). Finally, *social learning* outcomes throughout this review manifest in the reinforcement of social relationships within and among groups and organisations (Ritz, 2011; Bull, 2013; Westoby and Lyons, 2017; Quang *et al.*, 2019). These outcomes also refer to social and political action, such as social mobilisation and activism (Diduck and Mitchell, 2003; Marschke and Sinclair, 2009), in which individuals become part of community-based environmental organisations (Lange, 2004; Sims, 2017) or initiate projects to promote sustainable consumption in their communities (Sims and Sinclair, 2008; Moyer *et al.*, 2016).

4.2.3 Learning conditions. Among external conditions, *power relations* are reported as a crucial factor in management and decision-making processes in which participation processes are controlled by influential external stake holders who limit proper access to information and constrain opportunities for participation, thereby triggering a sense of futility and a lack of agency among the public (Diduck and Mitchell, 2003; Walker *et al.*, 2014).

One of the most often-mentioned conditions for fruitful transformative learning processes is providing *time and space for reflection and discourse*. Through this process, learners can express their emotions, narratives and thoughts freely and ultimately reflect upon their beliefs and assumptions via anything small, informal, genuine conversations to formal and structured gatherings (Ritz, 2011). As part of the transformative learning process, *social interaction among learners* is of rather importance – especially for the stages of discourse and action – as it enhances the understanding of the self and others (Lankester, 2013; Westoby and Lyons, 2017). Furthermore, this social interaction also manifests in the creation of a supportive social environment for learners, where they can feel safe and trustful, such as peer-, network- and community-based support to cope with disorienting dilemmas (Sims, 2012; Saravanamuthu, 2015).

Educational experiences beyond the formal settings are reported as being valuable to the transformative learning process and include activities in nature (Blake *et al.*, 2013) and study-abroad programmes (Ritz, 2011; Winter *et al.*, 2015; Bell *et al.*, 2016). Similarly, hands-on experiences have been able to leverage the transformative learning process by enabling learners to experiment with

sustainable behaviours and art projects (Bentz and O'Brien, 2019), or to implement ecological-related techniques and resource management plans (Burns, 2016; Sims, 2017).

The primary reported internal factor is that learners display *readiness and openness for a transformative experience* (Ball, 1999; Lange, 2004). This predisposition has multiple manifestations: excitement at taking part in new and challenging educational experiences (Blake *et al.*, 2013), a willingness to be an active part of management and decision-making processes (Sinclair *et al.*, 2013) and an interest in experiencing alternative tourism activities (Lloyd *et al.*, 2015; Chao, 2017). Another manifestation is that, before the learning experience, individuals have already changed their frames of reference to contribute to sustainability both individually and socially (Kerton and Sinclair, 2010; Lankester, 2013).

5. Discussion

The field of transformative learning theory in sustainability learning and ESD research has become an emerging field of inquiry, as demonstrated by the growing number of publications over time – a common trend in numerous areas of research not only in sustainability and ESD (Barth *et al.*, 2016; Figueiró and Raufflet, 2015; Aikens *et al.*, 2016) but also in adult learning and transformative education (Lange and O'Neil, 2018). Within this body of literature, several distinctive features of how transformative learning theory is used can be found.

Firstly, our findings indicate that transformative learning has become an attractive theory that is used in the field of sustainability but is far too often implemented without a critical exploration of the underlying theory. Transformative learning was a buzzword and a catchphrase among many publications in the review – a phenomenon that is also evident for other concepts, such as social learning (Reed *et al.*, 2010). There are at least three possible explanations for this occurrence:

(1) the term "transformation" is widely used in the sustainability discourse without further systemic characterisation, which renders it a buzzword for any process by which any change takes place (Feola, 2015; Few *et al.*, 2017);

(2) as a result of the influence of other disciplines (e.g. psychology), transformative learning is used as an adjective to tag different human experiences, thereby rendering the term meaningless (Tisdell, 2012); and

(3) many different perspectives and discourses have emerged within transformative learning, thus leading to a fragmentation of the theory rather than its unification (Cranton and Taylor, 2012).

Secondly, the findings of this review reveal that researchers identify a broad spectrum of potential learning outcomes for transformative learning; however, what often remains somewhat unclear and unspecified is whether transformative learning represents a learning outcome in itself or a means of achieving cognitive and non-cognitive outcomes to enable transformative actions. Moreover, the different frameworks reported in the literature to classify transformative learning outcomes (Sipos *et al.*, 2008; Diduck *et al.*, 2012) do not address this issue. The complexity of this problem could lay in the unpredictability and subjectivity of the outcomes of such life-changing experiences as well as the methodical and ethical implications in evaluating them. Nonetheless, recent efforts in evaluating transformative learning outcomes and levels of reflection through surveys and questionnaires were found in this review (Papenfuss and Merritt, 2019; Probst *et al.*, 2019; Brunstein *et al.*, 2019).

Thirdly, this review makes self-evident that transformative learning shares common elements to both experiential and social learning (Kolb and Kolb, 2005). From the experiential learning cycle, concrete experience and active experimentation figure

prominently in the results from this review, as exemplified by situations in which learners have hands-on experiences or are in contact with the natural environment or experiment with specific techniques to solve environmental problems. However, these activities also involve engagement in social interaction, reflection and dialogue in the form of discourse and thereby complete the experiential learning cycle: abstract conceptualisation and reflective observation. Furthermore, transformative learning involves two distinctive elements in social learning, as highlighted by Barth *et al.* (2017):

(1) social learning as the social environment that surrounds the learning process or learning that occurs via social interaction; and

(2) social learning as a learning outcome of a group, community or society.

Several times during this review, social learning as social interaction and as a learning outcome was identified: the social interaction component was seen in the transformative learning process, especially in discourse and action engagement, and social learning as an outcome was visible in non-formal and informal learning, especially in the context of environmental and resource management. Therefore, although transformative learning theory has received critiques of focusing solely on individual change rather than on social change (Hoggan, 2015), individual transformative learning increases the likelihood of social change (Quang *et al.*, 2019) within, among and beyond communities and organisations, sometimes even involving political action towards sustainability.

Finally, systems-thinking competencies, as well as normative and interpersonal competencies (Wiek *et al.*, 2011), can be related to the learning outcomes identified in this review. As an analytical meta theory (Hoggan, 2015), transformative learning can provide valuable insights into the process of developing these competencies. The development of each competency can be conceptualised as a transformative learning journey that involves several disorienting situations that require critical (self-) reflection efforts and that are put into practice through action engagement.

What can we learn from this review? Transformative learning holds valuable insights into informing and supporting the design and implementation of learning and educational interventions for sustainability. In ESD literature, the need for reorienting pedagogical practices from the "conventional" ones is repeatedly emphasised when seeking impactful learning outcomes both individually and socially. There are a variety of pedagogical efforts to accomplish this goal, from specific approaches, such as problems and project-based learning (Brundiers and Wiek, 2013) and art methods (Bentz and O'Brien, 2019; Walshe and Tait, 2019), to broad settings, such as interdisciplinary and intercultural learning environments (van Dam-Mieras *et al.*, 2008); nonetheless, the introduction of these methods and settings can provoke unexpected dilemmas. Hence, it is essential to consider both the disorienting dilemmas that can emerge during the learning interventions (whether they are planned as transformative or not) and the prior learning of individuals before embarking on these processes. Moreover, the normative orientation and inherent emotional charge in environmental and sustainability issues are also drivers of disorienting situations. The findings reveal the importance of planning these educational interventions to create supportive learning conditions such as those identified in the review (e.g. power relations, time and space for reflection and discourse, social interaction and support; see findings section). The most important precondition for coping with disorienting situations is to have the proper social support mechanism without precluding the triggering of learning. Additionally, the review highlighted the importance of being aware of individuals' readiness and openness to change and to learn, especially in the designing of the disorienting dilemmas, as not all individuals are ready to participate in these learning events.

6. Concluding remarks

The field of transformative learning and sustainability will continue to grow as researchers and practitioners in the field are searching for more transformative approaches to find better ways to promote sustainability transformation through learning and education. This systematic review allows for a better understanding of how the concepts and mechanisms explicated in transformative learning theory are used in sustainability learning and ESD research. We acknowledge the limitations of this paper regarding the inclusion of all core sample articles in the findings and discussion section, the depth of the discussion of the categories and themes presented, and a detailed elaboration of some elements and perspectives present in transformative learning theory. We consider our work to be exploratory and to serve as a point of departure for debates in the field. Our intention with this review is to set a point of reference from which potential articles that we might have missed (as well as future articles) can be integrated into the sample universe.

We found with this review that transformative learning theory has been used extensively in sustainability learning and ESD research, yet there is considerable superficial use of it. With the majority of studies concentrated in the *higher education in general* area, transformative learning in sustainability has become an emergent field of inquiry, supporting theoretical production as well as teaching and learning practices towards sustainability. Moreover, by examining the learning process, outcomes and conditions in the core sample of articles, we demonstrated that transformative learning – if carefully studied – could contribute to the design and implementation of the assessment of learning as well as to educational interventions towards sustainability. Furthermore, research on sustainability learning has contributed significantly to the further development of transformative learning theory. The sustainability context provides an empirical grounding that helps to highlight the fact that social learning, the role of experience and the competencies for sustainability are inherently part of transformative learning. Moreover, approaches in the assessment of learning outcomes in the field of ESD can contribute to completing and strengthening the evaluation methods of transformative learning.

Even though there is no direct impact in practice with this review, it serves as an organised literature source to support further knowledge in the field of transformative learning theory and sustainability. Especially for those dabbling in the field, both practitioners and researchers, this paper contains essential literature references to transformative learning theory and references of its application in sustainability-related contexts. Future research in transformative sustainability learning would be wise to note that more empirical research is needed in the areas of teacher education and formal learning other than in higher education. Finally, there is a need for better methods and tools that can provide insights into the processes and outcomes of transformative sustainability learning.

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Appendix

Set of publications of the sample universe (n = 226) organised according to the theoretical use of transformative learning (see Table 3).

Link: www.researchgate.net/publication/335920777_Appendix_-_Final_sample_of_articles_collected_in_a_systematic_literature_review_published_in_Rodriguez-Aboytes_and_Barth_2020_submitted_Transformative_learning_in_the_field_of_sustainability_A_systema

About the authors

Jorge Gustavo Rodríguez Aboytes is a PhD candidate at the Leuphana University of Lüneburg. He is carrying out his doctoral studies within the Robert Bosch Research Group "Processes of Sustainability Transformation", at the Faculty of Sustainability. He is currently working on research topics such as transformative learning, real-world laboratories, sustainability textiles and fashion plus other research interest in education for sustainable development, curriculum design and development, transitions and transformation research, etc. Jorge Gustavo Rodríguez Aboytes is the corresponding author and can be contacted at: rgrodrig@leuphana.de

Matthias Barth is a Professor of Education for Sustainable Development at the Faculty of Sustainability at Leuphana University of Lüneburg in Germany. His particular interest is in the nexus of learning and sustainable development. His current research projects investigate the role of formal education settings for competence development, transformation processes as learning processes and how to support them and competence development in higher education for sustainable development. Matthias is currently leading several sustainability science projects, including the Institute for Sustainable Development and Learning, engaging with transformation processes and the role of learning in these processes.

3 The context of sustainability transformation: The textile-fashion sector in Mexico

Before entering the conceptual domain of the dynamics of sustainability transformation, it is necessary to present the research context of this work: a) the global sustainability challenges of the textile-fashion sector and b) the structural conditions in Mexico that hinder its sustainability transformation.

3.1 Sustainability challenges in the global textile-fashion industry

The textile-fashion industry is one of the most immense and complex economic activities globally because of its diversity in products and global supply chain structure (Shishoo, 2012). The textile supply chain involves an interaction between different systems to serve the demand and supply of raw and manufactured materials and energy resources (Muthu, 2017). As shown in Figure 2, the textile-fashion industry can be modelled as a series of systems that constitute a supply chain and demand resources from the Earth or natural system. Each system comprises a different set of industries and actors. For instance, the fibre production system requires fertilisers, seeds, and other chemical products to ensure the cultivation and production of cotton, the most used natural fibre globally (Niinimäki *et al.*, 2020). In the case of the production of synthetic fibres such as polyester, oil and other chemical processes are needed. The textile production system comprises those industries that produce yarns and fabrics from the fibres. Here, most textile industries come into play by employing both mechanical and chemical processes. The clothing manufacturing system ranges from brands and designers to garment manufacturers, and modulates the demand and supply of materials. The retailing system refers to the brands and stores that interact with users to sell the respective clothing and garments. Finally, the use-dispose system includes people and actors who use, maintain, and dispose of the garments when they no longer satisfy their needs (Han *et al.*, 2017; Niinimäki *et al.*, 2020).

It is vital to notice that each system requires material and energy inputs and produces significant emissions of pollutants in water, soil, and air matrixes leading to various environmental problems, for instance, erosion of soil and depletion of nutrients (Muthu, 2014, 2017; Lehmann *et al.*, 2018; Niinimäki *et al.*, 2020). Another example is chemical pollution: According to Scott (2015), there are more than 8000 chemical compounds used in the textile supply chain, of which at least 165 chemical compounds used in textiles have been classified as dangerous to human health. However, the formulas of these substances are often confidential, or there is no record of them (Keßler and Kümmerer, 2021).

The production of fabrics generates impacts on the water and emits a large number of pollutants into the atmosphere, such as carbon dioxide, nitrogen, sulphur, and other volatile compounds, which contribute to climate change and global warming. Specifically, the generation of these pollutants occurs through drying processes in ovens that operate at high temperatures and the use of boilers (Khan and Malik, 2014). In the use-dispose system, on the one hand, significant amounts of water and energy are needed for the laundry, drying and ironing process, causing profound environmental impacts (Sherburne, 2009); on the other hand, the inadequate disposal of textiles and garments generates solid waste problems, contamination of water, soil and air, when textile waste is incinerated (Niinimäki *et al.*, 2020).

Focusing only on the environmental effects overshadows the social impacts and dynamics around the textile-fashion system. The complex supply chain involves an imbalanced relationship among stakeholders, ranging from farmers to clothing retailers. In order to produce a single garment, marketing, trading, and legislation are crucial aspects, and within them, there are power relations and structures that generate inequity, create monopolies, unfair trades and exploitation of local workforces (Sherburne, 2009). For instance, the end of the Agreement on Textiles and Clothing (ATC) resulted in open flows of materials and goods into the most important markets, contributing to the development and escalation of production-consumption models such as fast fashion (Vázquez-López, 2020b).

As the fast fashion model has become the predominant one, this industry is organised in a fragmented supply chain to maximise production rates at the lowest production costs, which leads to seeking cheap workforces and access to land use in regions with weak environmental and social state regulations (Frederick and Gereffi, 2011). The global apparel industry's supply chain segmentation gravitates around activities in developing countries, which offer intensive and cheap labour and good accessibility to resources (Chodhury, 2014).

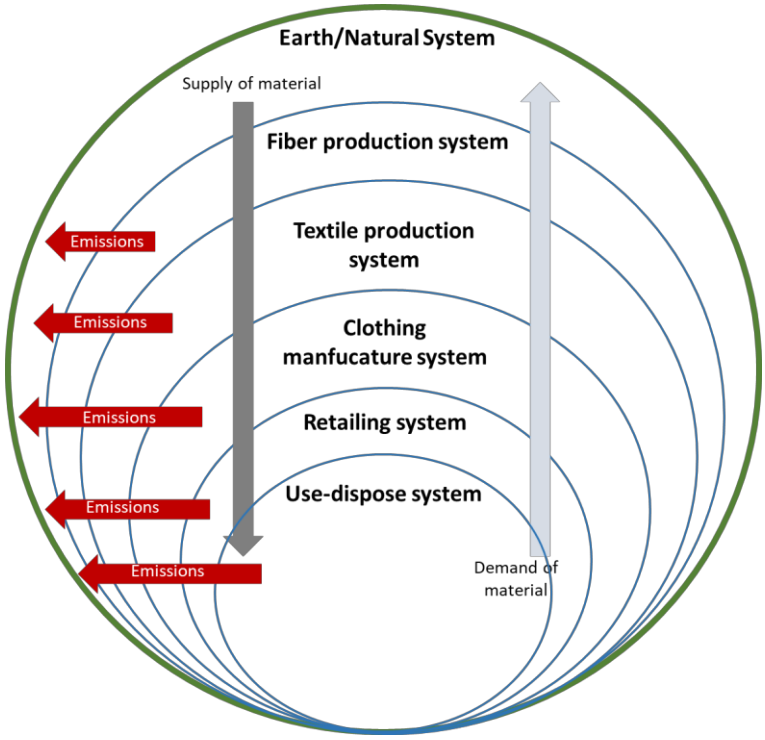

Figure 2. Embedded systems that constitute the overall textile-fashion industry (Chodhury, 2014; Muthu, 2017)

The transformation processes in this sector encompass various issues that are part of the different sustainability dimensions. Substantial innovation and research efforts are addressing these challenges, such as green technologies, low environmental impact processes (Rana *et al.*, 2015; Samanta *et al.*, 2019; Shahid-ul-Islam *et al.*, 2013), and innovations in business models (Pal, 2017); nevertheless, technical solutions remain shallow leverage points, and social change as well as paradigm shifts are urgently needed (Fletcher, 2009). In this way, the challenge for a sustainability transformation is that "whole new chains of production, relationships, dependence and interdependence need to be invented and developed" (Sherburne, 2009, p. 6). This requires actors to face and lead these changes, both in the technical and social aspects. These actors are the future change agents for sustainability who tackle environmental and social challenges by adopting sustainability criteria into their work and projects. Besides, change agents such as entrepreneurs "enact substantial change in the organisation and beyond, and which transfer the vision of sustainable development through cooperation and public relations to a wider group of the society" (Hesselbarth and Schaltegger, 2014, p. 26).

3.2 Structural conditions of the Mexican textile-fashion sector

Although the textile culture in Mexico is renowned for its Spanish and Indigenous folklore, nowadays, Mexico is an emerging fast fashion market to exploit (Deschamps *et al.*, 2017), one of the top ten world's' textile importers, and a crucial textile and apparel supplier to the US market (Keough and Lu, 2021). From small-scale and family-owned

company configuration, the Mexican textile industry started to grow as trade duties and quotas liberalised through the North American Free Trade Agreement (NAFTA) came into force (Oh and Suh, 2003; Vázquez-López, 2020a).

Taking advantage of NAFTA, the US textile and apparel industries aimed to strengthen the North American supply chain network to compete against a growing Asian textile industry. By producing and exporting materials such as yarns and fabrics to Mexico and other Central American countries, the US industries pursued the manufacture of garments at low labour costs. As a result, a major portion of US textile and apparel manufacture was relocated to Mexico through the creation of industrial complexes in order to perform as many supply chain capabilities as possible (Oh and Suh, 2003; Vázquez-López, 2020a). Nevertheless, contrary to a successful development expected with the implementation of NAFTA, the textile industry in Mexico stagnated due to the following factors: the structural political and social conditions in Mexico, the growth of Asian textile industries, commercial dependencies within the North American block and a weak domestic market (Oh and Suh, 2003; Vázquez-López, 2020a, 2020b).

By the time the US industries moved to Mexico, the textile infrastructure in Mexico was underdeveloped, and the corruption and political instability caused inefficiencies that increased the production costs (Oh and Suh, 2003; Frederick and Gereffi, 2011). Moreover, the rapid industrialisation of the textile and apparel manufacturing industries from the US to Mexico led to the fragmentation of local manufacturing companies, as there was never a strategic adaptation of Mexican small and medium enterprises (SME's) into the demands of US companies (Arroyo López and Cárcamo Solís, 2010; Vázquez-López, 2020a)

With the US being the most prominent apparel market in the world and due to the NAFTA quota- and duty-free tariffs, Mexico started to become a commercial bridge for Asian countries. They exported their yarns and fabrics to Mexico as these were cheaper because of currency differences, which resulted in overshadowing the production of textile materials in North America (Oh and Suh, 2003). However, beyond the market competition of yarns and fabrics, Asian countries also became strong competitors against Mexico as they started to export garments and apparel products directly to the US. In this sense, for instance, China surpassed Mexico in exports of textile goods to the US apparel market, regardless of NAFTA's advantages at the beginning of its implementation (Frederick and Gereffi, 2011). This situation caused the created industrial apparel manufacturing complexes to suffer bankruptcy, and the production of textile goods decreased drastically (Vázquez-López, 2020b).

Furthermore, comparisons can be made between the success of China in entering the US apparel market and the stagnation of Mexico’s textile industry. Even though China's labour costs are lower than in Mexico but higher than in other Asian countries, China has invested much more in infrastructure, leading to a further expansion of textile and manufacturing facilities. While the Mexican government's support and incentives for textile manufacturing have not been a priority, China's economic agenda focused much on developing the textile and apparel industry. This has translated into Mexico's high labour cost but low productivity, making them less competitive than China (Frederick and Gereffi, 2011).

NAFTA has locked Mexico's industries and markets within the North America block, leaving Mexico out of a global supply chain industry. This locking-in happened also because US firms wanted to keep domestic supply business models by moving to nearby, low-wage countries (including Central American countries) to manufacture labour-intensive apparel parts. Moreover, considering that cotton is a subsided crop in the US, it is exported to and used by Mexican and Central American textile industries, leading to a strong dependency on this fibre, limiting the development of products with other materials (Robinson, 2010). In this sense, China apparel export products are more diverse than Mexico's: "Whereas the top three products from Mexico accounted for over 50% of all US apparel imports from that country in 2009, China's top ten apparel exports to the US in 2009 represented less than 40% of

its total apparel exports to the US market" (Frederick and Gereffi, 2011, p. 74). This has also led to solid competition between Mexico and other Central American countries, focusing primarily on the same type of products. In other words, Mexico and Central American countries act as competitors instead of collaborating to face market pressures from Asia (Frederick and Gereffi, 2011).

Compared to China, Mexican firms did not develope capabilities and knowledge in other areas such as marketing, branding or product innovation (Frederick and Gereffi, 2011). These companies wanted to maintain relationships only with large and prominent US apparel companies (Vázquez-López, 2020b). The domestic textile market was not able to take off also because of the illegal entry of textile and garments from China to Mexico, as well as the second-hand clothing from the US, which sometimes are smuggled in and sold at both informal markets and large outlet retailers, which constitute half of the clothing market in Mexico (Vázquez-López, 2020b).

In sum, Mexico has no competitive advantage of proximity and preferential access (Frederick and Gereffi, 2011). The relocation of textile and garment factories to Mexico did not achieve its purpose and started to decay slowly, which also caused the decrease in the North American block of textile and garment manufacture competitiveness. Moreover, with Mexico being dependent on the development of the North American apparel manufacturing sector supported by NAFTA, the reconfiguration of the global textile scenario worsened the structural problems that the Mexican industry had carried along for many years, such as the use of obsolete technology infrastructure (Vázquez-López, 2020a).

Figure 3 summarises how the textile-fashion sector in Mexico is positioned. Although a new trade agreement just came into force in 2020 (i.e., USMCA, United States-Mexico-Canada Agreement), the NAFTA shaped the structural conditions in which this sector in Mexico operates. It is not in the scope of this work to discuss in detail the specific social and environmental problems that these conditions have generated as the sustainability challenges of the global textile-fashion industry manifest also in Mexico.

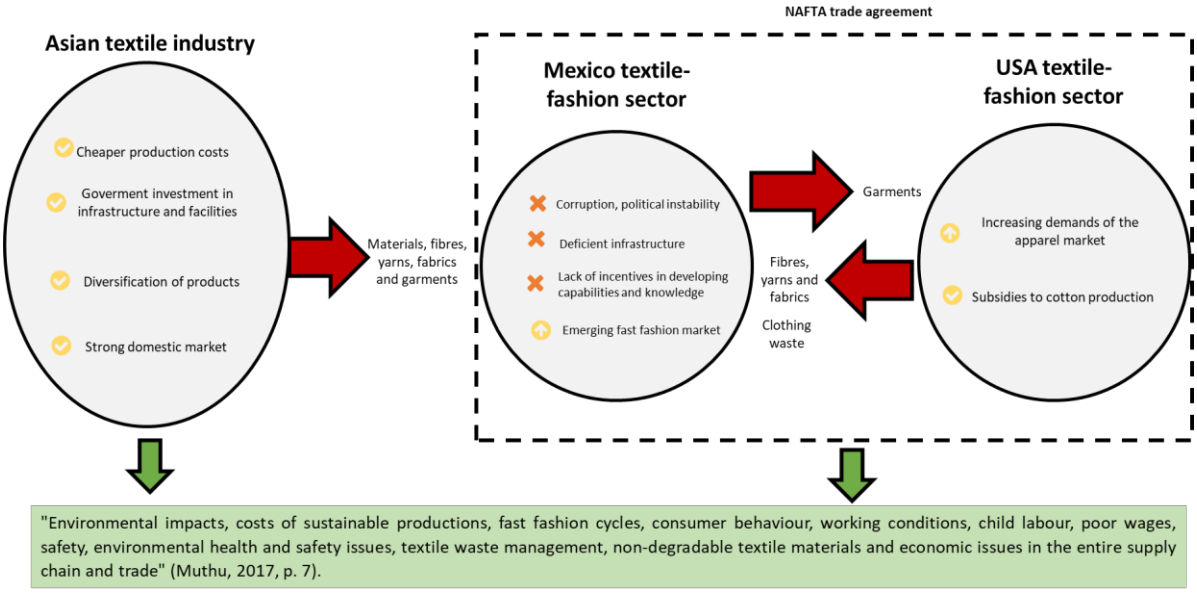

Figure 3. Configuration of the Mexican textile-fashion sector in the light of NAFTA and the influence of the Asian textile industry (Oh and Suh, 2003; Frederick and Gereffi, 2011; Vázquez-López, 2020a, 2020b)

4 Sustainability transformations and transformative learning

4.1 Understanding sustainability transformation through sustainability transitions research

As a research and practical approach in sustainability science, sustainability transformation does not provide analytical frameworks to understand the dynamics and mechanisms of transformation. On the other hand, the field of sustainability transitions research (henceforth, transitions research) focuses on studying the dynamics of large-scale socio-ecological transformations (Loorbach *et al.*, 2017).

Although the terms transformation and transition are widely used interchangeably without further distinction, they do differ in some aspects (Hölscher *et al.*, 2018). Transformation involves a fundamental change in the structure of a system, while transition refers to the process of change from one system structure, configuration or state to another (Loorbach et *al.*, 2017). The term transition emphasises the intermediate steps of change, thus allowing a better understanding of how transformation occurs. In the words of Hölscher *et al.* (2018), transitions "focus on the processes and dynamics producing patterns of change to explain 'how' the non-linear shift from one state to another is supported or hindered" (p. 3).

Sustainability transition research has consolidated itself as a field of knowledge whose aim "is to conceptualize and explain how radical changes can occur in the way societal functions are fulfilled" (Köhler *et al.*, 2019, p. 3). This field encompasses four different analytical frameworks (Markard *et al.*, 2012; Köhler *et al.*, 2019): multi-level perspective, strategic niche management, technological innovation systems and transition management. The multi-level perspective framework provides a model to characterise transition processes through the dynamics in the development and evolution of socio-technical regimes. Three key elements constitute this model: Niche (space for radical innovations to emerge and develop), regime (dominant production-consumption systems that determine the rules and pathways of its functioning), and landscape (outer material and social conditions that influence the regime and niche) (Geels, 2005). Strategic niche management helps to understand how a given unsustainable socio-technical regime can be structurally changed by utilising intentional, driven small-scale innovations in niches. The proper management of these innovations embedded in a certain (global) niche might accelerate the transformation of an unsustainable regime (Smith and Raven, 2012). Technological innovation systems focus on developing technological innovations and their integration into institutional and industrial ecosystems (Truffer and Coenen, 2012). Finally, transition management is a framework that involves governance and policy perspectives to implement strategies for societal transitions (Loorbach, 2010).

These frameworks share common concepts such as niche, which is rendered crucial for transitions since it provides learning spaces for the further development and application of innovations (Kemp *et al.*, 1998). For this doctoral work, the framework of sustainability transitions is used to understand the processes of sustainability transformation. In this sense, the study of transformative learning regarding processes of sustainability transformation can be better located and understood through the theoretical construction of niches in transitions research.

4.2 The multi-level perspective and sustainability niches

Introduced by Geels (2002), the multi-level perspective is an analytical framework that aims to understand the complex dynamics of systems transformation. As mentioned before, this framework is constituted by three nested layers: niche, regime and landscape. The interplay of these three layers has been modelled in four different sustainability transition phases: experimentation, stabilisation, diffusion/disruption, and institutionalisation/anchoring (Geels, 2019).

The first phase corresponds to the emergence and experimentation of innovations in a specific domain shaped by the cracks of a current regime and landscape conditions (Geels, 2002; Geels, 2005; Markard and Truffer, 2008). A sustainability niche (henceforth, niche) is the domain of application in which radical) innovations emerge and develop in order to contribute to the establishment of a sustainable regime (Kemp *et al.,* 1998). Niches serve as protected spaces that nurture and allow the maturation and diffusion of innovations. As a result, niches grow, develop and become domains of social network innovations (Schot and Geels, 2007; Smith, 2007; Smith and Raven, 2012).

Geels and Raven (2006) offered a differentiation between niches: global-niche and local-niche. The former refers to the overall dimension of application, in which knowledge, guiding principles, and agendas are diffuse and broad, while the latter refers to specific spaces in which these knowledge and guiding principles are interpreted and applied to the local or regional context. For instance, the global niche of sustainability fashion encompasses knowledge and guiding principles for innovations and structural changes in the current regime (Buchel *et al.*, 2018). The local niche of sustainability fashion entails practices in local contexts, e.g., a brand incorporating sustainable fashion principles. Geels and Raven (2006) also proposed another distinction between small market and technological niches. In the former, the introduction of innovations occurs at the backdrop of the regime, while in the latter, innovations are supported from the beginning by public subsidies and corporative funds. Nonetheless, as Schot and Geels (2007) point out, various niches can co-exist within the landscape-regime configuration.

Critical to the understanding of the sustainability transformation is the conceptual model of transition dynamics, which portrays how niches develop. While early models encompassed four phases, namely, predevelopment, take off, breakthrough, and stabilisation of the niche (Rotmans *et al.*, 2001), recent models considered more stages involving an upward movement of niches and a downward movement of the old regime (Loorbach *et al.*, 2017; Buchel *et al.*, 2018). However, sticking to the multi-level perspective model, niches evolve along with four phases: The first phase of transition is critical as innovations face different challenges such as high costs of operation, continuous experimentation and uncertainty about users' acceptance and cultural legitimacy (Geels, 2019). In the second phase, innovations stabilise in a network of knowledge, practices and experiences as users become familiar with them. The third phase represents the diffusion of innovation into mainstream markets, as channels of communication and interaction between the niche and regime are established (Smith, 2007; Geels, 2019). The fourth phase is the institutionalisation of the niche and its respective innovations.

This doctoral work focuses on niche formation and development as key processes in sustainability transformations, especially on the first three phases: emergence, disruption, and development. In this sense, it is of particular interest the transformative learning of actors, i.e., entrepreneurs involved in the development of innovations and their contribution to the development of niches and, subsequently, the sustainability transformations of the textile-fashion sector in Mexico.

4.3 Entrepreneurs as key actors in niches

Entrepreneurship could be related to niches since it implies developing something not present in a particular domain (Venkataraman, 1997). Entrepreneurship can be defined as identifying opportunities to be exploited in a specific domain or market and further applying them as products or services (Iversen *et al.*, 2008; Filser *et al.*, 2019). According to Zhao (2005), a term inseparable to entrepreneurship is innovation, which is "the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace" (Baregheh *et al.*, 2009, p. 1334). The relation between niche and innovation is that the former serves as the domain where innovation can emerge, develop, and mature (Markard and Truffer, 2008; Lopolito *et al.*, 2013). Researchers have framed innovation as

the renewal of production-consumption supply chains toward more sustainable socio-technical systems (Smith *et al.*, 2010).

Both innovation and entrepreneurship have been catalogued as vital elements in achieving the Sustainable Development Goals (SDGs) (Filser *et al.*, 2019). In this line, sustainable entrepreneurship comprises innovation activities that contribute to the organisation, the market, and society sustainability. Sustainable entrepreneurship encompasses both success in the market and social and environmental benefits by providing (radical), sustainable, innovative products or services (Schaltegger and Wagner, 2011). The individuals who exert this venture of sustainable entrepreneurship bridge economic success, social value and environmental care. These sustainable entrepreneurs differ from conventional entrepreneurs in making sustainable performance the core and primary motivation of their businesses (Schaltegger and Wagner, 2011; Schaltegger *et al.*, 2018). Although sustainable entrepreneurs are commonly related to start-ups projects, they can also be located in long-established corporations and institutions (Schaltegger and Wagner, 2011).

4.4 Transformative learning leading to sustainability transformations

4.4.1 Learning in transitions

Scholars in transition studies consider learning as a necessary condition for the development and aggregation of knowledge about the further application of innovations (Kemp *et al.*, 1998; Raven, 2007; Lopolito *et al.*, 2013), for the articulation of expectations and visions concerning an innovation (Hoogma *et al.*, 2002; Wiskerke, 2003), for niches to emerge (Raven *et al.*, 2010; Ortiz *et al.*, 2018), for sustaining and supporting governance processes related to transitions (Pahl-Wostl, 2009; Beers *et al.*, 2019), and overall for contributing to the transformation of dominant regimes and the shaping of the process of foundation, acceleration and the establishment of sustainable regimes (Loorbach *et al.*, 2017).

Although learning remains a vague concept, some groundwork has been done recently in reviewing the concept of learning in sustainability transition studies. van Poeck *et al.* (2018) proposed an analytical framework for learning based on Dewey's pragmatist education theory. They determined relevant factors that influence learning in transition-related settings, i.e., intrapersonal, interpersonal, institutional and material, which could empirically analyse the links between the learning process and its outcomes. More specifically, van Mierlo and Beers (2018) conceptualised learning in transition studies as two processes, namely discursive interaction and reflective action. The former entails exchanging information, knowledge, meaning, values, etc., in face-to-face settings or even asynchronous meetings. The latter refers to activities of an intuitive nature, where planning and evaluation of actions are undertaken to further lead to radical systemic changes.

Goyal and Howlett (2019) conducted a review in which they matched collective actors (i.e., technology constituencies, epistemic communities, instrument constituencies, advocacy coalitions) with their respective learning objects (i.e., technology development, framing of sustainability problems, creation of policy instruments, implementation of solutions and policy instruments). Based on that framework, they depict learning pathways and can visualise an actor-network participating in transitions processes. Furthermore, Beers *et al.* (2019) explored the negotiation of meaning empirically to support learning in transitions by specifically bridging and translating different contexts and perspectives from different actors participating in innovation projects.

Nonetheless, little is known about the role and importance of learning in specific elements of transitions research, and little systematic study has been done about conditions under which learning occurs in processes such as the formation and development of niches.

4.4.2 Learning in niches

Kemp *et al.* (1998) emphasised that "the focus on learning is an important aspect of strategic niche management" (p. 186). Furthermore, they also mention that niches "set in motion interactive learning processes and institutional adaptations" (Kemp *et al.*, 1998, p. 184) , which are important elements for transitions. This has opened up new interests in how learning helps to shape niche processes and determine their success. In transitions and strategic niche management literature (Wiskerke, 2003; Schot and Geels, 2007; Lopolito *et al.*, 2013; Mlecnik, 2014), scholars use terms, e.g., articulation of expectations, experimentation, and social change, which even though not referred to explicitly as learning, do constitute part of learning processes, outcomes and conditions. Therefore, a coherent analytical framework needs to focus explicitly on how learning unfolds in niche processes, which learning outcomes result from these processes, and which conditions are implicated.

Learning in processes related to niches cannot be deliberate; instead, they emerge in the ongoing process (Geels and Raven, 2006) and focus not only on technical knowledge but also on regulations and users' preferences (Smith, 2007; Schot and Geels, 2007); nonetheless, learning is frequently framed as single-loop learning. This type of learning in transitions and strategic niche management is learning about technology design, strategies and policy incentives, etc. (Hoogma *et al.*, 2002). On the other hand, double-loop learning refers to "conceptions about technology, user demands and regulations [which] are not tested but questioned and explored" (p. 29). In this type of learning, these authors include co-evolutionary learning (i.e., processes of mutual articulation and interaction among technologies, users' demands and regulations), which is a process in which the values of the actors involved (producers, users and third parties) are clarified and related to each other. The strong argument of Hoogma *et al.* (2002) is that strategic niche management will not succeed unless double-loop learning occurs.

In research related to niches, prior learning also plays an important role. Social norms dictated by the regime constitute this prior learning. Actors' meanings and preferences, both on the production and consumption side, are highly influenced by these rules and norms of the current regime. Referring to the quality of learning, Smith (2007) argues that much more evidence is needed regarding second-order learning since it "questions the values and assumptions that frame the configuration of that practice, and draws deeper reflections about the underlying approach" (p. 429). That is why Smith (2007) considers this prior perspective the starting point of actor engagement.

4.4.3 Entrepreneurial learning

Entrepreneurial learning is a dynamic process encompassing a set of entrepreneurs' prior experiences that change through reflection and practice in venturing contexts resulting in new knowledge, skills and personal development, which enables entrepreneurs to manage better their current and future ventures (Cope, 2005; Politis, 2005; Funken *et al.*, 2020).

According to Cope (2005), two main phases can be distinguished in the process of entrepreneurial learning: "learning prior to start-up and learning during the entrepreneurial process" (p. 377). Learning prior to start-up or entrepreneurial preparedness entails previous accumulated learning that entrepreneurs bring into the venture (Cope, 2005). This prior learning determines two things: first, the level of entrepreneurial preparedness before the venture, and second, the way the individual will experience the venturing process (Cope, 2005). Learning during the entrepreneurial process is action, experiential and learning-by-doing oriented, with some affective nuances (Cope, 2005). One of the key mechanisms in entrepreneurial learning is facing the so-called critical events (Cope, 2005), which entail both positive and negative experiences that entrepreneurs confront and solve during their venturing process triggering double-loop learning.

A further consideration in entrepreneurial learning is that entrepreneurs do not act independently; instead, they act in specific social communities. This social component is also manifested in social entrepreneurial networks, where they learn by establishing relationships and interacting with other agents in the social network context (Cope, 2005; Soetanto, 2017; El-Awad *et al.*, 2017). Another approach to entrepreneurial learning is through a competence network (Wing Yan Man, 2006; Lans *et al.*, 2014), which indicates that entrepreneurs are reflective and active in seeking learning opportunities, able to build up and maintain relationships, develop and organise business systems, and able to apply their learning outcomes to their venture efforts.

Others have conceptualised entrepreneurial learning through a competence approach (Wing Yan Man, 2006). Going beyond pure skills and knowledge acquisition, Wing Yan Man (2006) claims that a competent entrepreneur is reflective and active in seeking learning opportunities and applying their learning outcomes in their venture efforts. Lans *et al.* (2014) have broken down entrepreneurial competence into a) constructive identification of opportunities; b) ability to build up and maintain relationships; c) capacity to develop and organise business systems; d) specific technical and market knowledge; and e) metacognitive entrepreneurial skills.

Connections and similarities can be found between transformative learning theory and entrepreneurial learning; however, this link has not been studied explicitly yet. Considering that entrepreneurs are key actors in the function of niches and transition processes, studying their learning processes and outcomes from transformative learning can elucidate how transformative learning leads to sustainability transformations.

4.5 Processes of sustainability transformation enabling transformative learning

4.5.1 Articulation of expectations as a fundamental learning process in niche development

In strategic niche management literature, three key processes are differentiated: articulation of expectations and visions, learning activities, and social network building (Geels and Raven, 2006; Rantala *et al.*, 2020). Although scholars mentioned that these processes interact, mutually reinforce and co-evolve (Schot and Geels, 2008; Susur *et al.*, 2019), they overlook that learning is an inherent part of all of them, specifically in the articulation of expectations.

Individual and social expectations are socially constructed beliefs related to the future, which actors have concerning the innovations they are pushing to change a socio-technical regime. In other words, actors involved in developing a particular innovation believe that there will be some economic, social or even environmental gains (Kemp, 1994). Expectations can also come from discourses of agencies and institutions, from benchmarking, or from successful evidence of other projects' results (Naber *et al.*, 2017; Elmustapha *et al.*, 2018). As Kemp *et al.* (1998) expressed, "expectations encompass engineering ideas, management beliefs and expectations about the market potential, and, on the user side, perception of the technology. These beliefs and views on the new technology are highly subjective and differ across communities. They are also in constant flux, and the progression of ideas may be either a barrier or a catalyst to the development of a particular technology" (p. 183). The aims of entrepreneurs involved in the niche are not necessarily related to profitable expectations. They are also based on beliefs about the social and environmental benefits in the long term. These beliefs and expectations guide the trajectory development and absorb the downsides and failures during the experimentation and testing of the innovation (Schot and Geels, 2007).

It is necessary to emphasise the relation between learning, expectations, testing, and experimentation here. Wiskerke (2003) refers to testing as "a process of articulating, specifying, and sharing a set of expectations and visions of the real potentialities of novelties" (p. 433). Moreover, articulation of expectations entails not only learning about technical knowledge but also about "user needs, social benefits and adverse effects, and regulation

- and not just learning to specify existing user needs, technological options and regulatory requirements (i.e. forecasting), but also learning to question existing preferences and to find ways of building new ones“ (Hoogma *et al.*, 2002, p. 5). In this regard, the articulation of expectations between entrepreneurs and users may occur through experimenting with the innovation (i.e., the acquisition and use in daily life). On the one hand, users learn how to best use the innovation by either changing past practices or adopting new ones in their routines (Lie and Sørensen, 1996; Geels, 2002; Geels, 2005; Geels, 2010). On the other hand, entrepreneurs and start-ups get feedback to improve their products or services (Kemp, 1994).

Entrepreneurs and other actors engage in the niche with certain expectations and start building networks and experimenting with the innovation under their influence. However, these expectations do not remain the same as continuous learning processes reshape them while developing the niche (Elmustapha *et al.*, 2018). Furthermore, Naber *et al.* (2017) valued the articulation of visions and expectations through three indicators: articulation (expectations are clearly articulated between the members), robustness (the members share expectations), and high quality (expectations are substantiated by experiments, research, and experts).

Expectations robustness means that expectations have been articulated and supported by scientists, policy actors, and users (Hoogma *et al.*, 2002; Naber *et al.*, 2017). Shared and articulated expectations provide direction to the learning process to achieve the project's vision, purposes and goals (Hatzl *et al.*, 2016). The articulation of expectations also provides legitimacy to attract actors' attention and invest resources in an innovation that has yet to prove its market value (Schot and Geels, 2008; Naber *et al.*, 2017).

The communication and diffusion of positive expectations are essential to attract and include new actors. Geels and Raven (2006) claim that "actors, embedded in networks, are willing to invest resources (money, people) in projects, if they have a shared positive expectation of a new technology" (p. 376). In this sense, the articulation of expectations is important in building social networks and vice-versa, as they make the expectations more robust (Raven and Geels, 2010; Naber *et al.*, 2017). The articulation of expectations resulting in more robust and high-quality expectations leads to niche development (Susur *et al.*, 2019).

4.5.2 Business practices in niches: social media communication and e-commerce

Communication is a crucial business practice in promoting sustainability innovation because "inadequately communicated information causes the transition to be unsuccessful due to consumers' misunderstanding of their potential role in sustainable consumption" (Tseng *et al.*, 2020, pp. 3–4). Sustainability communication is inherently involved in the communication and articulation of expectations because it is not only a way of transmitting sustainability-related information to foster incidental behaviour change, it is also a type of dialogue between stakeholders and the public to promote self-empowerment and enable the formation of networks that contribute to the acceleration of transition processes towards sustainability (Newig *et al.*, 2013; Fischer *et al.*, 2021).

Nowadays, social media is gaining ground and changing the way that industries, institutions and start-ups communicate sustainability (Noris *et al.*, 2021). Social media (e.g., Twitter, Facebook, Instagram, TikTok) are online-communication platforms that allow massive and efficient distribution of information (i.e., pieces of information and knowledge in formats of texts, photos and videos) worldwide, instantly and at low cost (Sogari *et al.*, 2017).

Social media serve to re-contextualise niche innovations and reframe their application and use in other local or national scenarios (Rantala *et al.*, 2020). This is where local sustainability entrepreneurs play an important role in translating the use and benefits of specific innovations and connecting global and local actors, ultimately leading to the visualisation and diffusion of the niche (Rantala *et al.*, 2020). These social networks are formed based on

trust, transparency and support, and function as arenas for deliberation that involve cultural and symbolic representation mediated by mass media, corporations, government, and social institutions (Geels, 2002) and influence the formation of opinions, interpretation of information, articulation of expectations, and change in perceptions (Rantala *et al.*, 2020; Tseng *et al.*, 2020).

Social media also integrates other digital business applications such as electronic commerce (e-commerce) (Abed *et al.*, 2015; Nigam *et al.*, 2020). E-commerce "is a business innovation involving non-physical and electronic interactions, and maintenance of business relationships through sharing of information and knowledge" (Awa *et al.*, 2015, p. 78). Due to the rapid development of social media and internet-based technologies, e-commerce represents a competitive advantage to entrepreneurs and small-medium scale companies as they can better monitor, analyse and forecast the success of their innovation, product development and users' response (Awa *et al.*, 2015; Nigam *et al.*, 2020),

This part of the doctoral work focuses on sustainable fashion niche projects operating at the regional-local level in Mexico: ventures and start-ups founded and managed by entrepreneurs, mainly without any support from more prominent companies and public institutions. *Article 2* explores the learning processes that led entrepreneurs to intervene in transformation processes, while *article 3* explores the transformative learning processes of entrepreneurs as they engage in specific business practices using social media.

4.6 Article 2 - Learning processes in the early development of sustainable niches: the case of sustainable fashion entrepreneurs in Mexico

sustainability

MDPI

Article

Learning Processes in the Early Development of Sustainable Niches: The Case of Sustainable Fashion Entrepreneurs in Mexico

Jorge Gustavo Rodríguez Aboytes [1,*] and Matthias Barth [2]

[1] Robert Bosch Research Group, Faculty of Sustainability, Leuphana University of Lüneburg, 21335 Lüneburg, Germany
[2] Institute for Sustainable Development and Learning, Faculty of Sustainability, Leuphana University of Lüneburg, 21355 Lüneburg, Germany; matthias.barth@leuphana.de
* Correspondence: rgrodrig@leuphana.de; Tel.: +49-17-75-766-809

Received: 1 September 2020; Accepted: 8 October 2020; Published: 13 October 2020

Abstract: There are still several gaps to bridge in learning and sustainability transition research, one of which is the empirical exploration of learning processes and outcomes involved in the formation and development of sustainability niches. The purpose of this study is to investigate the formation and development of a sustainability niche through the lenses of individual and social transformative learning, specifically the learning processes and outcomes. We conducted a qualitative exploratory multi-case study of six different projects participating in the sustainable fashion and textiles niche in Mexico. We used documentation and individual interviews ($n = 7$) to collect evidence of the learning process in the formation and development of this niche. We used transformative learning theory to guide the analysis of the learning phenomena occurring in the development of this niche, distinguishing three main phases where individual learning takes place in the first two and social learning in the third. Analytical elements such as prior learning, disorienting dilemmas, action engagement and network building figure prominently in the learning process and outcomes in the development of the sustainable fashion niche in Mexico. This work provides a better and more detailed understanding of the multi-level perspective model through exploring sub-levels within the niche level, by shedding light on the importance of individual and social learning in the development of sustainable niches.

Keywords: sustainable niche; transformative learning; sustainable fashion; transition; entrepreneurial learning

1. Introduction

Learning is argued to contribute to the transformation of dominant regimes by shaping the transition process towards sustainable regimes [1]. Transition studies consider learning as a necessary condition for the development of new technologies [2–4], for the articulation of expectations and visions around an innovation [5,6], the emergence of niches [7,8] and the maintenance of governance processes related to transitions [9,10]. Recent efforts have attempted to bring more conceptual clarity regarding the role of learning in sustainability transition studies. For instance, van Poeck et al. [11] proposed an analytical framework for learning determining relevant factors that influence learning in transition-related settings. Van Mierlo and Beers [12] conceptualised learning in transition studies as two processes, namely discursive interaction and reflective action. Goyal and Howlett [13] conducted a review where they depicted learning pathways that allow for the visualising of an actor-network participating in transitions processes.

While all these studies provide interesting insights about learning in sustainability transitions, little is known about the role and importance of learning in specific dimensions of transitions research. One of these dimensions refers to the role of individuals who develop innovation niches through experimentation, with an emphasis on learning at individual and group level [14,15]. However, despite some theoretical and conceptual elaborations of learning in strategic niche management [3,16], the role of learning in the formation and development of sustainability niches is largely unexplored.

The purpose of this study is to explore the formation and development of a sustainability niche through the lenses of individual and social transformative learning. We investigate this through an exploratory qualitative case study of projects in the sustainable fashion and textiles niche in Mexico. We choose the case of the textile-fashion industry because its transition towards sustainability plays a significant role in achieving most of the United Nations' Sustainable Development Goals (SDG's) [17,18]. We take transformative learning theory [19,20] to guide the analysis of the learning processes, outcomes and conditions that led entrepreneurs to perform in the formation and development of a niche. Transformative learning contains analytical elements such as prior learning, disorienting dilemmas [21], discourse and action engagement [22] that allow us to investigate the evolution of entrepreneurs' individual learning to social learning during the venturing process in a sustainability niche.

This article sheds light on the importance of individual and social learning in the development of sustainable niches. It contributes to a better and more detailed understanding of a multi-level perspective model by exploring sub-levels within the niche level.

2. Theoretical Background

2.1. Niches and Sustainable Entrepreneurship

In transition theory, a niche is understood as a domain of application of emergent technologies or innovations [2] responding to existing structural problems of unsustainable regimes and landscape conditions [23–25]. Niches are not pre-defined spaces; rather, they are created and developed by innovators and entrepreneurs [14] who are dedicated to working and experimenting on innovations to develop new markets within a protected space. Niches are also spaces for entrepreneurs and innovators to learn and to build networks [16], allowing for a broader diffusion and spreading of innovations and, therefore, supporting the development of the niche [14].

The concepts of niches and entrepreneurship are inherently interrelated. Entrepreneurship is the process of identifying opportunities to create or extract value in a particular domain and in the further design and launch of products or services [26,27]. Consequently, niches serve as domains where entrepreneurs identify, experiment, develop and mature a particular innovation [4,25]. In sustainable entrepreneurship niches, entrepreneurs seek to attain success in the market as well as social and environmental benefits by providing (radical) sustainable innovative products or services [28]. By entering and positioning in the market, sustainable entrepreneurs gain the influence in social, economic and political spheres needed to drive sustainability transitions businesses [29].

2.2. Learning in Niches

Learning in niches occurs when entrepreneurs experiment with small-scale innovations in interactive and social settings [3,30]. Such learning takes places via learning by doing, trying, using, testing and experimenting as well as interacting with others [2,3,5,6,14,16,31]. Support for the learning process, social interaction and reflection, needs to be facilitated, by making room for experimentation [2] and providing a platform for sharing and reflecting upon experiences [3]. Additional conditions to support the learning process are: ensuring a diversity of different forms of expertise [2,6,14]; being aware of power relations [2], the role of infrastructure, complementary technologies and general landscape [6]; and establishing support through network building [5].

Learning in niches also entails social learning between innovators and users. Demands and expectations are negotiated to establish, develop and improve socio-technical practices around an

innovation [6,14]. The learning process aims at the development, maturation, application and diffusion of such innovations. It also guides transition trajectories avoiding undesired results. For this to happen, it is necessary to gain knowledge about the desirability, feasibility and viability of an innovation [2,3], considering different dimensions (e.g., technical, organisational, institutional and policy) at different levels (from niche to landscape) [5,6,16].

2.3. The Potential of Transformative Learning in Understanding Niche Formation and Development

Transformative learning theory focuses on the changes in adults' frames of reference—meaning structures that influence expectations, habits, feelings and thoughts—and how these changes lead to the emancipation of adults and, therefore, contribute to a better social future [32]. The transformative learning process consists of a series of intertwined steps [33]. Through experiencing and acting in the real world, frames of references are challenged in what is called disorienting dilemmas [21]. This is followed by process of critical (self-) reflection, where the learner examines his or her actions, interactions and premises of thought [34,35]. Self-reflection not only takes place individually, but it may also occur in social settings where different meanings and visions are shared, challenged and revisited. In such a process of discourse, the learner starts to understand the perspectives of others and to make sense of them [36]. For transformative learning to happen, an active engagement with the new revised meaning structures is necessary, by negotiating or exploring new relationships or roles, planning a course of action, testing solutions, and integrating these solutions into daily routines [37,38].

Transformative learning theory, which has been applied in various areas, including sustainability science [22,39], has been indirectly referred to in transition studies. Hoogma et al. [5], for instance, point out that an examination of frames of reference (i.e., meaning structures), together with a deconstruction of previous assumptions, expectations, ideas and habits is instrumental in strategic niche management. Schot and Geels [14], as well as Smith [16], highlight the role of expectations regarding an innovation during the formation and development of the niche. These expectations, which are embedded in frames of reference or are part of entrepreneurs' prior learning, are the starting point for entrepreneurs' engagement and guide the experimentation process and development trajectory of an innovation. Problems and negative developments that influence expectations and cause a disorienting dilemma can either hinder or facilitate experimentation [5,31]. Finally, as innovators and users reflect upon needs and consumption patterns through the experimentation phase, the expectations of actors, their visions and beliefs regarding the development and introduction of an innovation are made explicit, shared and articulated in a social reflective process [6].

2.4. The Global Niche of Sustainable Fashion

According to [31], a global niche is a worldwide community working on emergent topics by developing knowledge, practices, technology and policies in a specific area. Global niches emerge as a response to unsustainable socio-technical regimes, and they open up spaces for local niches and practices. Within the major economic activities all over the world, the current textile-clothing regime driven by a fast-fashion production-consumption model is one of the biggest and most complex industries in the world because of its diversity in products, role in the global supply chain and continuous innovation [40]. The textile supply chain comprises the design of the garment, the production of fibres, the supply of materials (yarns, fabrics, dyes, etc.), the manufacture of the garments, retailing, consumption and disposal.

The global sustainable fashion niche arose due to the increasing awareness of the negative socio-environmental impacts of this textile-fashion regime, such as labour exploitation, unsafe working conditions, textile waste pollution of water bodies and other ecosystems and pollution-related human diseases [41–43]. The global niche of sustainable fashion consists of a multi-actor network that is continuously interacting. This network is constituted by actors who are not only start-up clothing brands but also organisations, foundations, scientific researchers and consultants. They together aim for more transparency and traceability in the textile processes, respect for human rights, improvements

in working conditions, optimisation of energy and water use, reduced use of hazardous chemicals, use of low footprint fibres and closed-loop processes to avoid unnecessary production [44]. All of these actors can be categorised broadly in three groups: (1) technology and fibres (technology innovators), (2) business models and customer relations (fashion as a service business) and (3) value chain models and partnerships (ethical and sustainable brands) [45].

3. Methods

The research design of this study followed an exploratory multiple-case study approach. As a research strategy, case studies focus on a "bounded system" and the in-depth study of its context, driven by the desire to understand complex social phenomena [46,47]. Exploratory research aims at a robust understanding of a given phenomenon by providing additional perspectives and angles for its analysis [48].

We took entrepreneurs venturing with start-ups in the field of sustainable fashion as our study population. To capture the diversity of actors and projects that constitute the sustainable fashion niche in Mexico, a literature review and a web search identified potential case studies. The selection of the case studies followed five criteria outlined as follows. Case studies have been included if they:

1. Consist of small to medium size projects that are independent and locally oriented;
2. Generate for-profit services or products;
3. Have social and environmental goals;
4. Operate on a budget;
5. Are active at the time of data collection;
6. Can be contacted either electronically or in-person;

Criteria 1 to 4 emphasises the importance of considering only small entrants and rather new firms, with a small market share and who give the same importance to both sustainability and economic objectives in comparison to large incumbent firms, which are well-established, large and whose sustainability objectives are only complementary [49,50]. The last two criteria correspond to the practicality of the data collection.

We used a purposeful sampling approach through snowball sampling technique [51,52]. Purposeful sampling is the selection of participants who hold the most significant potential in providing relevant information regarding the phenomenon of study. This selection is based on specific inclusion criteria derived from insights about the particular area of research and corresponding literature [53]. Snowball sampling is a procedure to access informants through the contact information provided by other already approached informants, which is particularly useful in unexplored populations or social networks [54]. We employed such an approach and technique because, in the field of sustainable fashion and textiles in Mexico, there are neither reports nor studies that show who are the actors, projects or institutions involved in this transition of the sector towards sustainability. Thus, there is no account of how many entities of this kind exist.

Taking a Mexican business platform for sustainable fashion as the pivoting case, we identified 15 potential cases and created a sample universe of six cases to be included in the study. Given the exploratory nature of this research, we aimed for maximal contrasting rather than representativeness [55].

The study focuses on the phenomenon of a sustainability niche formation and development and related learning processes. The general research question is the following: What are the learning processes and outcomes during the formation and development of a sustainability niche? To answer this question, this research looks into (1) the different phases involved in the formation and development of the niche, (2) the prior learning experiences of the entrepreneurs who engage with a project in the niche, (3) the barriers and drivers these entrepreneurs encounter and (4) the individual and social learning outcomes resulting from these processes.

Data collection took place between March and June 2019 in Mexico City through semi-structured interviews. The interview guide was constructed around five main themes: individual learning trajectories prior to the venture in the niche; personal perception/knowledge about sustainability in the textile sector; the learning outcomes resulting from the venturing process; drivers and barriers in operation and potential growth of the niche; and network collaboration between niches and other actors and groups (see Appendices A and B). The interviews were conducted in Spanish, audio-recorded and transcribed by the first author. The transcripts were transferred to Qualitative Data Analysis (QDA) software (MaxQDA) and coded in English.

Data analysis encompassed an extraction of the basic information of the projects (e.g., foundation, activities, funding, etc.) as well as of the individuals (e.g., age, formal studies, etc.), a priori and a posteriori coding. A priori categories were deducted during the first coding round from the interview guidelines, transformative learning theory (e.g., learning outcomes), barriers and drivers, and the chronological order of projects participating in the niche. On the next coding rounds, a posteriori categories were identified in an iterative process between the data and the data analysis. From the data, we also found that within some of these categories, there were similar themes that could be grouped. For instance, a prior category, "learning outcomes", encompasses the a posteriori categories, such as "knowledge and skills about the niche", "entrepreneurial knowledge and skills", and "normative learning outcomes". These categories entailed common themes, for example, "knowledge of the textile market" for the first a posteriori category, "improving leadership skills" for the second, and "understanding other perspectives". For a better visual representation of these categories and themes in relation to each entrepreneur interviewed, we made use of the visual tool "MaxMaps" included in the MaxQDA software package. Data from the interviews were supported by additional data from document analysis (e.g., projects web site) and through observations in the fieldwork. Theoretical saturation was reached for the exploratory scope of this work by grouping the cases as meta-level actors, material suppliers and fashion brands.

4. Study Context: The Sustainable Fashion Niche in Mexico

In this study, we focus on the local, sustainable fashion niche in Mexico. The textile industry in Mexico, like in many other countries, faces negative environmental impacts, poor and largely unregulated working conditions, which have negative effects on productivity and on the health of workers and a lack of modernisation limits the competitiveness of the industry against products and materials imported from China [56]. Compared to other countries facing similar challenges regarding the textile-fashion regime, Mexico also faces unique ones: First, because of its geographic location, Mexico is the main linkage between North America and central-south America markets, resulting in many textile factories and many trading routes being established, making Mexico an important provider of textiles material and garments to the whole continent. Second, because Mexico's population aspires and tends to adopt fashion trends in western culture, Mexicans represent one of the major fashion consumer groups in the world [57].

The local sustainable fashion niche in Mexico responds to the challenges by introducing sustainably made supplies (dyes and fibres), waste-reduction measures and upcycling techniques into the manufacture processes. It also gives value and visibility to the artisanal production of regional and indigenous clothes, thereby ensuring social justice for marginalised indigenous populations, especially the women among them.

4.1. Description of the Case Studies

The six projects selected as case studies for the sustainable fashion niche in Mexico are located within a domestic supply chain; most of them are physically based in Mexico City. We follow Buchel et al. [45] categorisation of sustainable fashion niche actors (technology and fibres, business models and customer relations, and value chains models in partnerships) to group our case studies according to their position in the supply chain (see Table 1 for an overview).

Table 1. Overview of the projects that participated in the study.

Case Study Code	Entrepreneur Code	Position in the Supply Chain	Year of Foundation	Activities	Number of Workers	Sources of Initial Financing
CS1	entrep-1	Meta-level actors	2015	Provision of consultancy, communication, research and training services on topics of sustainability for the textile and fashion industry.	Two permanent people (owner and her partner) and two other people hired by the project.	Personal loans and sponsorship.
CS2	entrep-2	Meta-level actors	2016	Linking up (fashion) designers from the state of Morelos with communities of indigenous artisans to produce clothes or accessories with a focus on social justice, conservation and circular economy.	Group of ten brands and five people working in logistics and organisation.	Public resources from the government.
CS3	entrep-3 and entrep-4	Material suppliers	2018	Development of organic dyes through nano- and biotechnology.	Nine people of whom five are the founders of the project.	Prize and collaborating with investors.
CS4	entrep-5	Material suppliers	2014	Manufacture of fabrics from recycled materials such as PET, cotton, wool, polyester, acrylics.	Six people and a network of local textile workers.	Own capital.
CS5	entrep-6	Fashionclothing brands	2017	Design and manufacturing of new but zero waste clothes based on upcycling processes. The products are then retailed online or through various stores.	Owner only.	External funding application and money from another job.
CS6	entrep-7	Fashionclothing brands	2017	Design and manufacture of backpacks and accessories (e.g., wallets, purses) from textile waste (i.e., second-hand clothes). They retail their products online, through other retailers or variety stores.	Founder and four other people (those who sew/manufacture the backpacks).	From the sales of previous products.

4.2. Group 1: Meta-Level Actors

These projects are not positioned directly within the supply chain but at its meta-level. Although they do not participate directly in the production of a specific product, they provide mostly networking, training and communication or consultancy services to other companies and entrepreneurs in the domestic supply chain, even to the general consumers.

Case Study 1 (CS1): This project is a business platform that provides consultancy, communication, research and training services on sustainability topics in the fashion industry. It was conceived by a female entrepreneur (entrep-1) as a communication blog in 2011 and evolved to become a consultancy platform in 2015, financed by sponsorship and personal loans. Currently, this project has three permanent or primary associates, and it has positioned itself as a referent in the field of sustainable textiles and fashion.

Case Study 2 (CS2): This project is a platform that brings together designers and communities of indigenous artisans to produce clothes or accessories with a focus on social justice, conservation and a circular economy. It started in 2016 as an event for a public sustainability-oriented programme organised by the state government. Founded by a female entrepreneur (entrep-2), this project was initially supported financially by the government. However, it became an independent project constituted by a group of ten local brands and a community of textile artisans.

4.3. Group 2: Material Suppliers

The projects in this group produce sustainably made material, such as fibres, fabrics, yarns and dyes, and supply them to companies such as fashion brands or other companies in the supply chain.

Case Study 3 (CS3): This is a start-up that develops organic textile dyes from bio- and nanotechnology techniques as alternative dyes to address the water pollution issue. This project was founded by five people, including one male and one female entrepreneur (entrep-3 and entrep-4, respectively). This project was founded in 2018 at an entrepreneurship camp and won an international start-up competition where the founders had the opportunity to launch their project and were awarded a money prize for use in formalising their start-up. Through collaborating with investors and other professionals, this start-up is currently trying to grow as a company.

Case Study 4 (CS4): This company is a network of textile agents constituted as a small to medium company. It co-develops fabrics from recycled materials such as Polyethylene terephthalate (PET), cotton, wool, polyester and acrylic. Through personal financial inputs, this project was incubated as a side project in 2015 by a male entrepreneur (entrep-5) from another company dedicated to the production of recycled serapes (long blanket-like shawl). In addition to the network of textile agents, this company employs six workers. Currently, it is positioned as one of the most important suppliers of sustainable fabrics in Mexico and Latin America.

4.4. Group 3: Fashion Clothing Brands

This group consist of projects focused on the design of their original products while being provided with materials from other projects or companies. Although they manufacture their own products, they also subcontract the manufacturing process to other local groups. Some of them are also engaged with indigenous and rural communities. They may have their own physical stores, selling their products directly or through various external retailers.

Case Study 5 (CS5): This project designs zero-waste clothing from recycled fabrics, second-hand garments or clothing remnants. It was initiated in 2011 by a female entrepreneur (entrep-6) as an individual project during her university course of study. The fashion brand was founded in 2017 with personal funding and money from a fundraising campaign. Entrep-6 and a subcontracted seamstress produce the garments. The products are sold locally and online.

Case Study 6 (CS6): This project is dedicated to making backpacks and other accessories from textile waste and second-hand clothes. It was initiated by a female entrepreneur (entrep-7) in 2015 as a

university project, and it became a brand in 2017. The initial sales success of the project meant that she could self-finance the project. This start-up consists of four people, three of them dedicated to the manufacturing process with entrep-7 participating as the manager and designer. The products are sold via social networks, online and in variety stores.

5. Results

We single out three distinctive phases in the formation and development of the sustainable fashion niche in Mexico with learning happening in each phase (see Figure 1): the first phase, awareness of the niche, encompasses entrepreneurs' prior learning experiences concerning the niche. The second phase, entry into the niche, refers to entrepreneurs' learning process and outcomes while engaging with their projects. The third phase, development of the niche, entails a social learning process manifested in projects networking inside the niche and interacting with actors at the regime level. In what follows, we present our findings structured along with these phases and provide exemplary, typical direct quotations to provide examples of the a posteriori categories (the reader can find the direct quotations in Spanish in Appendix C).

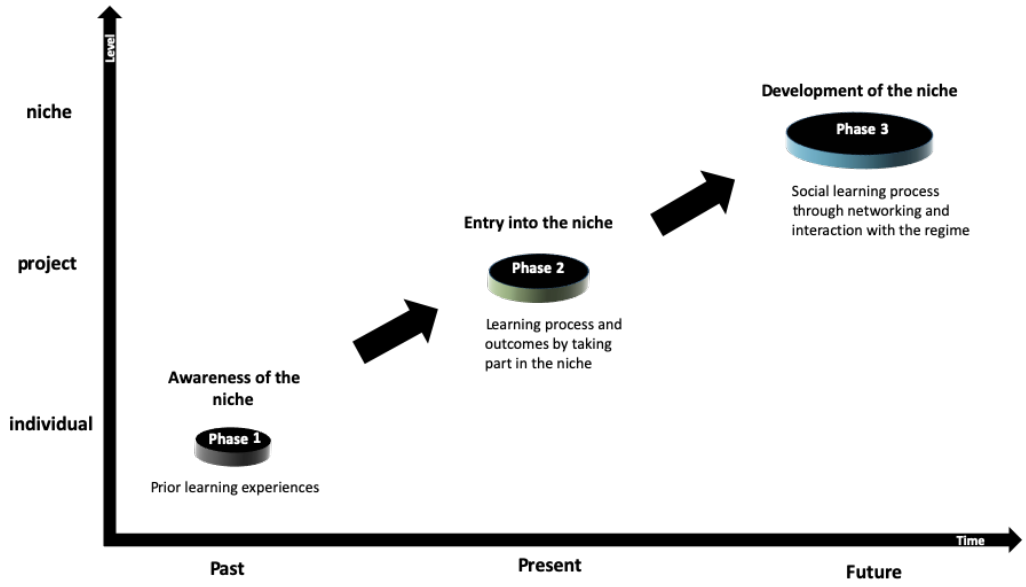

Figure 1. Phases in the formation and development of the niche.

5.1. Phase 1: Awareness of the Niche

The first phase refers to prior learning experiences regarding either sustainability, textiles, or both, that constituted individuals' frames of reference and led them to become aware of and venture into the sustainable fashion niche. These prior experiences can be further clustered in the four dimensions of (1) family-related, (2) individual attitudes, reflecting individual interests and values about the environment and social problems, including but not limited to, the textile sector, (3) educational exposure and (4) work-related. Figure 2 shows which of these dimensions are part of the entrepreneurs' frames of reference.

For each individual, a combination of two or more of these experiences raised awareness of the sustainable fashion niche and initiated their engagement in it. These experiences were often part of a process of continuous learning. However, at some point, individuals encountered a disorienting dilemma that caused transformative learning and a re-orientation of their behaviour. This is evident when the strong interest in social issues and human rights (*individual attitudes*) of entrep-1, combined with the course she took for her bachelor degree (*educational exposure*) led her to look more closely at the challenges of an unsustainable textile sector, resulting in insights that deeply influenced her:

> It shocked me a lot (. . .) to know how a multibillion industry that involves absolutely every political, economic, developmental, social, international, commercial topic . . . how it was possible that (the textile industry) had such a big impact at the social and environmental level. (entrep-1, direct and translated quote).

This encounter changed her area of interest. When entrep-1 wrote her thesis, it made her want to contribute to a transformation of the Mexican textile industry towards a more sustainable model:

> I found out what I wanted to undertake with this project, with this business, and to make a change in the industry, something positive with impact, and this is what I want to do for my whole life. It doesn't matter how long I take; it doesn't matter how much it costs me . . . this is my life and my professional project. (entrep-1, direct and translated quote).

Another example is that of family-related prior experiences as in the case of entrep-6, where a close experience with the textile industry made her concerned about environmental challenges (*attitudes dimension*) and triggered the decision to start the upcycling of clothes.

> Where I used to live there are jeans factories (that) . . . pollute horribly . . . the water, the environment; the people who work there inhale all these chemicals, and there are a lot of diseases (. . .) (Then) I started to investigate and found out that in order not to pollute, one must reuse waste. So, it occurred to me (that) with all the clothes I had, to start reselling clothes again with the mended and also with the remnants (that) my mom had. (entrep-6, direct and translated quote).

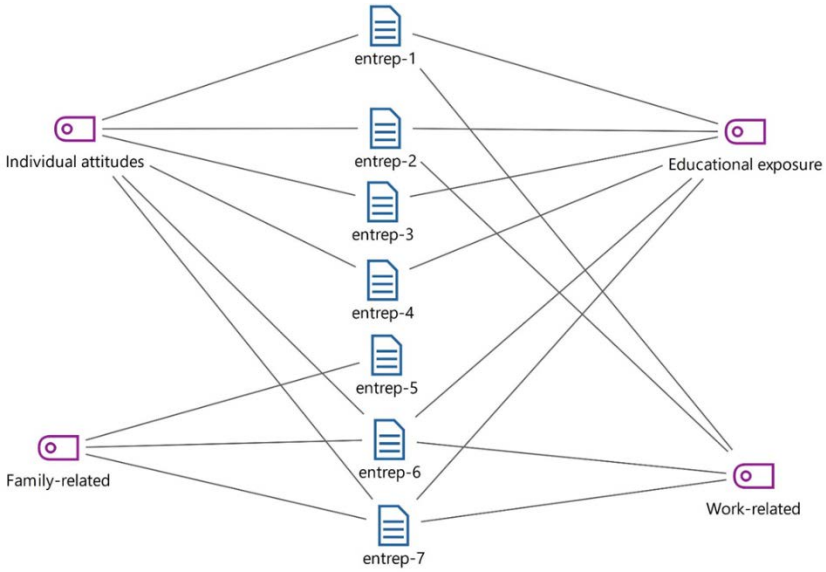

Figure 2. Prior experiences dimensions related to each entrepreneur interviewed.

5.2. Phase 2: Entrance into the Niche

In this phase, entrepreneurs entered the sustainable fashion niche with their respective ventures. The learning process in this phase involves individuals acting in a new environment and (1) identifying external barriers, (2) developing strategies to overcome these barriers, (3) resulting in an array of learning outcomes.

5.2.1. External Barriers

We clustered the external barriers that entrepreneurs experience when entering the niche as epistemic, economic, social and political. Figure 3 shows which of these barriers were mentioned by each entrepreneur.

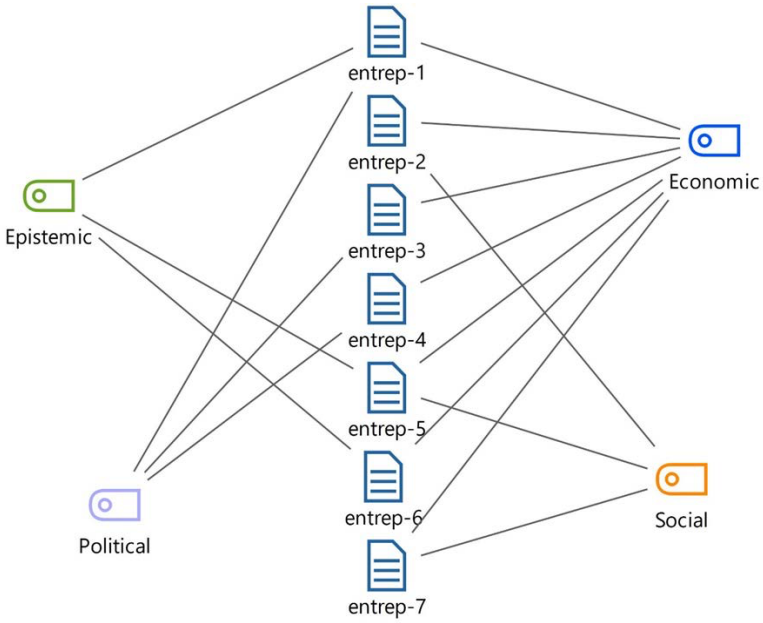

Figure 3. External barriers mentioned by each entrepreneur interviewed.

Epistemic barriers encompass lack of information and the small number of efforts in scientific research regarding sustainable textile processes, techniques and materials. In this sense, students and entrepreneurs willing to explore and innovate in this field lack academic support. Entrep-1, referring to the barriers, commented:

> (Innovating) interests me, but I am not applying it because I do not know how to, and no one can tell me how to do it. (entrep-1, direct and translated quote).

Economic barriers, which was one of the most mentioned barriers, refer to scarce financial resources to buy sustainably produced materials, acquire and use spaces or infrastructure, hire a work base or conduct research for further experimentation. For instance, most of the interviewees pointed out the high costs and lack of suppliers in Mexico for sustainable materials:

> I realised during this project that it is very hard to find materials that are more natural, more ecological (or) recycled, I mean, it is really very difficult if you want to work with a material that is 100% recycled, 100% natural, you have to bring it from other countries. (So), the cost is very high for that reason, because (such material) is not sold here. (entrep-7, direct and translated quote).

Moreover, projects in this niche often face mistrust from buyers and consumers. For suppliers of materials and for fashion brands, their potential buyers do not trust sustainably made products and, hence, stick to conventional products:

> In the end, people still prefer the trend, (and even though) they begin to consider to consume locally, (something) made in their own country, it is still attractive the idea of "(well), but I already know this brand, it is an international brand, so it cannot fail me, and this (other) brand I don't know it." (entrep-7, direct and translated quote).

Finally, the political barrier is the lack of incentives from the government to support actors and entrepreneurs who want to contribute to the transformation of the industry towards sustainability. Entrep-1 commented that this topic is not a priority for the government due to the lack of knowledge about how the fashion-textile industry works:

> There are no studies to raise awareness of how the textile industry works in Mexico as a sector at the national level. Therefore, if you do not understand it, you cannot link one to the other, so there cannot be public policies or regulations, because each industry is seen on its own and not as part of a value chain. That is the big problem. (entrep-1, direct and translated quote).

5.2.2. Strategies to Overcome the Barriers

Entrepreneurs have drawn on different strategies to overcome the barriers presented above. Figure 4 shows which of these strategies were mentioned by each entrepreneur.

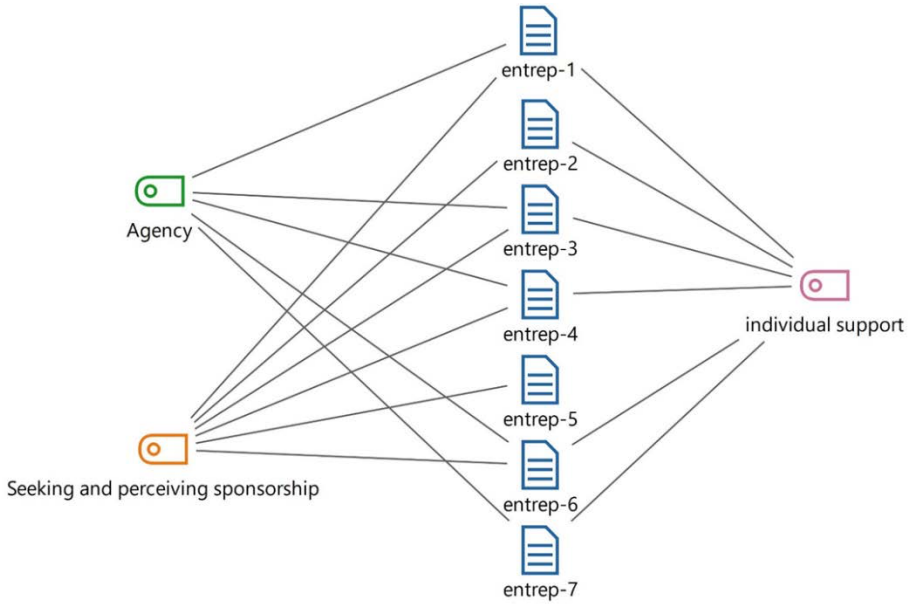

Figure 4. Strategies mentioned by each entrepreneur interviewed.

Agency is manifested in the interviewees' strong motivation to contribute to a better society and environment and to become a change agent for the transformation of the textile industry. In an entrepreneurial spirit, some of the interviewees mentioned that they were not only seeking to start up a project and make a profit from it; they also wanted to have a more significant impact by raising awareness about the importance of sustainability in the fashion textile industry.

Seeking and perceiving sponsorship and support from third parties, public and private institutions proved to be another impactful strategy. Entrep-2, for example, mentioned:

> The last event was 100% sponsored, (but) there wasn't any (economic) support. I mean, the governmental support was only for the facilities and the marketing of the event; however, the business sector has contributed, because, in a certain way, they see this as an area of opportunity. It is interesting when the business sector invests in this topic of fashion. (Entrep-2, direct and translated quote).

Furthermore, projects have received support from other, more prominent companies and foundations in terms of visibility. In this regard, entrep-5 mentioned:

> Two companies, with which we have worked on this matter of social entrepreneurship, have helped us a lot in aspects of visibility and that has catapulted us to achieve more things. Otherwise, it would have been more difficult to gain recognition (in the textile sector). (entrep-5, direct and translated quote).

Individual support proved to be the most important driver for entrepreneurs. Almost all of them had mentors such as bosses, professors or family members whose support has been crucial. Others received support from their relatives and friends, co-workers or business partners:

> I think that the greatest thing, and what I most appreciate, is the people who have joined the project for nothing in return. I mean, without a financial pay-back, because sometimes I haven't (the financial) capital to pay people (. . .) The fact that someone believes in you is retribution that you can't pay with money. (entrep-1, direct and translated quotation).

5.2.3. Individual Learning Outcomes

This process of entering the niche and overcoming the external barriers resulted in an array of individual learning outcomes, of which gaining knowledge and skills about the niche, entrepreneurial knowledge and skills, in addition to normative outcomes, figured prominently (see Figure 5).

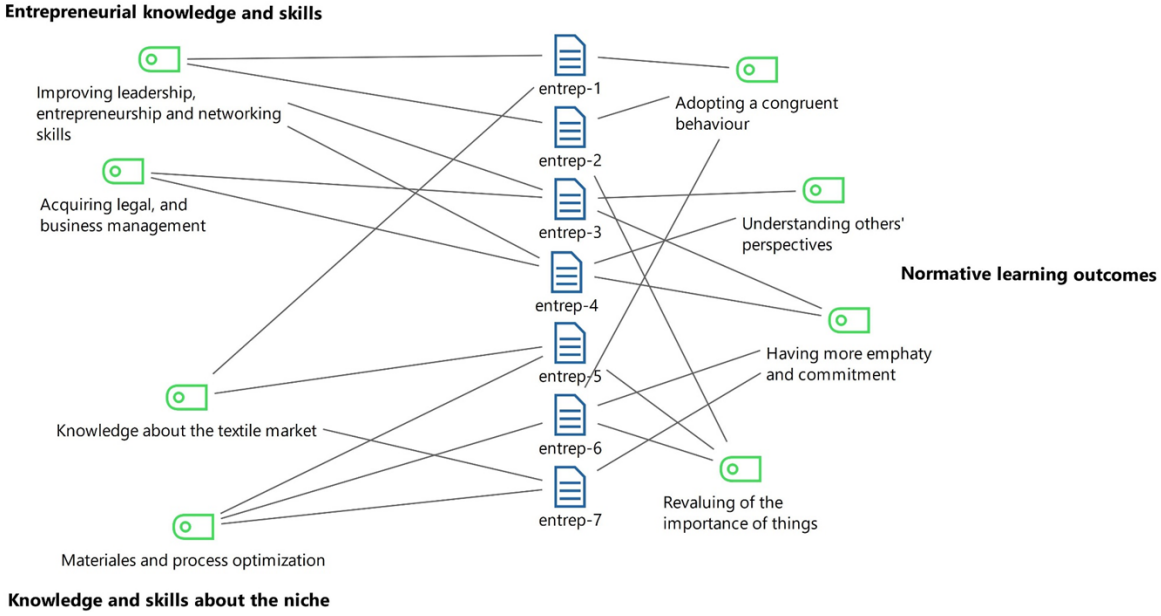

Figure 5. Learning outcomes referred to each entrepreneur interviewed.

Knowledge and skills about the sustainable fashion niche refer primarily to the field of fashion and textiles, ranging from Mexican traditions, new sustainable materials to process optimisation. For instance, entrep-7 said:

> I have improved the quality of the processes and the backpacks. I have also tried to optimise certain processes to avoid wasting fabric (...) I have learned a lot about Mexican embroidery and the entire textile culture in indigenous communities. (entrep-7, direct and translated quotation).

In addition to such basic knowledge, every entrepreneur developed various entrepreneurial skills, especially in leadership, business management and legal issues. For example, entrep-3, as a nanotechnology engineer had to learn different things from different fields of knowledge:

> Now, I have to learn legal terms, financial terms, to think how an administrator would do it, to imagine myself talking about accounting related things . . . (entrep-3, direct and translated quote).

Beyond the knowledge and skills that are directly related to the profession, learning also led to a reflection and reconfiguration of individual values and norms. Individuals learned to be more congruent with themselves, e.g., by changing their consumption attitudes. For instance, entrep-2 commented:

> Now I think more before purchasing anything, and I repeat it, it is not only what you eat, but also what you wear, it is to be coherent with myself, from sorting the garbage at home to buying things that are worth it for which I can pay a bit more. But it has helped me a lot to change my perspective and to value what I have around me. (entrep-2, direct and translated quote).

Moreover, related to what they learned about optimising resources, they have changed the way they value things. In this regard, entrep-5 said:

Basically, I am a finance person, so the aspect of prioritising money, I mean, the business was the priority. At this moment we are already making decisions based on more variables, for instance, the impact of what we do, which for us is very important. This is one of the most important variables when we make decisions in the production (process) (entrep-5, direct and translated quote).

5.3. Phase 3: Development of the Niche

In this third phase, entrepreneurs have settled down in their ventures, to some extent, and continue to contribute to developing the niche. This leads to two sorts of social learning processes. The first is a process of network building among projects and initiatives within the niche; the second is an interaction and communication between niche projects and actors at the regime level. (see Figure 6).

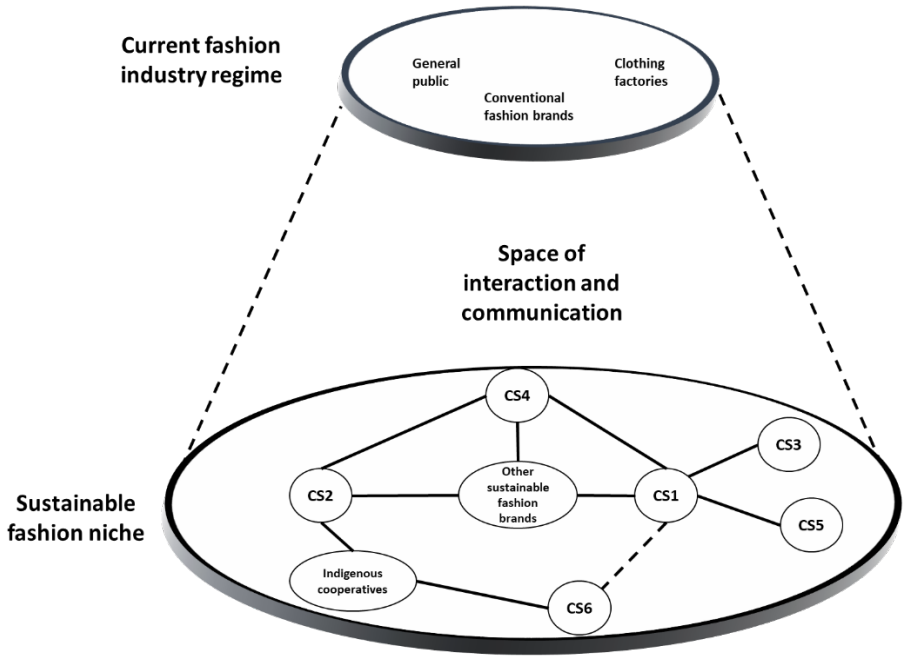

Figure 6. Representation of the network of projects in the sustainable fashion niche and the interaction with the regime level.

When the different projects in this niche started to share information or collaborate, they became visible to one another, and network building occurred. In this regard, entrep-5 mentioned:

> There is some sort of a network; we almost know each other (...). Actually, the issue of sustainable fashion in Mexico is still very small. I mean, almost everyone knows each other, we have talked for a few minutes. There is an informal network. Many of them

(collaborations) are marketing support, of ideas; we support one another in different ways. (entrep-5, direct quotation).

Figure 6 portrays the constitution of the network of projects as case studies in the sustainable fashion niche in Mexico, and the space of interaction and communication between the niche and the fashion industry regime in Mexico.

The lines between case studies indicate their connection based on established collaboration formats, ranging from only sharing information to having a commercial relationship. The dashed line between CS1 and CS6 indicates that they have not directly collaborated, yet they were sharing the stage at a communications event in a Mexican university. CS1, CS2, CS4 have also been collaborating with other sustainable fashion brands, and CS2 and CS6 have been working with indigenous cooperatives.

The interaction and communication between the sustainable fashion niche and the current fashion industry regime (conventional fashion brands, the public, clothing factories, etc.) are manifested when projects open and communicate the field of sustainable fashion by making information accessible, generating knowledge and raising awareness. Figure 7 shows the social impact, which the interviewed entrepreneurs think they are making with their respective ventures.

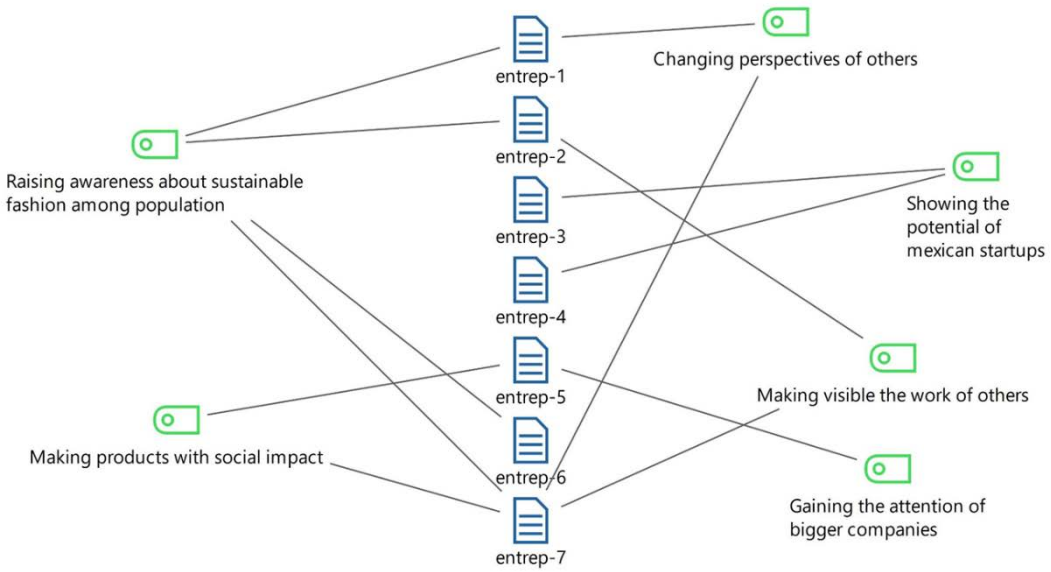

Figure 7. Social learning outcomes referred to each entrepreneur interviewed.

For instance, these projects have been contributing to the raising of awareness about the niche by developing knowledge and making information more accessible. In the words of entrep-1:

> I think that in terms of communication of knowledge, the development and knowledge, or the development of research, of material, I think that is the biggest impact and the accessibility to it. The fact that people today have access to this material because they have had a sensitisation about the topic (of sustainable fashion), which didn't exist 13 years ago. (entrep-1, direct and translated quote).

Interviewees also mentioned that their products are having a significant impact because the consumers or buyers now accept the new sustainable products; they are changing their perspectives. In this vein, entrep-7 said:

> Many people have been interested in donating garments for the production of backpacks (. . .) So, they make this shift in their thinking: "Well I am not going to throw away all of the clothes that I am not wearing; (I would better) give them a second use, and from there, to begin to consider my way of consuming". (entrep-7, direct and translated quote).

Furthermore, through collaborating with some NGOs, consultancy offices and conventional fashion brands, the sustainable fashion niche is gaining the attention of bigger Mexican textile industries. On this subject, entrep-5 said:

> So, we have had an impact on big companies, on the discourse of big companies, not only in the ideas but also in the way they are communicating their objectives. (entrep-5, direct and translated quote).

6. Discussion

The sustainable fashion niche in Mexico has been evolving mainly due to the ventures of independent and locally oriented entrepreneurs. However, the role of actors at the regime and landscape-level should not be underestimated [14], and this is certainly true here as well. From our findings, we see learning occurring predominantly as individual learning in the first two phases and as social learning in the third phase of the development of the niche. The first two phases have much in common with two stages in entrepreneurial learning, namely, "learning prior to start-up and learning during the entrepreneurial process" [58].

First, the prior learning dimensions of the reported entrepreneurs tell us that, before entering the niche, these entrepreneurs were not experts in the field of sustainable fashion, perhaps only in textiles or only in sustainability, but not in both fields. That does not necessarily mean that they were unprepared for this endeavour; however, according to [58], the learning prior to starting up determines the way entrepreneurs are going the face the venturing process. From our findings, we can see that entrepreneurs' lack of expertise in either the sustainability or the fashion field, combined with the epistemic barrier, made the entrepreneurs struggle to find available information and research in the field of sustainable fashion.

Second, in entrepreneurial learning literature, it is often mentioned that critical events occur when entrepreneurs start to perform tasks in the venturing process entailing a specific emotional charge [58,59]. However, our findings suggest that the concept of critical events expands this notion in sustainable entrepreneurship, that is, critical events in the lives of entrepreneurs are also related to environmental and social disorienting dilemmas that challenge their frames of reference and, ultimately, constitute a crucial factor for entrepreneurs deciding to venture into the sustainable fashion niche.

For the third phase of the niche development, our findings provide evidence that "achieving social innovation, by definition, implies social learning" [1]. This is manifested in two processes: The first is the building up of a project network inside the niche, and the second is the interaction of the niche projects with actors at the regime level. From the evidence of our study, we see that entrepreneurs learn in a multi-actor setting [60], that is, they do not act on their own. Instead, they act in specific social communities, namely entrepreneurial networks, where they learn by establishing relationships and interacting with other agents in the social network context [58,61,62]. Moreover, since social learning outcomes entail the formation of new relationships and interconnections [63,64], we argue that the formation of the network inside the niche is an outcome of this social learning process.

Furthermore, our findings suggest that communication efforts of niche projects and their interaction with actors at the regime level are slowly resulting in double- and triple-loop learning, which are two essential elements of social learning [60,65]. Primarily, the niche projects in sustainable fashion aim to do things differently (double-loop learning). This is manifested when they communicate the niche and innovate in the form of products or services, where some aspect of the articulation of demands and expectations between entrepreneurs, regime level actors and users is just beginning to take place [6]. This kind of learning can also be inferred from interviewees' perceptions about raising awareness and changing the perspectives of the public and of regime actors towards sustainable fashion. For instance, gaining the attention of bigger companies means that market incumbents in Mexico are being challenged by newcomers and start-ups regarding innovation in fashion and textiles [49]. On the other hand, the sustainable fashion global niche has been growing and making big companies start reorienting their practices towards ethical consumption, fair-trade and circular economy [66,67].

Therefore, we see, in learning occurring in the development of sustainability niches, a potential for transformative social learning. This is because it entails not only a change in individual frames of reference but also the change in frames of reference to social groups or organisations.

Applying and relating the insights of transformative learning, experiential learning, and social learning to the case helps us to understand that learning in niches is not just learning by doing through activism. The action component manifested in experimenting with an innovation (e.g., producing recycled fabrics) involves phases of disorientation, critical reflection and discourse; nonetheless, these elements of transformative learning are not always explicit during the entrepreneurs' venturing process. In the findings, we can infer from entrep-1 and entrep-6 excerpts in phase one, that as a result of their disorienting experiences, they embarked on a critical reflection process and changed or strengthened their perspective and orientation towards sustainable fashion. Although reflection processes are not mentioned explicitly, the data show that they reflected upon the situation and their assumptions. Moreover, in the case of discourse, its occurrence can be inferred in entrepreneurs' interaction with other projects in the niche network or with actors at the regime level. Because discourse implies making meaning through challenging and validating the assumptions of others, the change of perspective and the raising of awareness of actors at the regime level could be preceded by discourse activities. It is essential to consider that disorienting dilemmas, critical reflection, discourse and action engagement occur throughout the different phases of the development of the niche. All of this brings to mind one critical issue around transformative learning theory, namely that some scholars have contested the theory [68,69] by arguing that transformative learning processes do not follow the stages established by Mezirow [36]. Our proposition here is that not all elements or analytical categories of transformative learning always have to be explicit in all studies; rather, the different elements of this learning theory help us to understand unexplored learning phenomena, such as learning in transitions.

Finally, although scholars in transitions literature allude to conditions that support learning in the development of sustainability niches [3,5], due to the lack of empirical studies about learning in this area, there is no account of the barriers that hinder the learning of entrepreneurs as they venture into the niche. This is problematic, especially in the context of developing countries, because it is crucial to anticipate these barriers in order to propose general and context-specific conditions that better support the learning of entrepreneurs and, hence, avoid undesirable failures and results. One of the major barriers in the development of sustainable niches is that start-ups have limited economic resources because projects need infrastructure, equipment and financial resources to innovate further and experiment. We argue that this barrier is one that impacts negatively on the learning of these entrepreneurs and, therefore, in the development of the niche. Nonetheless, the fashion business environment in Mexico has been just recently open to explore new alternatives in sustainable fashion. Slowly, alliances are starting to form in order to cope with the inherent challenges of this industry but with a sustainability perspective. We suggest that this sustainable fashion niche in Mexico has been functioning as a space where network building occurs [5], which allows not only the further diffusion of innovations but also strongly supports individual and transformative social learning processes.

7. Conclusions

In this paper, we have attempted to provide an understanding of the learning phenomena around the formation and development of sustainability niches, through exploring the learning processes and outcomes within the different phases of the formation and development of the sustainable fashion niche in Mexico. We have identified three major phases that evolve over time and span from the individual level to the niche level. For the first phase, awareness of the niche, we clustered four main dimensions of the prior learning experiences of the entrepreneurs; for the second phase, entry into the niche, we analysed the external barriers and strategies that entrepreneurs had to overcome to succeed in the niche, as can also be seen in their learning outcomes; and, for the third phase, development of the niche, we found that a social learning phenomenon occurs, which is manifested in the formation of a

ventures network inside the niche and in the interaction efforts carried out between niche entrepreneurs and actors at the regime level.

Both entrepreneurial learning theory and transformative learning theory shed light in uncovering the black box of learning in niche formation. The findings show that as entrepreneurs venture into the sustainable fashion niche, they enter a process of transformative social learning, which is explicitly manifested in different elements, such as the formation of frames of references, disorienting dilemmas experienced, critical (self-) reflection, action engagement and configuration of networks and relationships inside and outside the niche. From the results, we draw three main conclusions: (1) Entrepreneurs' prior learning determines the way they experience the venturing process. (2) Critical events or disorienting dilemmas in entrepreneurs' life have been crucial factors for them to decide venturing into the niche sustainable fashion. (3) Transformative social learning takes place as the niche of sustainable fashion develops, through the formation of the network inside the niche and raising awareness of actors at the regime level.

Our study suggests that, although the sustainability niche provides rich opportunities for individuals to venture into projects [70], it is the effort that entrepreneurs put into their ventures that develops the niche. Even though our present study is exploratory in nature, it provides valuable insights about the importance of studying learning in sustainability transitions research more closely, more specifically, regarding sustainability niches. First, we contribute to a better and more detailed understanding of a multi-level perspective model through exploring sub-levels within the niche level, that is, how the individual level in transitions evolves to the development of a niche. Second, this paper also reinforces the theoretical connection between entrepreneurial learning and transformative learning, the latter being a learning theory that supports the analysis of the learning of entrepreneurs. Moreover, this paper also illustrates the potential that both entrepreneurial and transformative learning has in explaining the learning phenomena occurring in the early development of sustainability niches.

We acknowledge the limitations of our study regarding the extent of the depth in the elaboration of some conceptual elements of transformative learning theory, such as critical reflection and discourse, as well as the utilisation of entrepreneurial learning. Due to the exploratory character of this study, we cannot provide more general, detailed and confirmatory explanations regarding the learning processes, outcomes and conditions involved in the development of sustainability niches. Moreover, we are aware that the findings from this study cannot be extrapolated to the study of the same phenomena in other geographical contexts and types of niches.

Further research is needed in assessing the impact of the development of niches in user practices, the extent of the influence that conditions at the regime and landscape level exert on the development of the niche. Moreover, a more detailed study is required to differentiate the learning processes and outcomes of entrepreneurs according to their position in the supply chain.

Author Contributions: Conceptualisation, J.G.R.A. and M.B.; methodology, J.G.R.A. and M.B.; formal analysis, J.G.R.A.; investigation, J.G.R.A.; writing—original draft preparation, J.G.R.A. and M.B.; writing—review and editing, J.G.R.A. and M.B.; supervision, M.B.; project administration, M.B.; funding acquisition, M.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research was made possible within the graduate school "Processes of Sustainability Transformation", which is a cooperation between the Leuphana University of Lüneburg and the Robert Bosch Stiftung. The authors gratefully acknowledge the financial support from the Robert Bosch Stiftung (12.5.F082.0021.0).

Acknowledgments: The first author wants to thank Mireille Acquart for her valuable help and support during the fieldwork in Mexico regarding this research. We also want to thank the entrepreneurs who agreed to be interviewed for this research.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses or interpretation of data; in the writing of the manuscript or in the decision to publish the results.

Appendix A

Table A1. Interview guide (original in Spanish).

Tema	Preguntas
Información del emprendedor y del projecto	¿Cuál es tu nombre? ¿Cuál es tu edad? ¿Cuál es tu ultimo grado académico obtenido y en qué campo? ¿Cuál es tu actividad profesional actual? ¿Cuál es el nombre de tu projecto o start-up? ¿Cuál es tu rol en él?
	¿Qué actividades lleva a cabo tu proyecto?
	¿Cuántas personas trabajan para/en tu proyecto?
	¿Cómo surgió la idea de crearlo? (Cómo se fundó, quien y cuando)
	¿Cómo se ha financiado hasta el momento?
Trayectoria de aprendizaje individual antes del comienzo del empredimiento en el nicho	¿Cómo llegaste a interesarte en el campo de la sustentabilidad en la moda y textiles?
	¿Hubo algún evento decisivo en tu vida que te haya motivado a emprender en este campo de la sostenibilidad y la moda?
	¿Has tenido algún apoyo de personas durante este proceso de emprendimiento?
	Antes de que te interesaras en esto, ¿ya tenías alguna preocupación, conocimiento o predisposición hacia los temas ambientales y de sustentabilidad? ¿Cómo lo aprendiste?
	¿Ya tenías conocimientos previos sobre moda y textiles? ¿Cómo lo aprendiste?
	¿Pertenecías o trabajaste en alguna organización con fines altruistas, ambientales o de justicia social?
Percepción/conocimiento individual sobre sostenibilidad del sector textil	¿Cómo percibes el estado actual del campo de la moda y textiles sostenibles en México? ¿Qué problemas identificas?
Resultados de aprendizaje durante el funcionamiento del proyecto	¿Qué has aprendido en cuestión de conocimientos y habilidades durante todo este tiempo trabajando en tu organización?
	¿Has redefinido tus valores y normas personales al estar trabajando en esto?
	¿Te consideras como un agente de cambio para contribuir a un cambio hacia la sustentabilidad en el sector de la moda y textiles?
	¿Cuál consideras que ha sido el mayor impacto positivo que con tu organización has logrado en este campo de la sostenibilidad y la moda en México?
Apoyos y barreras en el funcionamiento y potencial crecimiento del nicho	¿Qué apoyos/incentivos has encontrado para seguir funcionando/expandirte o en el campo?
	¿Qué limitantes/barreras has encontrado para seguir funcionando/expandirte o en el campo?
	¿Tienes planes de que tu organización crezca más? ¿Cuáles son?
	¿Qué necesitarías (apoyos/incentivos) para que tu organización tenga un mayor impacto para la transición hacia la sostenibilidad textil?
Colaboración de redes entre niches y otros actores y grupos	¿Podrías mencionar los nombres de cinco proyectos con los más colaboración has tenido en cuestión de moda sostenible?
	¿Estarías interesado/a en formar parte de una red de otros proyectos innovadores en sustentabilidad del sector de la moda y textiles?
Pregunta de cierre	Finalmente, en términos generales ¿cómo has sentido la entrevista?

Appendix B

Table A2. Interview guide (translated to English by the authors).

Topic	Questions
Information about the entrepreneur and project	What is your name? What is your age? What is your last academic degree obtained and in which field? What is your current professional activity? What is the name of your project/start-up? What is your role in it?
	Which activities does your project carry out?
	How many people work in/for your project?
	How did you come up with the idea of your project? (How it was founded, who did it and when.
	How has your project been financed so far?
Individual learning trajectory before the beginning of the venture in the niche	How did you get interested in the field of sustainability in fashion and textiles?
	Was there a decisive event in your life that has motivated you to venture in this field of sustainability and fashion?
	Have you had any support from people during this venturing process?
	Before you got interested in this, did you already have any concerns, knowledge or predisposition towards environmental and sustainability issues? How did you learn it?
	Did you already have previous knowledge about fashion and textiles? How did you learn it?
	Did you belong or work in any organisation with altruistic, environmental or social justice purposes?
Individual perception/knowledge about sustainability in the textile sector	How do you perceive the current state of the field of sustainable fashion and textiles in Mexico? What problems do you identify?
Learning outcomes during the operation of the project	What have you learned in terms of knowledge and skills during all this time while working in your organisation?
	Have you redefined your personal values and norms while working on this?
	Do you consider yourself as a change agent that contributes to a change towards sustainability in the fashion and textiles sector?
	What do you consider to have been the greatest positive impact that your organisation has achieved in this field of sustainability and fashion in Mexico?
Drivers and barriers in the operation and potential growth of the niche	Which kind of drivers/ incentives have you found to continue operating/expanding or in the field?
	Which limitations/barriers have you encountered to continue operating/expanding or in the field?
	Do you have plans for your organisation to grow more? For example?
	What would you need (support/incentives) for your organisation to have a greater impact on the transition towards textile sustainability?
Network collaboration between niches and other actors and groups	Could you mention the names of five projects with the most collaboration you have had in terms of sustainable fashion?
	Would you be interested in being part of a network of other innovative projects in sustainability in the fashion and textile sector?
Closing questions	Finally, how did you feel in this interview?

Appendix C

The order of the quotations is according to their appearance in the results section.

Table A3. Direct quotations in Spanish.

Section (5. Results)	Original Quotation (Spanish)	Translation of the quotation (English)
5.1 Phase 1: Awareness of the Niche	Me impactó mucho (...) el conocer cómo una industria multibillonaria y que involucra absolutamente todo tema político, económico, de desarrollo, social, internacional, comercio... cómo era posible que tuviera un impacto tan grande a nivel social y luego en la parte ambiental (entrep-1, cita directa)	It shocked me a lot (. . .) to know how a multibillion industry that involves absolutely every political, economic, developmental, social, international, commercial topic . . . how it was possible that (the textile industry) had such a big impact at the social and environmental level. (entrep-1, direct and translated quote).
	Fue cuando descubrí que quería emprender con este proyecto, con este negocio, y realizar un cambio en la industria positivo con impacto y que pues esto es lo que quiero hacer toda mi vida. No importa cuánto tiempo me tarde, no importa cuánto me cueste... este es mi proyecto de vida y mi proyecto profesional. (entrep-1, cita directa)	I found out what I wanted to undertake with this project, with this business, and to make a change in the industry, something positive with impact, and this is what I want to do for my whole life. It doesn't matter how long I take; it doesn't matter how much it costs me . . . this is my life and my professional project. (entrep-1, direct and translated quote).
	En donde yo vivía hay fábricas de pantalones (que)... contaminan horrible... el agua, el ambiente; la gente que trabaja ahí aspira todos los químicos y hay muchas enfermedades (...) (Entonces) empecé a investigar y ya descubrí que para no contaminar tanto pues hay que usar de residuos. Entonces, se me ocurrió (que) con toda la ropa que tenía ahí empezar a vender ropa otra vez, con la reconstruida y también con los retazos que mi mamá tenía. (entrep-6, cita directa)	Where I used to live there are jeans factories (that) . . . pollute horribly . . . the water, the environment; the people who work there inhale all these chemicals, and there are a lot of diseases (. . .) (Then) I started to investigate and found out that in order not to pollute, one must reuse waste. So, it occurred to me (that) with all the clothes I had, to start reselling clothes again with the mended and also with the remnants (that) my mom had. (entrep-6, direct and translated quote).
5.2. Phase 2: Entrance into the Niche (External Barriers)	Me interesa (innovar) pero no lo estoy aplicando porque no sé cómo y no hay nadie que me diga cómo lo hago (entrep-1, cita directa)	(Innovating) interests me, but I am not applying it because I do not know how, and no one can tell me how to do it. (entrep-1, direct and translated quote).
	Me he dado cuenta en esto del proyecto que es difícil encontrar materiales como más naturales, ecológicos (o) reciclados, osea, en realidad es muy difícil si quieres trabajar con un material 100% reciclado, 100% natural, lo tienes que traer de otros países. (Así que) el costo es muy elevado por lo mismo, porque (tal material) no se vende aquí. (entrep-7, cita directa)	I realised during this project that it is very hard to find materials that are more natural, more ecological (or) recycled, I mean, it is really very difficult if you want to work with a material that is 100% recycled, 100% natural, you have to bring it from other countries. (So), the cost is very high for that reason, because (such material) is not sold here. (entrep-7, direct and translated quote).

Table A3. *Cont.*

Section (5. Results)	Original Quotation (Spanish)	Translation of the quotation (English)
5.2. Phase 2: Entrance into the Niche (External Barriers)	La gente al final de cuentas se sigue yendo por la moda, (y aunque) empieza a considerar ya el consumir de manera local, (algo) hecho en su propio país, sigue siendo atractiva la idea de "(bueno), pero ya conozco esta marca, es una marca internacional, entonces no me pueda fallar, esta (otra) marca no la conozco..." (entrep-7, cita directa)	In the end, people still prefer the trend, (and even though) they begin to consider to consume locally, (something) made in their own country, it is still attractive the idea of "(well), but I already know this brand, it is and international brand, so it cannot fail me, and this (other) brand I don't know it." (entrep-7, direct and translated quote).
	No hay un estudio(s) de cómo hacer consciente cómo funciona la industria textil en México como un sector a nivel nacional. (Entonces) si no lo comprendes, no hilas ninguna con otra, entonces no puede haber ni una política pública ni regulatoria, porque cada industria se ve por separado y no como una cadena de valor. Ese es el gran problema. (entrep-1, cita directa)	There are no studies to raise awareness of how the textile industry works in Mexico as a sector at the national level. Therefore, if you do not understand it, you cannot link one to the other, so there cannot be public policies or regulations, because each industry is seen on its own and not as part of a value chain. That is the big problem. (entrep-1, direct and translated quote).
5.2. Phase 2: Entrance into the Niche (Strategies to Overcome Barriers)	El evento pasado fue patrocinado 100%, (pero) no hubo tampoco apoyos (económicos). Osea, el apoyo gubernamental fueron las instalaciones, la difusión (del evento); pero también el sector empresarial se ha sumado, porque pues bueno de cierta manera también lo ven como 1 área de oportunidad. O sea que ya el sector empresarial invierta en este tema de moda está interesante. (entrep-2, cita directa)	The last event was 100% sponsored, (but) there wasn't any (economic) support. I mean, the governmental support was only for the facilities and the marketing of the event; however, the business sector has contributed, because, in a certain way, they see this as an area of opportunity. It is interesting when the business sector invests in this topic of fashion. (Entrep-2, direct and translated quote).
	Dos empresas con las que hemos trabajado en este asunto del emprendimiento social, (nos) han ayudado mucho en aspectos de visibilidad y eso nos ha catapultado a poder lograr más cosas. Si no, sería muy difícil realmente lograr una fama (en el sector textil). (entrep-5, cita directa).	Two companies, with which we have worked on this matter of social entrepreneurship, have helped us a lot in aspects of visibility and that has catapulted us to achieve more things. Otherwise, it would have been more difficult to gain recognition (in the textile sector). (entrep-5, direct and translated quote).
	Yo creo que el más grande, y que es lo que más agradezco, es gente que se ha sumado al proyecto a cambio de nada; osea, sin valor económico, porque no he tenido a veces (el) capital (financiero) para pagar (a la) gente (...) Que alguien crea en ti es una retribución que no la puedes pagar con dinero. (entrep-1, cita directa).	I think that the greatest thing, and what I most appreciate, is the people who have joined the project for nothing in return. I mean, without a financial pay-back, because sometimes I haven't (the financial) capital to pay people (. . .) The fact that someone believes in you is a retribution that you can't pay with money. (entrep-1, direct and translated quotation).

Table A3. *Cont.*

Section (5. Results)	Original Quotation (Spanish)	Translation of the quotation (English)
5.2. Phase 2: Entrance into the Niche (Individual Learning Outcomes)	He mejorado mucho la calidad de los procesos y de las mochilas. He intentado también como optimizar ciertos procesos para evitar el desperdicio de telas (...) He aprendido mucho sobre el bordado mexicano y como toda esta cultura de textiles en las comunidades indígenas. (entrep-7, cita directa).	I have improved the quality of the processes and the backpacks. I have tried also to optimise certain processes to avoid wasting fabric (...) I have learned a lot about Mexican embroidery and the entire textile culture in indigenous communities. (entrep-7, direct and translated quotation).
	Ahora he de tener que aprenderme ahora términos legales, términos financieros, de pensar como lo pensaría un administrador, de imaginarme hablando cosas contables. (entrep-3, cita directa)	Now, I have to learn legal terms, financial terms, to think how an administrator would do it, to imagine myself talking about accounting related things. (entrep-3, direct and translated quote).
	Ahora pienso más antes de comprar cualquier cosa, y vuelvo a repetir, no nada más es lo que comes sino lo que vistes, pero también a ser coherente conmigo misma, desde separar la basura en casa o de hacer compritas que valen la pena, no importa, lo pago un poquito más. Pero si me ha ayudado bastante a cambiar mi perspectiva y a valorar más lo que tengo alrededor. (entrep-2, cita directa)	Now I think more before purchasing anything, and I repeat it, it is not only what you eat, but also what you wear, it is to be coherent with myself, from sorting the garbage at home to buying things that are worth it for which I can pay a bit more. But it has helped me a lot to change my perspective and to value what I have around me. (entrep-2, direct and translated quote).
	Básicamente soy financiero, entonces el aspecto de la prioridad del dinero, osea, del negocio era prioridad. En este momento estamos tomando ya decisiones basadas en más variables (por ejemplo, el) impacto que para nosotros es muy importante. Esta es una de las variables más importantes a la hora de tomar decisiones en (el proceso de) producción. (entrep-5, cita directa)	Basically, I am a finance person, so the aspect of prioritising money, I mean, the business was the priority. At this moment we are already making decisions based on more variables, for instance, the impact of what we do, which for us is very important. This is one of the most important variables when we make decisions in the production (process) (entrep-5, direct and translated quote).
5.3. Phase 3: Development of the Niche	Existe como una red, casi todos nos conocemos. Realmente es muy pequeño el asunto todavía de moda sustentable aquí en México. Osea te digo, casi todos nos conocemos, hemos platicado algunos minutos. Existe la red informal. Muchas (colaboraciones) son apoyos de mercado, de ideas, nos apoyamos entre nosotros de diversas formas. (entrep-5, cita directa).	There is some sort of a network; we almost know each other (. . .) Actually, the issue of sustainable fashion in Mexico is still very small. I mean, almost everyone knows each other, we have talked for a few minutes. There is an informal network. Many of them (collaborations) are marketing support, of ideas, we support one another in different ways. (entrep-5, direct quotation).

Table A3. *Cont.*

Section (5. Results)	Original Quotation (Spanish)	Translation of the quotation (English)
5.3. Phase 3: Development of the Niche	Creo que, en términos de comunicación de conocimiento, el desarrollo de conocimiento o el desarrollo de investigación de material, creo que es el impacto más grande y la accesibilidad a la misma. El que hoy la gente tenga la accesibilidad a estos materiales porque han tenido una sensibilización sobre el tema (de moda sostenible), no había hace trece años (entrep-1, cita directa)	I think that in terms of communication of knowledge, the development and knowledge, or the development of research, of material, I think that is the biggest impact and the accessibility to it. The fact that people today have access to this material, because they have had a sensitisation about the topic (of sustainable fashion), which didn't exist 13 years ago. (entrep-1, direct and translated quote).
	Mucha gente se ha interesado en donar prendas para hacer las mochilas (...) Entonces hacen ese cambio de pensamiento: "Pues no voy a tirar toda la ropa que ya no uso, mejor (voy) darle un segundo uso y pues a partir de ahí a empezar a considerar también mi forma de consumo. (entrep-7, cita directa)	Many people have been interested in donating garments to produce the backpacks (. . .) So, they make this shift in their thinking: "Well I am not going to throw away all of the clothes that I am not wearing; (I would better) give them a second use, and from there, to begin to consider my way of consuming". (entrep-7, direct and translated quote).
	Entonces hemos impactado en grandes empresas, en el discurso de las grandes empresas, no solamente en las ideas sino en la forma en que comunican sus objetivos. (entrep-5, cita directa)	So, we have had an impact on big companies, on the discourse of big companies, not only in the ideas but also in the way they are communicating their objectives. (entrep-5, direct and translated quote).

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4.7 Article 3 - Evolution of entrepreneurs' expectations using Instagram as a business practice: A transformative learning perspective in the case of sustainable fashion entrepreneurs in Mexico

World Development Sustainability 1 (2022) 100005

Contents lists available at ScienceDirect

World Development Sustainability

journal homepage: www.elsevier.com/locate/wds

Evolution of entrepreneurs' expectations using instagram as a business practice: A transformative learning perspective in the case of sustainable fashion entrepreneurs in Mexico

Jorge Gustavo Rodríguez Aboytes[a,*], Matthias Barth[b,1], Daniel Fischer[c]

[a] Robert Bosch Research Group, Faculty of Sustainability, Leuphana University of Lüneburg, Universitätsallee 1, 21335 Lüneburg, Germany
[b] Institute for Sustainable Development and Learning, Faculty of Sustainability, Leuphana University of Lüneburg, Universitätsallee 1, 21335 Lüneburg, Germany
[c] Department for Social Sciences, Wageningen University and Research, 6708 PB Wageningen, Netherlands

ARTICLE INFO

Keywords:
Expectations
Sustainable niche
Transformative learning
Sustainable fashion
Sustainable entrepreneurship
Instagram

ABSTRACT

Sustainability entrepreneurs act based on expectations about how products will be received by consumers, in which directions markets and demand will develop, or which business models and innovations will prevail. Through their action-guiding function, expectations play an important role in how sustainability ventures develop in and out of niches. However, little attention has been paid to how new communication media, especially increasingly important social media, affect the way entrepreneurs articulate and change their expectations. This paper addresses this research gap using transformative learning theory to examine the communication of Mexican sustainable fashion entrepreneurs on Instagram. We used snowball sampling to select a representative sample of fashion brands operating in the sustainable fashion niche in Mexico. We used a mixed-methods approach: To analyze entrepreneurs' expectations, their use of social media and other learning outcomes, we employed semi-structured interviews. To track the evolution of entrepreneurs' expectations and their activity on Instagram, we scraped content (posts) from their respective brands' pages. Fashion brands in Mexico with business models based on sustainable fashion are a mixture of market-based and grassroots initiatives. Although sustainability concerns drive the ventures of sustainability entrepreneurs, Instagramhas played a crucial role in the evolution of entrepreneurs' expectations towards innovation with products and business growth. This change in expectations can be understood as a transformative learning process that underscores different phases, action engagement, disorienting dilemmas and discourse. We contribute to opening and exploring the black box regarding the learning processes in the articulation and evolution of expectations.

1. Introduction

Sustainability transitions require the participation of industries, public institutions and incumbents, as well as the active involvement of sustainability entrepreneurs through sustainable innovations and ventures [1,2]. Sustainability entrepreneurs (henceforth entrepreneurs) hold specific expectations about the future and the desired performance and outcomes of their sustainable ventures (henceforth ventures) [3–5]. Guided by their expectations, entrepreneurs test and experiment with their innovations as they seek to ascertain the desirability, feasibility and viability of their ventures [6] and to raise awareness of the broader cause of sustainability [7]. However, in doing so, entrepreneurs' expectations do not remain static; they evolve throughout the venturing process.

The evolution of expectations is a central topic in sustainability transitions and strategic niche management [8–10]. Although commonly referred to as articulation of expectations, we use the term evolution of expectations instead to denote the dynamic nature and gradual change of expressions over time. Change in entrepreneurs' expectations not only affects the direction of the ventures but also influences the development and trajectories of sustainability niches (henceforth niches) [8,9]. Nonetheless, the evolution of expectations entails communication and learning processes that have rarely been explored from a learning perspective, remaining black boxes [11].

The evolution of entrepreneurs' expectations can be considered a transformative learning process. Transformative learning refers to changes in individuals' meaning structures that guide their thoughts and actions [12]. As individuals act and experience the world, they might face critical events that challenge these meaning structures. They then enter a process of critical (self-) reflection and discourse, in which they revisit and change them [13,14]. In this sense, entrepreneurs' expectations can be understood as meaning structures that are constantly chal-

* Corresponding author.
E-mail address: rgrodrig@leuphana.de (J.G. Rodríguez Aboytes).
[1] Present address

https://doi.org/10.1016/j.wds.2022.100005
Received 6 September 2021; Received in revised form 12 March 2022; Accepted 23 March 2022

lenged, revisited and changed, as entrepreneurs engage in communication and interaction during the venturing process.

Today, part of this process is the use of social media as a business practice, which allows entrepreneurs to improve their communication and business activities [15–18]. Instagram, for instance, is one of the social media platforms most used for businesses purposes: “90% of people on Instagram follow a business; two in three people surveyed say that Instagram enables interaction with brands; and 50% [of users] are more interested in a brand when they see ads for it on Instagram” [19, “Join millions of businesses engaging with vibrant communities”].

As there is little existing empirical evidence concerning the learning processes behind the evolution of expectations, we raise the following research question:

How does Instagram use affect the evolution of entrepreneurs’ expectations and transformative learning?

The topic of expectations has been studied in several contexts such as sustainable energy [9,20], bioplastics [21] and industrial ecology niches [22]. However, other important sectors such as the textile-fashion industry (henceforth fashion industry) have been overlooked despite their relevance to sustainability transitions. Due to the unsustainable production and consumption practices of this industry [23,24], a sustainable fashion niche has emerged, creating space for innovation and venturing. Entrepreneurs, mostly from the global north, have engaged in new business models by incorporating both technological and social innovations (e.g., circular production, cradle-to-cradle materials and supply chain traceability) [25]. However, in other regions of the world such as Mexico, entrepreneurs and venture practices in this niche have not yet been investigated.

Mexico is both a fast-growing fashion market for international fashion firms and an important textile manufacturer for the US fashion market [26,27]. With regard to sustainability challenges, Mexico suffers from high environmental pollution due to the textile industries and maquiladoras, perpetuating poor economic, social and health conditions for workers and communities [28,29]. The growing fast fashion culture in Mexico also leads to a higher rate of clothing disposed of in landfills, justified by reports of increase of textile waste in landfills in low- and middle-income countries due to increased consumption patterns [23]. Nonetheless, a sustainable fashion niche is gaining momentum in Mexico, fueled by dispersed ventures and start-ups led by entrepreneurs who are aware of and want to tackle the sustainability challenges of the fashion industry [30]. Sustainable fashion entrepreneurs represent crucial stakeholders who connect production practices with consumer habits and behaviours among their ventures. For that reason, Mexico was chosen as a relevant context to study the evolution of entrepreneurs’ expectations and their impact on the sustainable fashion niche.

The purpose of this work is to explore the transformative learning process behind the evolution of entrepreneurs’ expectations due to the use of Instagram as a business practice. We focus on Mexican entrepreneurs running small- and medium-sized fashion brands tagged as "sustainable". We chose Instagram because it is the social media platform with the largest influence on fashion brands’ communication [31]. We will provide a transformative learning model that explicates the evolution of expectations due to the influence of Instagram as a business practice, specifically including (a) a description of entrepreneurs’ initial expectations regarding their ventures and Instagram use, (b) an analysis of learning mechanisms implicated as entrepreneurs use Instagram and (c) the respective change in expectations and other learning outcomes.

2. Theoretical framework

2.1. The niche of sustainable fashion: properties and business models

The current regime of the fashion industry is one of the most complex economic activities due to the global configuration of the supply chain, which has negatively impacted multiple socio-ecological systems [32]. As a response, a global niche of sustainable fashion has emerged to transition towards a sustainable industry that optimises the use of material resources and energy, reduces the pollution of socio-ecological systems, and respects human rights through transparent and traceable production-consumption schemes [33].

Although several terms are used to refer to the sustainability dimension of the fashion industry, such as ethical, slow, or ecological fashion [34–36], sustainable fashion is characterised by the following properties:

- Sustainable processes: Low-impact, environmental approach to design, supply of materials, manufacture, logistics, retailing and disposal
- Sustainable materials: Use of raw, natural, organic or upcycled materials (fibres, yarns, dyes, fabrics, etc.) that can be extracted/prepared with minimal environmental impact
- Slow production: Handmade, artisanal production, small batches, timeless collections, production on demand
- Ethical impact: Respect for and appreciation of workers, fair wages, good labor conditions; socioeconomic support for disadvantaged groups, promotion of sustainable consumption, addressing gendered beauty stereotypes, etc.

These properties are translated into specific business models by either large companies or entrepreneurs. 25 [25] identified five major trends in business models with their respective drivers of innovation: circular economy (e.g., recycling, upcycling), corporate social responsibility (e.g., fair trade, locally sourced), sharing economy (e.g., renting, second hand), technological innovation (e.g., sustainable raw materials, zero waste) and consumer awareness (e.g., lowsumerism, slow fashion).

2.2. Evolution of expectations as a process of transformative learning

As an innovation emerges to respond to the sustainability challenges of a current regime, it must prove its technical and economic feasibility and its socio-environmental benefits [6,37]. This validation process starts as soon as entrepreneurs formulate expectations around these innovations and their respective ventures. Such expectations can be defined as "a set of cognitive rules that are oriented to the future and related to action, in the sense that they give direction to search and development activities" [8, p. 375]. In this sense, entrepreneurs’ expectations include future personal and collective visions about the success of their ventures and their contributions to sustainability transition. According to the literature, expectations can be classified into two major groups:

- Market-economic: Commercial profits, customer loyalty, brand image, market diversification/expansion [10,38]
- Socio-environmental: Contributing to the common good, creating benefits for local businesses, supporting and informing people about ethical decisions, reducing environmental impact, building awareness, promoting sustainable development and alternative lifestyles [38]

Initially formed as vague promises with a high degree of uncertainty [39], expectations are continuously reshaped in an ongoing learning process as innovations are challenged or do not work as planned [10,9]. This learning process can be explained by the learning selection model [40,41] based on Kolb’s [42] experiential learning model. This learning model shows a cycle of experience, making meaning, drawing conclusions (e.g., changing expectations) and action: Entrepreneurs experience events that challenge their expectations. They reflect upon these experiences and make sense of them. Based on this reflection, they draw conclusions and might change their expectations accordingly. Their new expectations are translated into actions that trigger a new cycle of experience.

The learning selection model resonates with transformative learning theory [43] (see Fig. 1). Expectations constitute part of the meaning structures that determine how entrepreneurs perform and experience

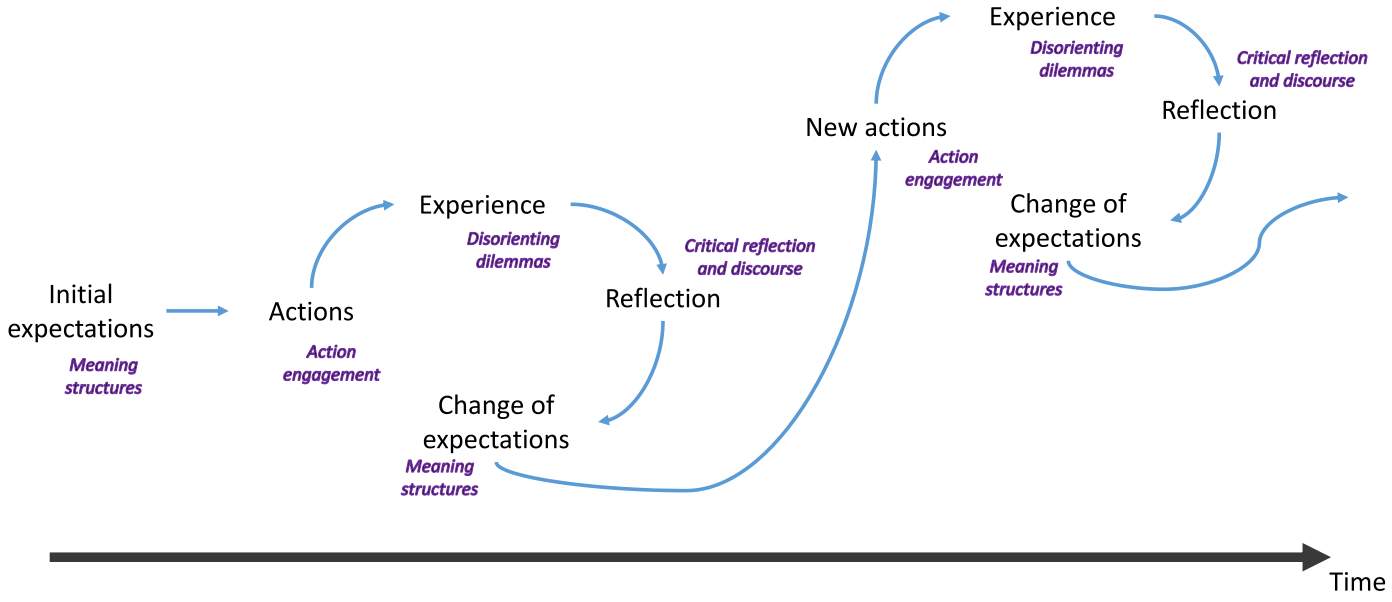

Fig. 1. Model of evolution of expectations, based on the learning selection model [40,41] and complemented with elements of transformative learning theory (words in italics and purple) [43].

the venture; that is, expectations guide their practices and activities in the venturing process [30,44]. Expectations are challenged and confronted as entrepreneurs experiment and test their innovations, causing disorienting moments or dilemmas [45]. To make sense of these moments of discrepancy and contradiction, entrepreneurs enter a process of critical (self-)reflection and discourse [46] in which they examine their meaning structures and expectations, resulting in learning outcomes such as a change of perspectives and expectations [47].

2.3. Social media in strategic niche management

Communication is inherently involved in articulating expectations because it constitutes a dialog between stakeholders that enables the formation of networks, contributing to the acceleration of sustainability of transition processes [48,49]. The emergence of social media (e.g., Twitter, Facebook, Instagram) is changing how sustainability is communicated [50]. Social media encompasses online communication platforms that allow massive distribution of and interaction about information and knowledge with minimal time delays and at a low cost [51]. Like any social media, Instagram is a social network of users constituted not only by individual people but also by companies and institutions. Instagram attractiveness relies on engaging users through posts in the format of images and videos [52]. Users follow each other to see each other's posts. They interact through functions such as likes, comments and private messages [31]. Today, many businesses are using Instagram to locate potential customers and promote products and services through content creation [53].

When entrepreneurs create social media content, they introduce features of their innovations and new business models or even disclose their working environments [54]. Moreover, by interacting on social media, entrepreneurs infer users' purchasing practices and influence consumption behaviours through strategic communication [55]. Social media extends communication about niche innovations, bridges knowledge between niche and regime actors, and helps constitute social networks, which ultimately leads to the visibility and diffusion of the niche [10]. Social media re-contextualises niche innovations and reframes their application and use in other local or national scenarios [10]. This is where local sustainability entrepreneurs play an essential role in translating the use and benefits of specific innovations and connecting global and local actors. Furthermore, social media influences processes such as forming opinions, understanding information, articulating expectations, and changing actors' perceptions [7,10]. From a transformative learning perspective, social media might be seen as an area for critical reflection and discourse as "people construct meaning and make sense of the information they encounter" [10, p. 3]. In this context, discourse encompasses sharing, challenging and validating viewpoints that could lead to a change in frames of reference, meaning structures and expectations.

As entrepreneurs participate in the sustainable fashion niche through various business models and innovations, they develop certain expectations that are likely to change and evolve during their venturing process. While social media, specifically Instagram, represents a new method of business practice for entrepreneurs, given its features, its influence in processes of articulation and evolution of expectations as a transformative learning process remains unknown.

3. Research methodology

Given the lack of previous research on entrepreneur expectations in the fashion industry, we employed an exploratory research approach for this study. We used a mixed-methods research design (see Fig. 2) to (a) estimate the population of sustainable fashion brands in Mexico, (b) identify an appropriate sample and (c) collect data through both quantitative and qualitative methods.

3.1. Sampling

As there is no official account of how many sustainable fashion brands in Mexico exist, we estimated the size of this population with snowball sampling through social media. Traditional snowball sampling permits access to hard-to-reach or unexplored populations [56,57] and consists of approaching subjects whose names or information have been given by previous informants or initial seeds [57,58]. However, this technique is constrained by material and time obstacles [57]. Therefore, an alternative approach is snowball sampling with online tools. Snowball sampling through social media does not require asking subjects about other potential subjects' information and makes the identification of social networks easier. Nonetheless, to date, this technique has mainly been used for sample recruitment purposes [59].

Our exploratory approach made it necessary to select a feasible set of theoretically defined cases to investigate the phenomenon in greater

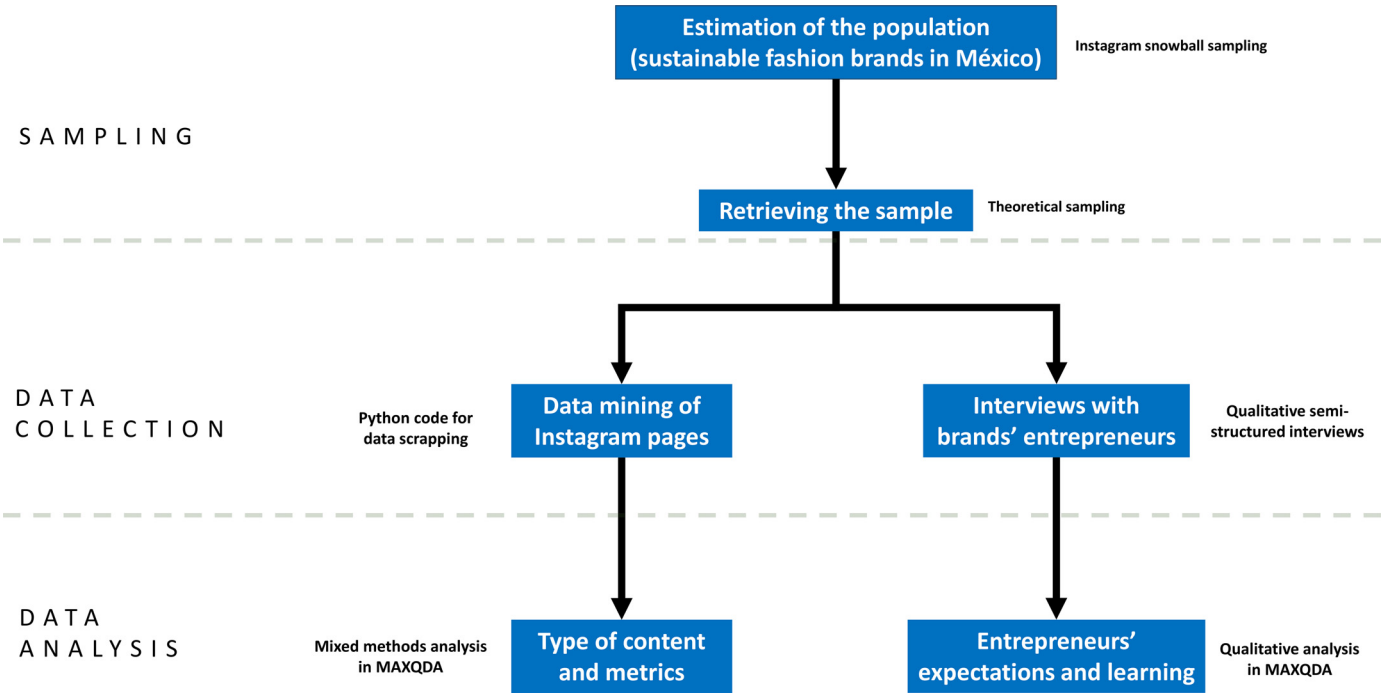

Fig. 2. Research methodology.

depth qualitatively.We began the snowball sampling with two initial seeds, namely two fashion brands identified in Rodriguez Aboytes and Barth's study [30]. Using the grid view of each seed's Instagram page, we screened the posts whose date of publication ranged from January 1st 2019 to October 29th 2020, in order to identify those posts whose cover image contained phrases related to the sustainable fashion properties described in Section 2.1. Then, we located other brands that were tagged in those posts (see Fig. 3) and collected the brands' names for an inclusion/exclusion criteria selection. We excluded brands that did not operate in Mexico or focused primarily on accessories such as jewelry, home textiles or second-hand or vintage clothing. The remaining brands were included in a preliminary sample and functioned as new seeds. The identification of brands from the initial seeds corresponds to iteration 1. We ran five iterations in total, which led to a preliminary sample of 82 brands (see Appendix A for a detailed description of the snowball sampling procedure).

We imported all the brands' general descriptions from three sources (i.e., Instagram, Facebook and brand website) to MAXQDA andreduced the preliminary sample to 59 brands by excluding those brands that did not fulfill the attributes of sustainable fashion (see Section 2.1). We further refined the sample by focusing on one aspect that characterises brands' business models in the niche of sustainable fashion: the supply of materials. To this end, we only included brands that explicitly showed on their social media and website that they were mostly using sustainable materials (fabrics, threads and dyes), regardless of if they were focusing on aspects of slow or ethical fashion. The resulting sample, that is, the sample universe, consisted of 37 brands.

To arrive at a final set of brands for data collection, we grouped the 37 brands according to the type of clothing they produced and the business model according to theirmaterial obtainment: either by self-upcycling clothing waste or via an external supplier. These two dimensions are key to inform the theoretical sampling. We show this classification in Fig. 4, highlighting the iteration from which the selection of brands resulted.

To achieve the aspired depth in the analysis, from each group in Fig. 4 (type of product, business model), we selected the brand with the highest number of followers on Instagram and added it to the final sample, as we consider the number of followers a criterion of group representativeness. If the brand's founders did not consent for data collection (interviews) or were unavailable, we chose the next brand with the most followers. In the case of footwear with an upcycling model, no brands were available. The final sampling resulted in ten brands (see also Fig. 4).

3.2. Data collection

We collectedboth qualitative and quantitative data using semi-structured interviews and data scraping as two complementary methods. The latter has become a valuable method to gather and collect high volumes of data from digital web platforms through automatised search and data collection routines [60]. Qualitative interviews allow collecting information based on the particular perspectives of subjects who participate in a given phenomenon [61].

We first scraped all content (the first post the brand ever published to the last one until December 14th 2020) from the ten brands' Instagram pages using an algorithm programmed in Python (see Appendix B). We extracted and downloaded each post link, its description, the date it was posted and its number of likes. We then conducted semi-structured interviews in Spanish with the entrepreneurs who founded their respective brands (see interview guide in Appendix C). Interviews lasted between 30 and 60 min and were recorded and transcribed. The interview data were not translated for the analysis.

3.3. Data analysis

We performed a content analysis of the Instagram data [62] in MAXQDA, where each brand represented a document group containing each Instagram post as a single document. We proceeded to code inductively both each post's content (photo or video) and its description (omitting hashtags) in each document. The number of likes was introduced as an integer variable (see Fig. 5). In this way, we developed a category system where each category represented a specific type of content. A single document (post) could have more than one type of content; different categories were assigned to different segments

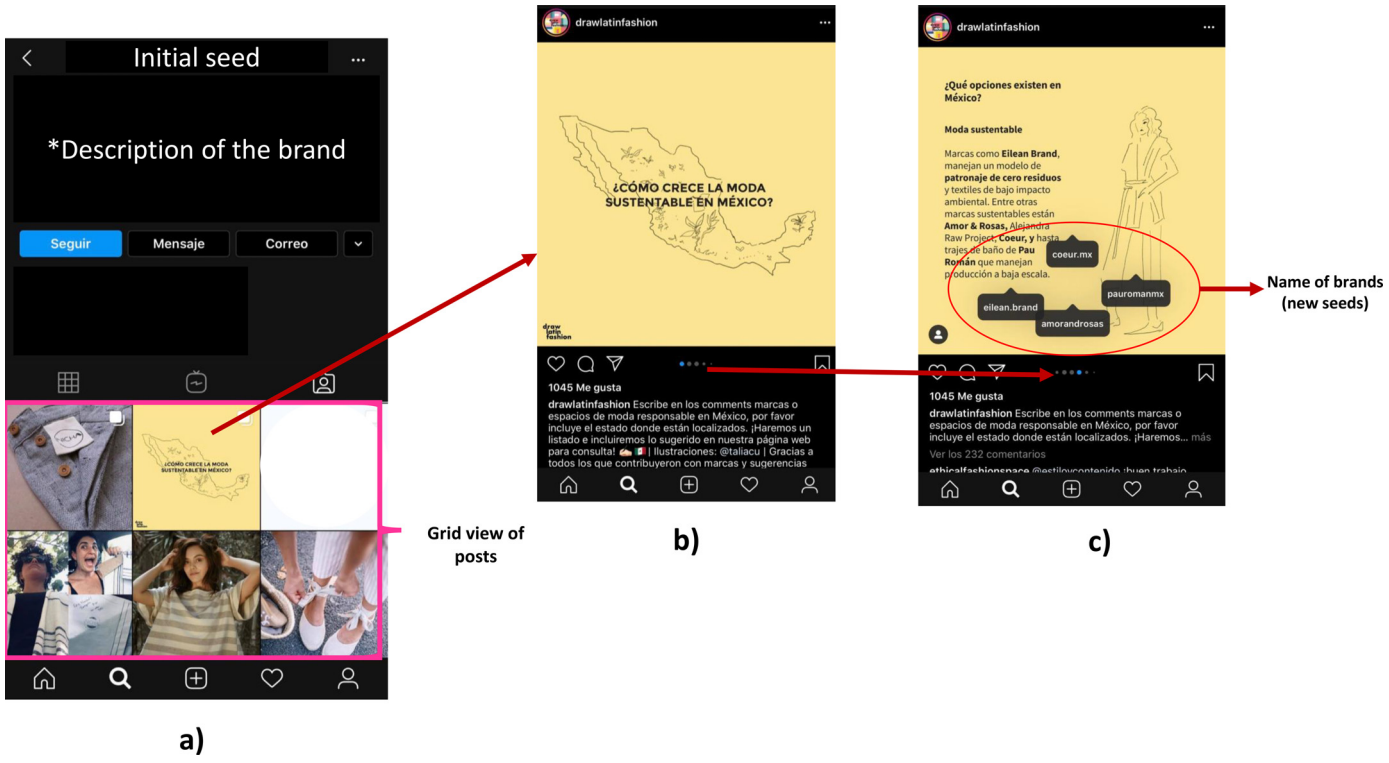

Fig. 3. Representation of the snowball sampling procedure with Instagram: (a) grid view of the seed's Instagram page, (b) cover image of a post[1] with a phrase related to sustainable fashion, "How does sustainable fashion grow in Mexico?" (translated by the author), (c) brands tagged in the post. Source of the post: drawlatinfashion (2019).

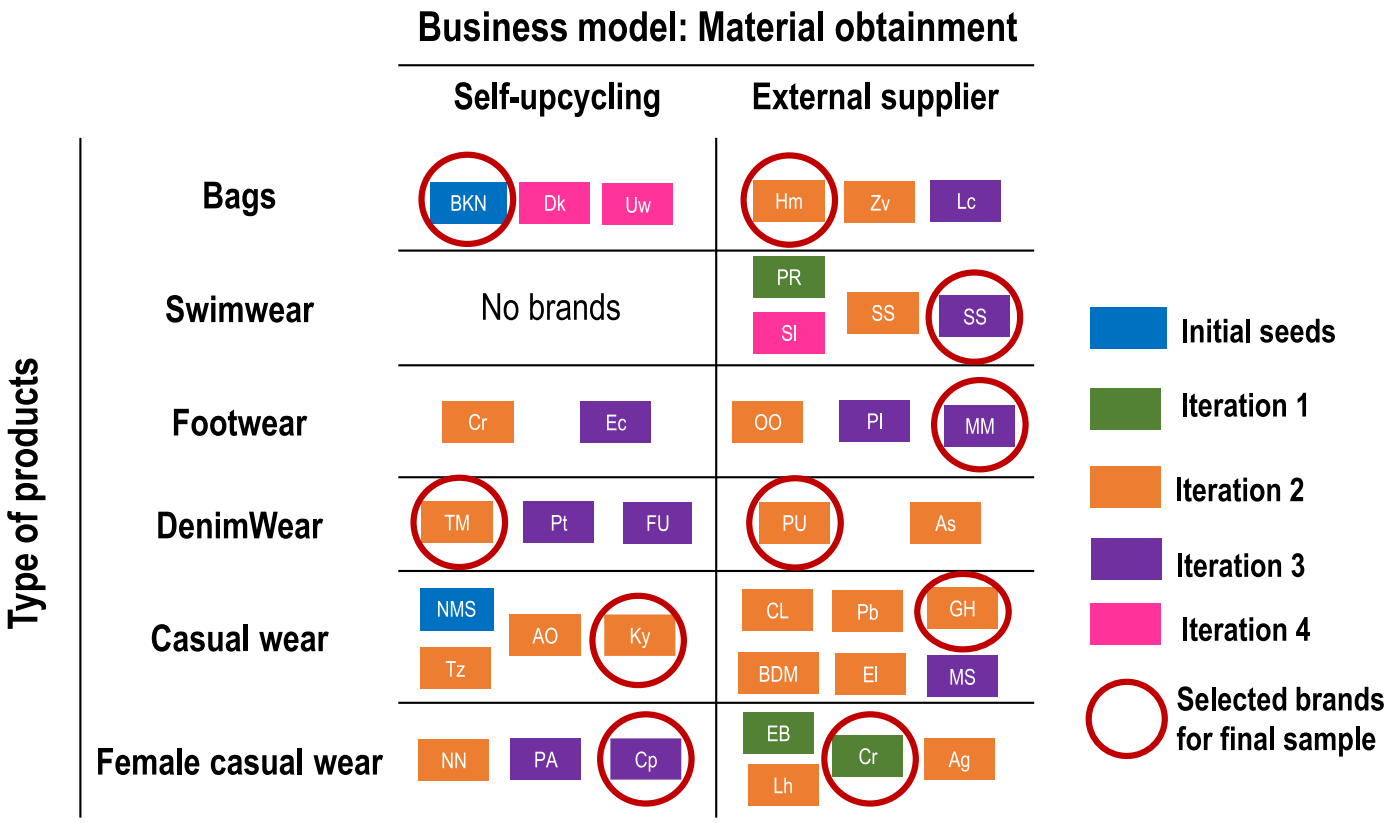

Fig. 4. Classification of sustainable fashion brands population (n = 37) and selection of brands for the final sample (n = 10).

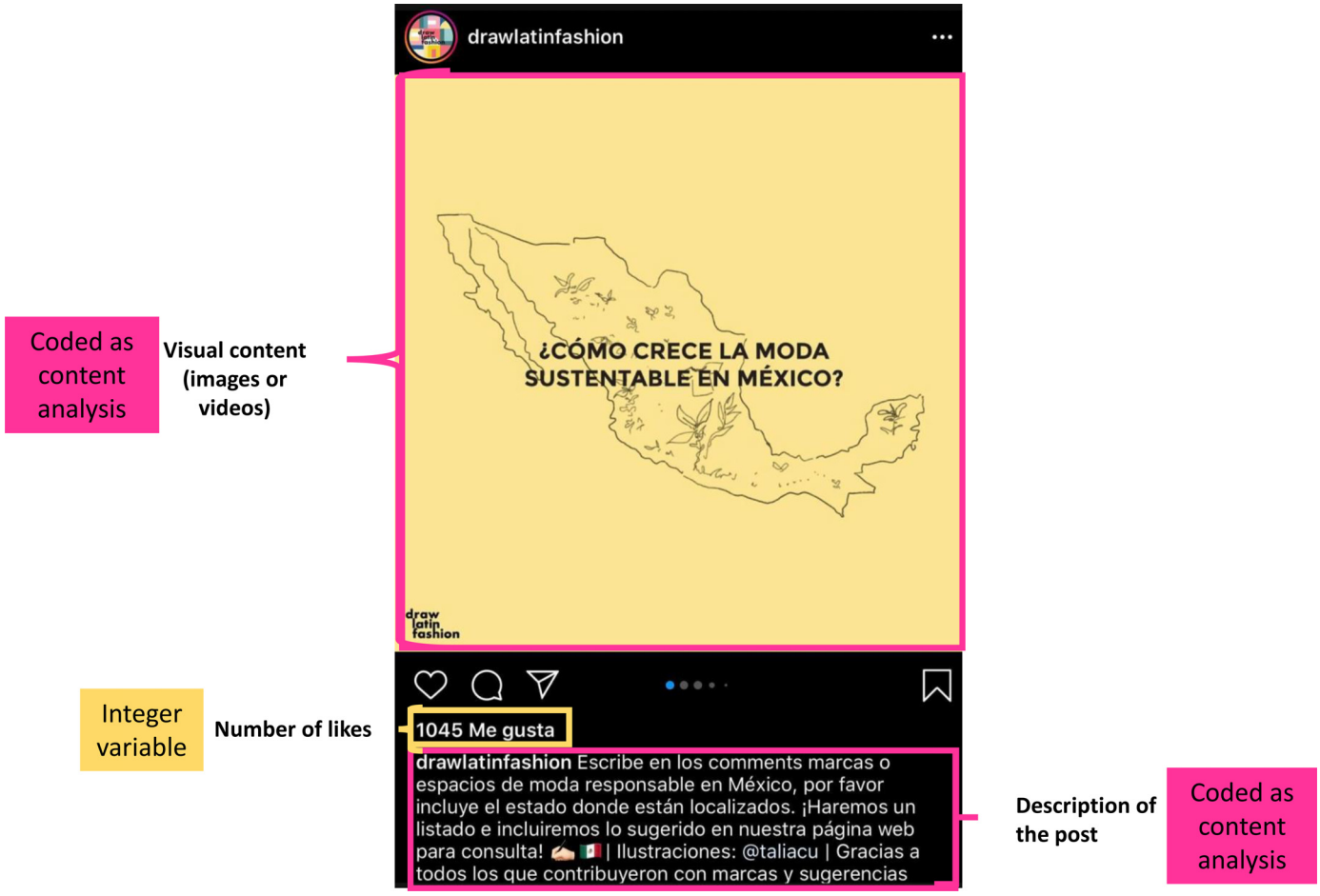

Fig. 5. Example of an Instagram post[1] and the elements that were considered for analysis.

within a single document (see Appendix D for the category system of the posts). For interview data, we ran a preliminary deductive coding derived from the main topical areas of the interview guide. This deductive coding allowed us to organize preliminary data into three sections, namely initial expectations, use of Instagram, and current expectations and learning outcomes. Again using MAXQDA software, we grouped the entrepreneurs' initial venture expectations into the categories described in Section 2.2 (i.e., socio-environmental and market-economic). From there, we derived specific themes inductively. Separated from the initial venture expectations, we also inductively derived themes regarding expectations about the use of Instagram. For this second section of the data, the use of Instagram, we performed inductive coding to identify common categories. We again used the categories in Section 2.2 to classify the entrepreneurs' expectations and identified themes inductively. We coded the learning outcomes inductively, although we realised that they appeared throughout all the data in no specific chronological order (for the detailed category systems from the interview data, see Appendix C).

4. Findings

The structure of this section is derived from the preliminary organization of the data. In the first subsection, we present the entrepreneurs' initial expectations regarding both the venture and the use of Instagram. In the second subsection, we present the ways in which entrepreneurs use Instagram as a business practice. This subsection combines findings from the data analysis of the interviews and the content analysis of the brands' Instagram pages. In the third subsection, we show the evolution of entrepreneurs' expectations and the associated learning outcomes. To refer to the interview excerpts, we use the prefix e- in the code names of the brands. All the excerpts were translated into English by the authors.

4.1. Initial expectations

We grouped entrepreneurs' initial venture expectations into socio-environmental and market-economic expectations. For our purposes, the former type of expectations refers to raising awareness about the impact of the fashion industry, fostering sustainable consumption, and contributing to solving social or environmental problems.

"My idea was not to sell the backpacks; it was more like reaching people by telling them that they could do other things with the clothes they discarded, that they actually were not gargabe yet. It was not necessary to dispose of them immediately." (e-BKN)

The latter type of expectations refers to profit-making and achieving market success by offering high-quality products that can compete against those from conventional fashion brands.

"So I basically wanted to reuse and take advantage of all the [recycling] processes. I mean, at the end of the day, all this is a business. So, it's about how I can have economic raw material and at the same time quality raw material to lower my costs and to be able to present it in something that is of greater value, to add our value to it and that has quality." (e-TM)

In general, entrepreneurs held both types of expectations, although there was a slight tendency to prefer socio-environmental ones. There was no difference in the types of expectations according to material obtainment (by self-upcycling or by external supplier) nor type of product. However, holding both types of expectations was troubling for some entrepreneurs.

“For me, to get the idea that we are a sustainable brand, it’s difficult, that’s why I don’t like to trumpet myself in that, because as we have already said, it’s difficult for your whole process to not affect the environment in some way.” (e-MM)

Since almost the beginning of their ventures, most of the entrepreneurs have used Instagram as a business practice. They view this social media platform as a sort of requirement, not only for positioning their brands in the market but also for societal impact. Today, an Instagram account is vital for the existence of their brands.

"There are already many brands that no longer even have pages; they have Instagram. In the past, if you didn’t have a website, you didn’t exist. Now, if you don’t have Instagram, you don’t exist. I think that more than being an advantage, it is already a requirement for any brand." (e-Hm)

In this sense, entrepreneurs’ initial expectations were channeled to the use of Instagram for their brands. We identified four types of expectations regarding Instagram: retailing efficiency, communicating sustainability, showing the brand’s processes and transmitting positive messages.

For most entrepreneurs, Instagram is the main window to show their products and innovations and connect with users from different places. Since Mexican entrepreneurs face many economic barriers in their journeys [30], Instagram provides an efficient method of client acquisition and retailing; entrepreneurs utilize Instagram tooptimise resources by not having a physical retailing location or even by not maintaining a website.

"[Instagram is] a free platform where you can show your work. So, it was easy for me to open my Instagram and start uploading photos of my products. And I caught clients from there. So I think it was like … [that] the first approach that I had with my clients was through this network.” (e-Ky)

Moreover, communicating sustainability aligned to entrepreneurs’ socio-environmental expectations. Entrepreneurs wanted to make people conscious of the value of clothing and encourage them not to buy the cheapest garments produced under fast-fashion models. Through their brands, entrepreneurs wanted to show that they were not only selling clothing but also contributing to solving problems in the fashion industry, more than a mere greenwashing strategy.

"You must have 100% coherence and congruence with what you do because if you doubt a little, you fall into greenwashing, and people no longer buy your story. We really have to fall in love with this problem that we are trying to solve, which is the pollution of the fashion industry, and be able to teach these people that we are truly committed to solving this problem.” (e-GH)

In addition to these expectations, entrepreneurs also wanted to show the brand’s production processes and transmit an inspiring brand image. Entrepreneurs mentioned that Instagram offered the opportunity to show users what occurs behind the scenes of the brand and to go beyond the superficial representation that conventional fashion brands project.

"Being transparent with them, that they understand what we do with the brand, all the sustainable part (…) We engaged with Instagram not only to promote products but also to give users a bit of positivity, not being so superficial.” (e-PU)

Therefore, entrepreneurs’ venture expectations are better understood in the context of their aims regarding the use of Instagram as one core venture practice.

4.2. Use of instagram as a business practice

The use of Instagram as a business practice encompasses two main activities: content creation and interaction with users. During these activities, entrepreneurs experienced learning processes that changed their initial expectations.

4.2.1. Content creation

Content creation refers to “brand-initiated marketing communication on [the brand’s] own visual social media account. Advertising and brand-generated visual content share commonalities as both contain visual and textual message elements and are produced by brands” [63, p. 22].

We identified five predominant types of content (not mutually exclusive) created by entrepreneurs:

- Product features: Posts showing the garments (frequently worn by models) and describing their features
- Advertising: Posts with information on the availability and shipping of items and special offers and events related to the items
- Inspiration: Posts with an explicit message of inspiration, often combined with elements of art, nature and architecture
- Sustainability: Posts with information and reflections about the environment, nature and sustainability
- Transparency: Posts where brands show the processes behind the products, the people involved, collaboration with other projects and retailing experiences
- Other: Posts referring to the personal experiences of the entrepreneurs or founders are shown and shared, including their motivations. Posts also referring to the crisis by the coronavirus pandemic

We observed that the type of content on the brands’ Instagram accounts changed over time. A general pattern was that sustainability content decreased while content related to product features and advertising increased (see example in Fig. 6).

This change in the type of content created is also corroborated in the interview data. Some entrepreneurs mentioned changing the type of content they create as they observe the impact their content generates. Entrepreneurs evaluate this impact through metrics such as the number of likes, comments, shares, etc. For instance, some entrepreneurs realised that posts were not targeting the intended users, that users were reacting in a defensive way to some messages, or that the sustainability aspect of the brand and products was not the center of attention.

"We get many more likes in posts where the model is showing her body than in others where there is a fish caught in a net (…) I feel that we have to learn to integrate better the message, that a swimsuit is recycled as the model is showing it; otherwise, people do not pay much attention to it." (e-SS)

As the above statement shows, some entrepreneurs reflect upon their experience and draw conclusions about it. In some cases, entrepreneurs adapted their practices to prevent these kinds of experiences.

"I admit that I talk a lot about the design [of the backpacks], how they can be used, which parts are kind of hidden (…) because I feel that I bore people when I tell them that the backpacks are made of used clothes." (e-BKN)

We found no evidence in the data that the variation of content was due to the pandemic. Since there are very few posts overall that refer to any aspect of the pandemic, it can be concluded that the coronavirus pandemic had a direct effect on retailing and consumption practices i.e.,closing of physical stores and increasing of online retailing, where fashion brands are more proactive to adapt and innovate [64].

4.2.2. Interaction with users

Entrepreneurs interacted with users in two ways: (a) inquiry about product features, price and retailing and (b) feedback about products and content on Instagram. Entrepreneurs interact with users mainly via the Instagram private messaging feature and seldom directly on posts or through features such as Instagram live videos. One key aspect regarding feedback is that some entrepreneurs include users’ opinions and ideas in their design and production processes.

"That is something that I have done a lot from the beginning, to do it a bit collaboratively and that is because the people who are clients of the brand, many of whom have become friends, so to speak, have felt

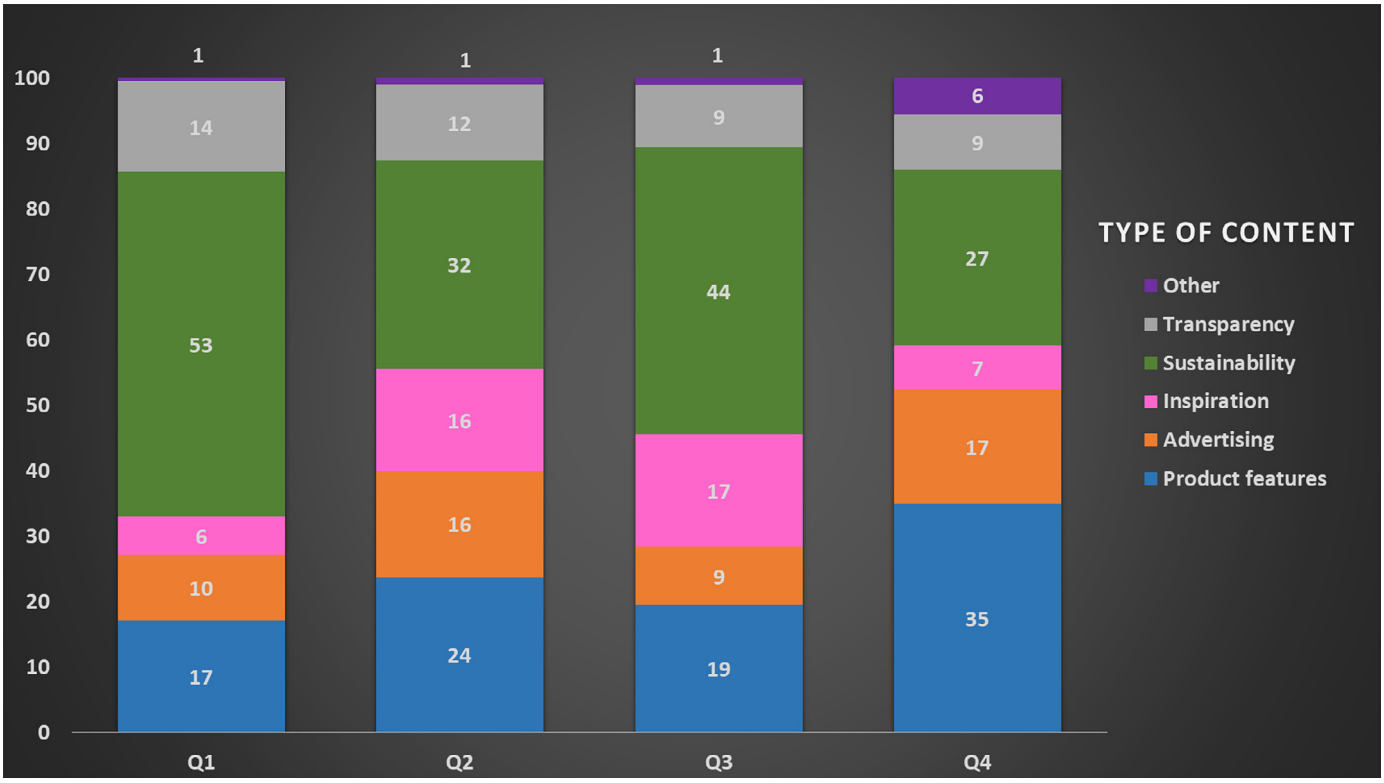

Fig. 6. Distribution of the type of content on GH's Instagram page, showing a decrease in sustainability content and an increase in content related to product features and advertising (see the distribution of all brands in Appendix D) *We divided the number of posts on each brand's page into four equal parts based on the date they were posted. Q1 represents the first 25% of the published posts; Q2, the second 25%, and so on until Q4.

free to express their opinions and give their feedback or so, what would they like. I like that a lot." (e-Cr)

Moreover, their constant interaction with users allows entrepreneurs to better understand their preferences.

"That has also been very cool, to change according to what the consumers like within our own preferences. They have shown us what they like, which is also cool in networks that you can observe." (e-PU)

Although entrepreneurs frequently mentioned that they have received positive feedback regarding their products, others have started to be more critical of their products and designs.

"I think that I do need to be more critical because I get carried away with thoughts like 'oh well, what I'm already doing is fine, it doesn't need improvement'; but when users say 'hey, but you should do this and this' I do a review of the design or the quality of the materials, and I change them." (e-BKN)

In general, we see that the two activities that constitute the use of Instagram have different implications for changing expectations; however, together, both play a significant role in the evolution of expectations.

4.3. Evolution of expectations

From the use of Instagram as a business practice, entrepreneurs' venture expectations have evolved over the course of time and oriented more towards innovation with products and business growth. Innovation with products entails enhancing design and product features, diversifying products and experimenting with new materials and designs. Regarding the business growth expectation, entrepreneurs mentioned that they aim to increase production and expand their selling points and distribution nationally or even internationally.

"We want to expand, to introduce in different countries the possibilities that denim has in terms of sustainability, and through social networks reach more people, put different selling points and create more relationships." (e-PU)

Entrepreneurs have become more competent in the management of Instagram for their ventures. They can now understand and make use of (a) paying services within Instagram to make their content and brands more visible and (b) the role of influencers in attracting new users. Moreover, entrepreneurs have learned how to segment the market, which is refining the groups of users they are targeting. Other entrepreneurs have also learned to improve their customer service, especially considering that they are usually retailing via Instagram and seldom physically.

"Whether they send us an email, in the webchat, here or whatever, I always like to make it very personalised, from, 'What is the problem?' 'How can we help?' Whatever and transfer it in social media… I think that is what I have learned." (e-Cr)

Expectations regarding Instagram aligned to the aforementioned expectations and learning outcomes. Now that entrepreneurs possess more insights regarding social media management, they aim to make the most of the different options Instagram offers to reach wider audiences.

"I plan to stay always on Instagram, growing this community and taking advantage of all the tools that Instagram has. I also want to continue experimenting with [these tools] because it generates more visibility to an audience that has not been following yet." (e-Cp)

At the same time, entrepreneurs also aim to create more sustainability content. In particular, most entrepreneurs who were driving their ventures primarily based on market-economic expectations realised that, since Instagram is one of the most popular social media platforms, it has the potential to communicate and raise awareness about the main issues of sustainability.

"If people are on their cell phones all day, especially on Instagram, what if more information appears to them, information about the fact that the world is ending, that it is real. Yes, with this urgency and concern to do something, to create awareness, to provide more information about it. In this way, I would like to grow MM to more than just a sales platform." (e-MM)

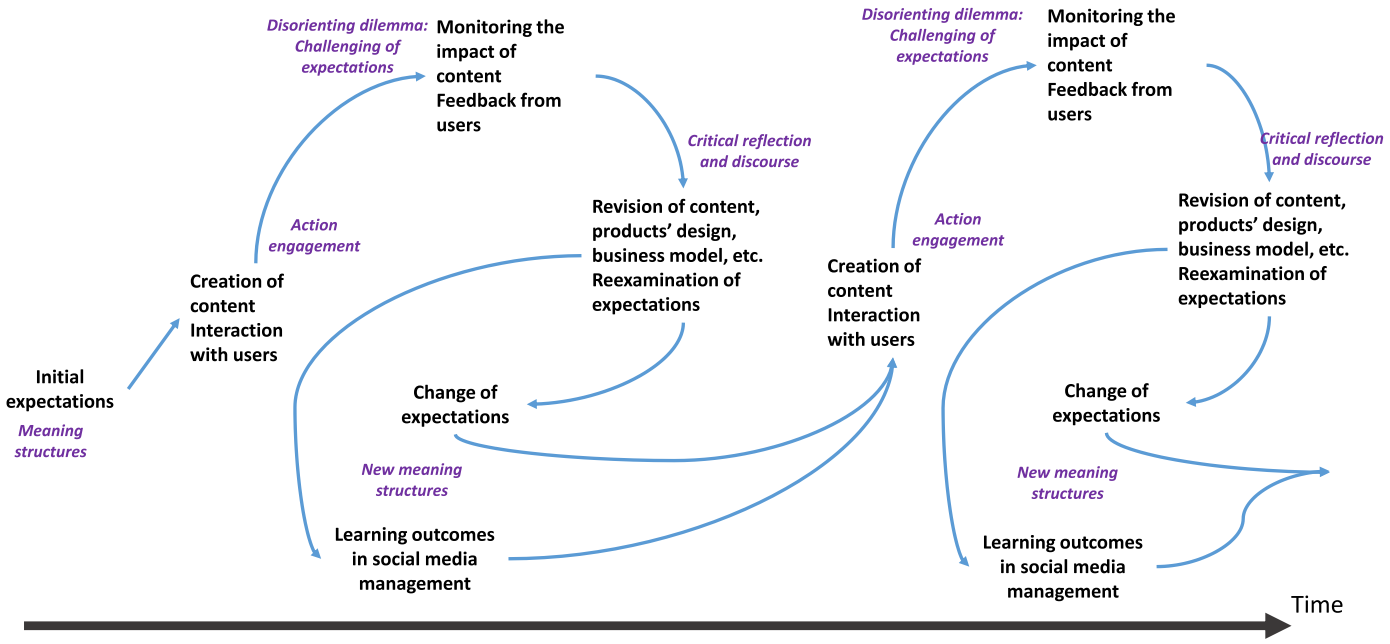

Fig. 7. Transformative learning model of the evolution of expectations using Instagram as a business platform.

5. Discussion

Drawing from the learning selection model [40,41], we propose a model (see Fig. 7) that illustrates the transformative learning process behind the use of Instagram as an essential practice affecting the evolution of entrepreneurs' expectations. In this model, entrepreneurs, guided by specific initial expectations, engage in activities on Instagram (content creation and interaction with users). By monitoring the impact of their content and receiving feedback from users, entrepreneurs' expectations are challenged and confronted, entering a state related to disorienting dilemmas, as stated in transformative learning. Entrepreneurs then reflect upon this experience by revising their content, product design and business model and re-examining their expectations. As a result, entrepreneurs modify their expectations and enter a new cycle, which continues as long as they employ Instagram as a business practice.

The main features of this model are prior learning, experimentation, disequilibrium and reflection, four essential components of transformative learning processes [14]. When referring to entrepreneurs' expectations, we are discussing meaning structures that guide their actions. We can infer from our findings that entrepreneurs generally focused on two major aspects of their brands: market-economic and social-environmental. Although entrepreneurs held both types of expectations, this differentiation allows us to understand that they approached the sustainable fashion niche as a combination of market and grassroots ventures [38]. We underscore the importance of studying initial expectations in strategic niche management processes, as these expectations define the nature and type of ventures, as well as the way entrepreneurs experience and act in the ventures [30,44]. This will allow us also to understand the diversity of ventures, business models and practices in sustainability niches.

It has been argued that experimentation and testing products are crucial in the strategic management of sustainability niches [65], but these arguments originated in an era before the explosion of internet applications such as social media and e-commerce. Today, especially considering the social restrictions posed by the coronavirus pandemic, Instagram has become fundamental to the survival and operation of these fashion brands. In this sense, entrepreneurs' expectations gained a new meaning. Instagram is not only a virtual space for market experimentations allowing entrepreneurs to scale up and promote their innovations; it is also a powerful tool that contributes to changing actors' perceptions [7,10]. Therefore, when discussing expectations in sustainability transitions, we should consider expectations regarding the use of social media.

It is commonly assumed in strategic niche management that learning occurs by doing, experimenting or similar methods [11]. With the use of social media, learning by doing has gained a new dimension. It is not only a matter of testing and innovating with products; it concerns testing how to attract users and influence their perspectives about sustainability. Content creation and interaction with users are two fundamental actions in this regard. Content creation can appear to be a trivial activity but is the primary action of entrepreneurs on Instagram, even before interaction with users. Content through posts functions as a dialogical element around which entrepreneurs and users interact. Without content, there would be no interaction. Therefore, most entrepreneurs' expectations and efforts are oriented towards content creation.

Although action engagement, expectations disequilibrium, critical reflection and discourse are analytically distinct, they occur almost simultaneously. Once the content is created, users can see it, react to it, comment on it and further inquire about its message. Contrary to the classic criticisms of transformative learning as a purely individual process, transformative learning inherently entails a social component. In other words, expectations are challenged or confronted by others.

Challenging expectations is related to the concept of disorienting dilemmas in transformative learning. This disequilibrium episode occurs as soon as users react or do not react to a certain type of content. In our findings, we saw this with sustainability content. The metrics of the number of likes, shares and comments on posts are indirect interactions between entrepreneurs and users. The disequilibrium of expectations also occurs during virtual but direct interaction with users through private messages, either through online retailing activities or users' feedback. In both situations, the disequilibrium in expectations occurs because of users.

The phases of critical reflection and discourse are manifested when entrepreneurs revise their content and re-examine their expectations. Critical reflection is an intrapersonal process, while discourse is a social one. Both complement and begin from the disequilibrium of expectations. These are the key moments where expectations change. Although these moments do not occur in intentionally and purposefully designed situations, we can infer these moments from entrepreneurs' expressed

moments of making sense of their disequilibrium experiences. The discourse phase could even begin as entrepreneurs interact with users. Discourse aligns directly with the processes of validating expectations through users' acceptance of content and products and making sense of users' demands.

Overall, entrepreneurs' venture expectations have evolved and oriented more towards market growth and expansion, diversification of products and better organisational management. This is clear in the evolution of the brands' Instagram content, focusing more on product acceptance and advertising and less on sustainability. What we found resonates with the findings of Kuckertz and Wagne[66], who indicated that sustainability expectations in entrepreneurs "vanishes as business experience is gained" (p. 535). However, we argue that these expectations are not forgotten completely; they are latent, but the focus shifts to market-economic expectations.

What is a possible explanation for a stronger focus on market-economic aims? York and Venkataraman [67] explain that the future value and contribution of environmental innovations are uncertain, which pushes entrepreneurs to place their economic expectations at the forefront and seek market acceptance through social media [68]. In this sense, we suggest that entrepreneurs have oriented towards market validation and as a way to achieve symbolic legitimacy [69,70].

Moreover, based on van Lente and Bakker's [71] model of expectations phases, we argue that the evolution of entrepreneurs' venture expectations results from a tension between sustainability contributions and market acceptance. In the beginning, entrepreneurs want to positively impact the environment and society by communicating about sustainability topics, especially the impacts of the current fashion regime, and posing their products as sustainable alternatives. However, as the venturing process begins, sustainability expectations compete with product acceptance, market positioning and profit expectations. Since Instagram is a social media platform that has evolved to function primarily as a business platform, the improvement of entrepreneurs' skills in managing this platform may have influenced their orientation towards market-economic expectations.

By proposing our transformative learning model of the evolution of expectations, we highlight that social media plays an essential role in the development of innovations, business models and sustainability niches. We argue that entrepreneurs use social media not only to align their expectations with users' preferences but also to build up social networks [6,10]. Instagram is indeed a social network of users, incumbents and other actors that transcends physical and geographical scales. As social networks develop, entrepreneurs' expectations become more robust and impactful in expanding the niche, attracting new actors and generating trust in users [20,22,72].

6. Conclusions

What can we learn from this research, and what are the next steps for practitioners? We have contributed to sustainability transition research by empirically exploring how the evolution of expectations, as a transformative learning process, occurs with social media, i.e., Instagram, as a business platform. We propose a model that shows that the evolution of expectations fundamentally entails a transformative learning process. Investigating the evolution of expectations is vital for understanding how sustainable niches evolve and elucidating how processes of articulation of expectations take place.

From our research, we can see that the sustainable fashion niche in Mexico is in a phase of market acceptance, influenced by the booming e-commerce. While it was initially concerns about sustainability that spurred ventures by sustainability entrepreneurs, Instagram has played a critical role in advancing these expectations of entrepreneurs toward product innovation and business growth; however, with this comes the risk that socio-environmental expectations may be eclipsed as market penetration increases.This has important implications for sustainability transitions, as the early formation and development of a sustainability niche do not lead automatically to a sustainable regime. Therefore, it is urgent to develop a research agenda for a strategic management of sustainability niches in Mexico and the Latin American region to guide these transformation processes. A better understanding of articulation of expectations as a learning process will facilitate conditions that support the transition towards a sustainable regime through learning interventions in the form of training and mentoring programs for entrepreneurs that help them manage and assess their expectations. Policy strategies that give institutional support and legitimacy to entrepreneurs' ventures and learning intervention are also essential.

Social media, especially Instagram, has been growing in attention not only in research in marketing studies but also in the sustainability field [see, for example, 31,53,73]. Our research provides an example of the potential use of social media in combination with qualitative and quantitative methods to explore phenomena in various sustainability areas. We recommend social media as a valuable research tool to explore unknown populations of initiatives or enterprises in sustainability niches.

We acknowledge the limitations of this paper: We have likely neglected brands and enterprises that were not mentioned in the Instagram posts or outside social media. The evolution of users' preferences and practices regarding sustainable fashion in light of the evolution of entrepreneurs' venture expectations is out of the scope of this work. Our study is exploratory rather than conclusive. We have only grazed the tip of the iceberg regarding the connection between strategic niche management, social media and transformative learning. Future research is needed to explore (a) the change of users' expectations and preferences about sustainable fashion through social media;(b) the application of niche experiments with social media as a tool for monitoring the learning processes in strategic niche management; and variation of social media usage and consumption practices in the sustainable fashion niche after two years of coronavirus pandemic.

Footnotes

1. Source of the post: Drawlatinfashion [@drawlatinfashion]. (August 20th, 2019). Escribe en los comments marcas o espacios de moda responsable en México, por favor incluye el estado donde están localizados. [Image].Instagram. https://www.instagram.com/p/B1Y_91LJip6/ (last date accessed 30/08/2021)

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This research was made possible within the graduate school "Processes of Sustainability Transformation", which is a cooperation between the Leuphana University of Lüneburg and the Robert Bosch Stiftung. The authors gratefully acknowledge the financial support from the Robert Bosch Stiftung (12.5.F082.0021.0). We also want to thank the entrepreneurs who agreed to be interviewed for this research, Levke Hintz for her assistance in collecting and organizing the data related to Instagram pages, and the reviewers for their constructive insightful feedback.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.wds.2022.100005.

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5 Synthesis and Discussion

5.1 Theoretical journey and summary of findings

One of the main challenges throughout this research journey has been to navigate through different fields of knowledge and weave different theories, models and frameworks, e.g., transformative learning and sustainability niches. Figure 4 illustrates the conceptual journey of this dissertation, which is structured around the three individual articles. This figure helps the reader to recapitulate the different theories, concepts, and models untangled in the above chapters.

From transformative learning theory and sustainability, *article 1* provided a systematic review of scientific studies focused on these fields' conceptual and operative conjunction. From here, two main branches have derived respectively. The sustainability branch followed transitions research because it encompasses certain analytical models, such as the multi-level perspective, that explain better sustainability transformation. From this model, the concept of sustainability niches was taken to allocate the learning phenomena occurring in the sustainability transformation in the Mexican textile-fashion sector. Moreover, the concept of niches served to frame and guided the empirical work of this project. Because it was essential to understand the human intervention in the transformation process, entrepreneurs were taken as the main actors that participate in the formation and development of niches.

On the other hand, the learning branch coming from social, experiential and transformative learning merged with concepts of entrepreneurial learning at the background of learning in transitions. As a result, *article 2* comprised an initial empirical attempt to study the formation and development of sustainability niches through the analysis of transformative learning of entrepreneurs. In this sense, through the lenses of entrepreneurial learning, transformative learning took a nuanced approach to the study of processes of sustainability transformation.

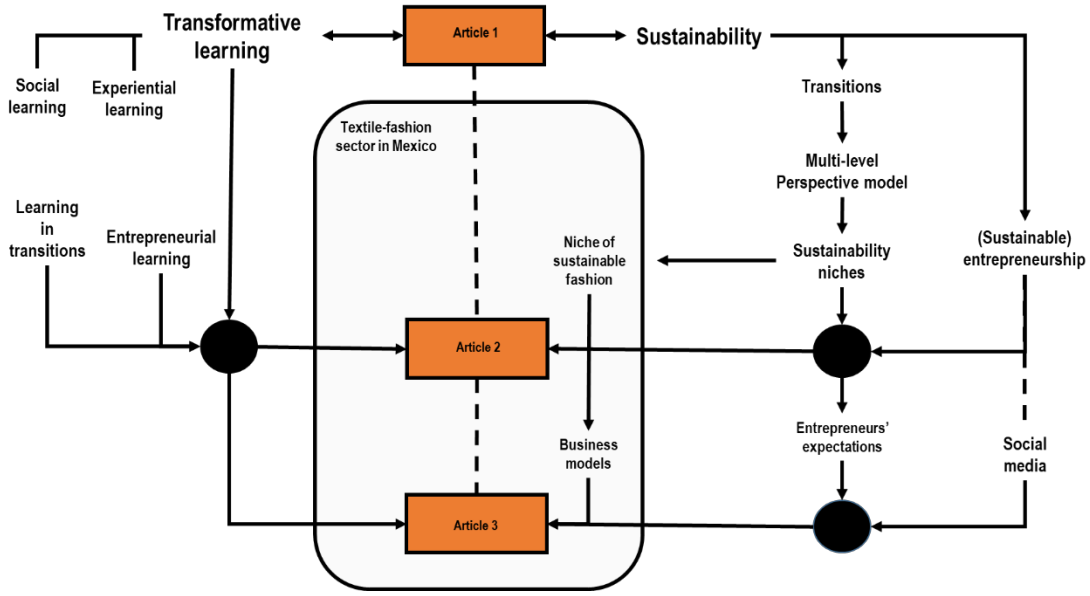

Figure 4. Conceptual map of this dissertation

For *article 3*, specific concepts were taken from the conjunction between entrepreneurship and niches. The concept of expectations can be read more in the stream of strategic niche management, but it was not

differentiated according to the actors participating in niche processes. In this sense, part of this conceptual journey was to make the connection between entrepreneurs and expectations explicit as a boundary object that can be studied through learning lenses. Social media emerged as a research object regarding entrepreneurial activities because it is a means for entrepreneurs to carry out different business and communication practices. As a result, *article 3* comprised a conceptual interplay of social media and entrepreneurs' expectations as a transformative learning process.

Furthermore, a summary of the key findings of each article is provided below:

Article 1 - Transformative learning in the field of sustainability: a systematic literature review (1999-2019)

- Transformative learning has become an attractive term in sustainability, but it is used without critically exploring the underlying theory.
- Most of the empirical studies in this review occur in formal and higher education settings. Although the importance of higher education in achieving a sustainable world is out of doubt, there is a lack of research in other settings and contexts.
- Transformative learning shares common elements with other learning theories, such as experiential and social learning, and specific approaches, e.g., competencies for sustainability.
- Core elements of the transformative learning process are nuanced according to specific sustainability contexts.
- It is essential to consider both the disorienting dilemmas that can emerge during the learning interventions and the prior learning of individuals before embarking on these interventions.
- Transformative learning in the context of the sustainability field has a broad spectrum of learning outcomes, e.g., knowledge gaining, change in perspectives, development of competencies, and social learning.
- It is crucial to plan educational interventions and supportive learning conditions such as those identified in the review, e.g., power relations, time and space for reflection and discourse, social interaction and support.

Article 2 - Learning Processes in the Early Development of Sustainable Niches: The Case of Sustainable Fashion Entrepreneurs in Mexico

- Prior learning determines the way entrepreneurs experience the venturing process.
- Critical events or disorienting dilemmas in entrepreneurs' lives shape their frames of reference and are crucial factors for deciding whether to venture into the niche sustainable fashion.
- Entrepreneurs become more competent in sustainable entrepreneurship as they succeed in their ventures by overcoming external barriers; however, they draw on specific strategies such as agency, individual support and financial sponsorship.
- Social learning takes place as the niche of sustainable fashion develops: (1) the formation of networks inside the niche is an outcome of this social learning process; (2) entrepreneurs' communication efforts in raising awareness about sustainable fashion could lead to change in regime actors' frames of reference, resulting in transformative social learning.
- Three phases of the formation of the niche can be devised: awareness of the niche, entry into the niche and development of the niche.

Article 3 - Evolution of entrepreneurs' expectations using Instagram as a business practice: A transformative learning perspective in the case of sustainable fashion entrepreneurs in Mexico

- Entrepreneurs hold mainly two types of initial venture expectations, socio-environmental and market-economic, which sometimes are troubling as they entail opposite interests. These expectations are further channelled into expectations regarding the use of Instagram as a business practice.
- The use of Instagram as a business practice is constituted by two main activities: content creation and interaction with users, which affect entrepreneurs' expectations. Entrepreneurs enter a process of reflection by revising their content, product design and business model and re-examining their expectations. As a result, entrepreneurs modify their expectations and, therefore, their practices.
- Entrepreneurs' venture expectations evolve and orient towards market growth and expansion, diversification of products and better organisational management. This evolution results from a tension between sustainability contributions and market acceptance.
- Social media plays an essential role in developing innovations, business models and sustainability niches. As entrepreneurs succeed with their ventures' social media activities, their expectations become more robust and impactful in expanding the niche.

Derived from the overall research question, three specific research questions can be answered with the findings summarised above:

- How is the sustainability transformation occurring in the textile-fashion industry in Mexico?
- To what extent does entrepreneurs' transformative learning lead to sustainability transformation through the formation and development of sustainability niches?
- How do the dynamics between landscape, regime and niche enable transformative learning in entrepreneurs?

5.2 Understanding the sustainability transformation of the textile-fashion industry in Mexico

How is the sustainability transformation occurring in the textile-fashion industry in Mexico?

The multi-level perspective model (Geels, 2002, 2019) allows us to better understand the process of transformation occurring in the textile-fashion industry in Mexico (see Figure 5). Historically, landscape conditions such as NAFTA structured the regime by locking in the Mexican textile industry to manufacture garments and textile goods for the US apparel market. Nonetheless, other intertwined landscape conditions significantly influenced the regime, namely the expansion of the global fast fashion model and the growth of Asian industries. The low cost and fast rate of textile production in Asia made it possible for this market to enter the North American region, despite the commercial benefits that NAFTA was supposed to bring. In this sense, the textile-fashion regime in Mexico eventually included Asian textile materials to lower the production costs.

Moreover, the fast and mass fashion models expanded worldwide in the last two decades (Niinimäki *et al.*, 2020), causing an increase in demand for cheap clothing in Mexico. On the other hand, fast-fashion consumption practices in the US promoted a major disposal of clothing, of which a major proportion has been sent to Mexico. In this sense, a considerable fraction of products to satisfy the Mexican apparel market come from garments imported from Asia and discarded clothing from the US. This has led to a path dependency: the Mexican industry is underdeveloped with an obsolete infrastructure and a lack of incentives in capabilities, research and knowledge to reactivate the industry, thus, perpetuating the necessity of importing materials and garments. In essence, there has been a sustainability gap in the textile-fashion regime in Mexico as this sector depends on external material flows and demands while producing high internal socio-environmental costs.

Nevertheless, this gap in the regime has recently become a potential domain of application for sustainable innovations and solutions. Following the transition dynamics proposed by Geels (2019), in this particular case study, the global niche of sustainable fashion through the manifestation of movements and concrete projects and businesses in Europe gained momentum that inspired entrepreneurs in Mexico. As a result, Mexican entrepreneurs saw this gap in the current textile-fashion system as a window of opportunity toward sustainability transformation. They ventured into the domain of sustainable fashion influenced by movements and examples of ethical and slow fashion worldwide. The global fashion niche was then taken as a reference for Mexican entrepreneurs who wanted to start up their projects in this domain, leading thus, to the formation and development of a local, sustainable fashion niche. With different business models, these entrepreneurs have become key actors in contributing to the sustainability transformation of the textile-fashion regime. The most relevant entrepreneurs and respective ventures were classified as meta-level actors, material suppliers and sustainable fashion brands (see *article 2*). As discussed in the sections below, it is only worth mentioning that most of these entrepreneurs started from the bottom; they were motivated to tackle the downfalls of the unsustainable regime and drew on their learning processes until they formed social networks inside the niche.

As mentioned in chapter 4, the multi-level perspective model itself explicates the evolution of niches through four different phases: experimentation, stabilisation, diffusion/disruption and institutionalisation (Geels, 2019). Only the first three are relevant for this work (see the white arrow at the bottom of Figure 5). In the experimentation phase, entrepreneurs were pushing new initiatives and pioneering alternative projects across the Mexican supply chain. Although many entrepreneurs started with non-profit projects, they were slowly realising the economic value that their projects entailed; however, most of them lacked the financial means, had limited access to knowledge and information, experienced mistrust and scepticism of users, and lacked the institutional support regarding innovation and entrepreneurship (Rodríguez Aboytes and Barth, 2020a).

In the stabilisation phase, entrepreneurs' erratic and isolated efforts with their ventures aligned as they entered the niche market, that is, a specific group of users who shared sustainability fashion values in their purchase intentions. This alignment also occurred due to the formalisation and maturation of relationships and practices initiated in the experimentation phase. Although the experimentation phase is still occurring, the innovations have stabilised as products or services with a specific value in the market and opened up flows of resources for the continuation of the venture. Moreover, projects and ventures organised in networks have allowed the circulation of knowledge, information and experiences.

It is in the third phase where the current sustainability transformation of the textile-fashion industry occurs. The niche network constituted by these ventures has disrupted the regime level; they are going beyond the niche market to reach users and actors who are not familiar with sustainability. It is essential to underscore that the disruption phase in this particular case has been triggered due to certain landscape conditions. The consolidation of social media as one of the main ways of communication nowadays, accompanied by the streamlining of e-commerce, has opened new windows of opportunity for the interaction between sustainability niches and regimes. In this respect, spaces of communication and interaction have opened up, in which different regime actors such as conventional brands, textile factories, public institutions and users are realising and exploring the features of sustainable fashion.

Landscape conditions such as the prominence of social media and e-commerce have exacerbated the gaps in the regime. On the one hand, these conditions have functioned as a boost for the local niche because they have allowed entrepreneurs to make their projects visible without the necessity of opening physical places for their businesses. However, social media have also boosted fast fashion practices, as many brands and fashion

companies use it for marketing purposes (Bauman and Lucy, 2020). For example, one consequence of this is the saturation of packaging services to deliver garments purchased online. A current landscape condition related to these conditions is the coronavirus pandemic. Although this topic was not touched on in the individual studies, it affected many businesses worldwide, leading to an increase in online shopping as the sanitary rules restricted physical shopping practices (Martin-Neuninger and Ruby, 2020).

By looking into the interplay between the different levels in the multi-level model, it is clear that the landscape conditions affect both the regime and the niche. The regime has also affected the formation and development of the niche; mainly, it has hampered and limited entrepreneurs to start and develop their respective ventures. The lack of knowledge, research and institutional support for their ventures have become substantial barriers that entrepreneurs had to affront (Rodríguez Aboytes and Barth, 2020a). Moreover, regime dynamics such as importing textile products from Asia and discarded clothing from the US represent a strong market competition for entrepreneurs, especially now that they are entering the regime.

Although Figure 5 suggests an order in the niche evolution phases, in reality, there are no clear limits or separations between them. For instance, experimentations continue even when the innovations have been positioned in mainstream markets. Experimentation involves disruption and articulation of expectations between different niches and regime actors. The dynamic of the transformation is evolving as this space of communication, business and interaction continues. As this process has started without strategic management of the niche, a call for efforts is now critical. Now that entrepreneurs have entered into the regime level, there is a possibility that they are absorbed by it as they focus more on profit and market expansion rather than sustainability (Rodriguez Aboytes *et al.*, Forthcoming),

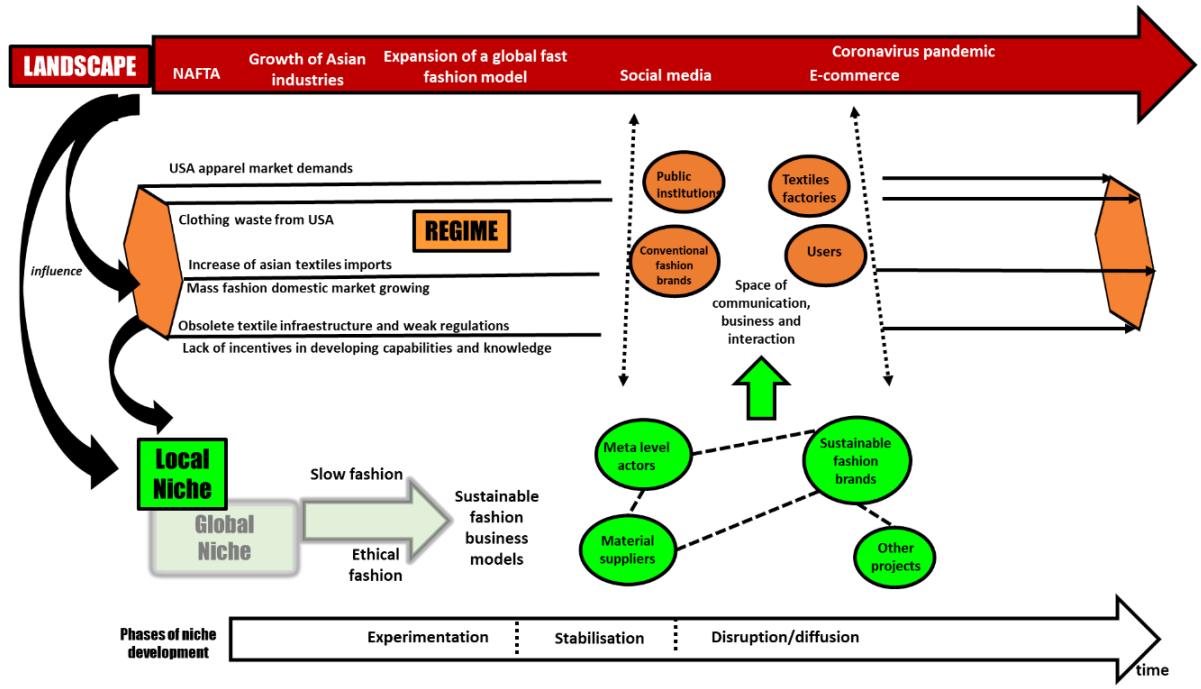

Figure 5. Process of sustainability transformation of the textile-fashion industry in Mexico through the multi-level perspective model (adapted from Geels (2019)).

5.3 Venturing into niches as a transformative learning endeavour toward sustainability transformation

→ *To what extent does entrepreneurs' transformative learning lead to sustainability transformation through the formation and development of sustainability niches?*

The multi-level perspective model is valuable for characterising sustainability transformation and analysing transformative learning (see Figure 6). This model provides an analytical structure with different levels (i.e., landscape, regime, and niche) to study complex dynamics and interrelations, the learning processes in the venturing and development of sustainability niches being one of them. In analysing these dynamics, it is impossible to discuss learning abstractly without specifying the learners, that is, the learning subjects. It becomes crucial to understand entrepreneurs' learning journeys because they are key actors in the development of niches,

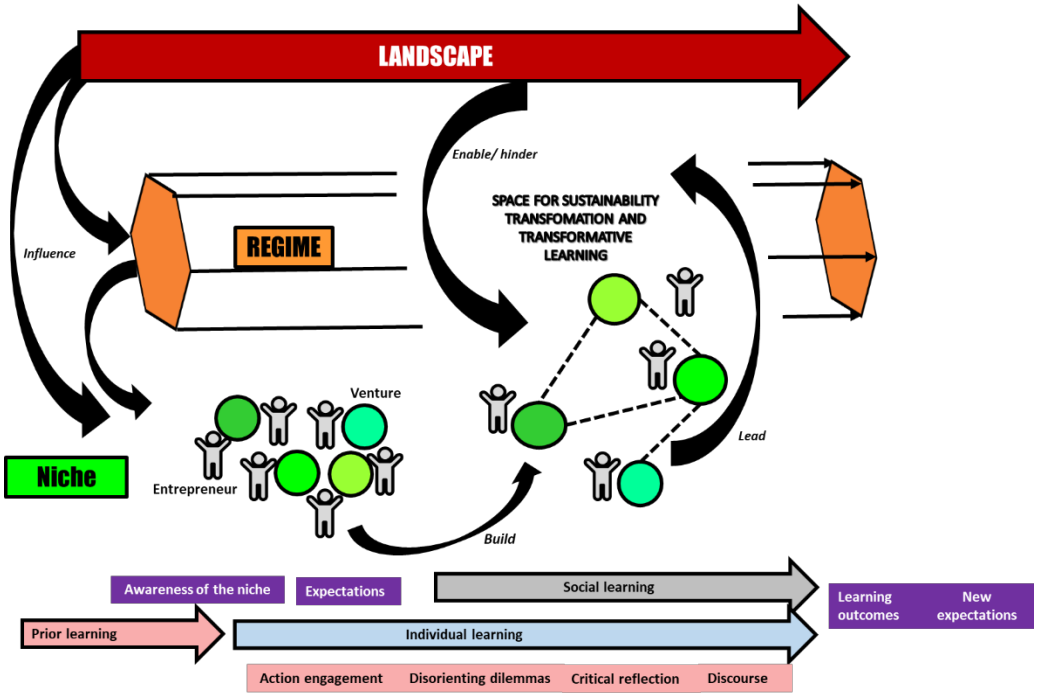

Figure 6. Venturing into niches as transformative learning in the multi-level perspective model (adapted from Geels (2019)).
Note: Each circle representing a venture has a different nuance of green in order to visualise the difference in the venture's structure and business models.

Article 2 confirmed that entrepreneurs are not born as such; instead, they go through a learning process that shapes their vision and decision to become entrepreneurs. One crucial aspect of entrepreneurs is that they transit from individual learning processes to social learning outcomes; through their ventures and participation in the niche, they form social networks, which further impact the development of the niche (Rodríguez Aboytes and Barth, 2020a). Drawing on the case study, entrepreneurs enter a transformative learning path, which can be broken down into specific learning mechanisms such as prior learning, disorienting dilemmas, action engagement and critical reflection; nevertheless, prior learning constitutes the individuals' base for engaging in sustainability transformation.

Individuals, before becoming entrepreneurs, accumulate a set of prior learning experiences that influence them to engage in specific domains, i.e., sustainability niches. Transformative learning empowers individuals to engage in social action by reflecting on the sustainability problems they have observed and experienced during their lives (Rodríguez Aboytes and Barth, 2020a). Entrepreneurs do not just become aware of sustainability-related issues; they also realise that they are agents who can contribute to its solution. By becoming aware of a crack in the regime, individuals become entrepreneurs as they identify opportunities and potential products and services that can have an economic and social impact. Therefore, entrepreneurs start forming expectations as they realise ventures' economic value and sustainability contribution, which lead them to take action.

Given that a sustainable niche is an unexplored territory, these entrepreneurs act as pioneers as they must face much uncertainty along the way. Entrepreneurs develop certain expectations formed from prior learning

experiences, through which they give direction to their ventures. Although expectations related to ventures in sustainability niches can be classified in market-economic and socio-environmental, expectations can be further categorised into specific types according to the niche. Depending on the predominance of a type of expectation, entrepreneurs orient and channel their actions towards certain purposes, influencing the structure of their ventures, i.e., business models (Rodriguez Aboytes *et al.*, Forthcoming). Therefore, a sustainability niche might contain ventures aiming at common sustainability goals (e.g., tackling the negative impacts of fast fashion) but pursuing different objectives depending on their business models. For example, some ventures' business models tend more towards profit and expansion while others choose non-profit configurations and aim for more social impact (Rodriguez Aboytes *et al.*, Forthcoming).

Regardless of the configuration of the ventures, entrepreneurship is loaded with critical events or disorienting experiences that confront individuals with unplanned scenarios and failures. As entrepreneurs carry out their different practices, they face epistemic, economic, social and political barriers that challenge their initial expectations (Rodríguez Aboytes and Barth, 2020a). The confrontation between these experiences and their expectations reflects the aspect of disorienting dilemmas. However, disorienting dilemmas are not a synonym for transformative learning; they are just unintended experiences that occur in non-structured situations and emerge during the venturing process. What makes this process transformative is how entrepreneurs respond to these conflicts, as they have to make sense of them by critically reflecting upon their practices and personal assumptions.

The process of critical (self-) reflection is essential because entrepreneurs change their frames of reference by examining and modifying their initial venture expectations. As a result, previous expectations are modified, and new ones are generated, which entail the purpose and structure of their ventures (Rodriguez Aboytes *et al.*, Forthcoming). The change in expectations is accompanied by other conditions such as individual agency and external support that ranges from family support to sponsorship from others (Rodríguez Aboytes and Barth, 2020a). These conditions need to be acknowledged because entrepreneurs' ventures would not be possible without them.

Until here, it is possible to see how individual transformative learning unfolds in entrepreneurial journeys in sustainability niches. Most entrepreneurs start their respective projects individually or with very few associates. In the beginning, entrepreneurs and their projects remain isolated from others. However, another core element of transformative learning is discourse, which allows us to see the progression from the individual to social learning. Entrepreneurs enter the discourse phase as they start interacting with users, other entrepreneurs and actors in both the niche and regime.

To validate their ventures and cope with the uncertainty regarding the suitability of their ventures, entrepreneurs need to articulate their expectations to others. In this sense, articulation of expectations is fundamentally a discourse process because entrepreneurs do not only reflect upon their practices and assumptions, but they also have to make sense, directly or indirectly, of others' frames of references, perspectives and expectations. Critical reflection and discourse manifest in communication, collaboration, and negotiation processes, allowing the building of social networks of ventures within the niche.

→ *How do the dynamics between landscape, regime and niche enable transformative learning in entrepreneurs?*

The interplay between niche, regime and landscape greatly affects individual learning processes (see Figure 6). For instance, prior learning is constituted by social norms dictated by the regime. As Smith (2007) mentioned, actors' meanings and preferences, both on the production and consumption side, are highly influenced by these

rules and norms of the current regime. Moreover, Geels and Raven (2006) indicate that expectations are influenced not only by local practices but also by external or landscape factors. Therefore, entrepreneurs' frames of reference are still embedded in the regime that seeks to maximise profit by lowering production costs by all means.

As mentioned above, an essential phase in entrepreneurs' transformative learning is that these embedded frames of reference are challenged as entrepreneurs become aware of the regime and the possibility of transformation. In this sense, the awareness of the global sustainable fashion niche renders the beginning of their transformative learning journey. Moreover, as entrepreneurs realise the existence of global niches, guiding principles and international agendas, they decide to land and contextualise them by starting their own ventures. Global niches act as landscape conditions and contribute to setting up specific local niches.

The structural conditions coming from the regime and landscape levels generate complex scenarios that may cause disorienting dilemmas in entrepreneurs. These scenarios themselves do not enable transformative learning; it is up to entrepreneurs and specific learning conditions that lead to their transformative learning. Furthermore, landscape conditions have also propitiated a particular configuration of transformation processes, specifically those related to digitalisation. Digitalisation through social media and e-commerce practices function as both drivers and barriers in the evolution of the sustainability niches.

On the one hand, digitalisation has accelerated unsustainable practices such as an increment in consumption of goods, while companies now try to increase their profit as retailing becomes more efficient. On the other hand, digitalisation has made it easier for entrepreneurs to enter markets as they do not need significant investments to acquire clients and retail. Especially the use of social media as a business practice has become crucial for entrepreneurs. Entrepreneurs can connect with the users and other actors through social media, and the niche increases its visibility. In terms of transformative learning, social media functions as an external transformative learning condition as it creates spaces for interaction, reflection and discourse. Ultimately, digitalisation has strengthened the development of niches by making the creation of venture networks more efficient.

In sum, transformative learning is inherent in entrepreneurial journeys and the development of ventures. Considering that these ventures constitute the core of sustainability niches, it is clear that transformative learning is a core process in the formation and development of niches. Individual prior learning, expectations, and actions initiate the path of sustainability transformations; disorienting dilemmas, critical reflection, and discourse accelerate them. On the other hand, the interaction between niche, regime and landscape has generated a space for sustainability transformation and transformative learning. Now, regime actors interact with niche actors, establishing new collaboration relationships. Depending on the management and support of this transformation, the niche can either be absorbed by the regime or constitute the foundations of a sustainable one.

5.4 Understanding processes of sustainability transformations through transformative learning theory

→ *To what extent does transformative learning contribute to processes of sustainability transformation?*

Individual changes in paradigms, mental models, and worldviews are fundamental conditions for sustainability transformation, which implies transformative learning. Additionally, the emphasis on paradigm change in the sustainability discourse also pleads for profound social change through learning (Göpel, 2016a; Davelaar, 2021; Linnér and Wibeck, 2021). In this sense, transformative learning as a (meta-) theory (Hoggan, 2016) contributes to understanding not only how adults learn in these transformation processes but also how they can shape them, being one of the ultimate learning outcomes, the empowerment of individuals and the development of their full

autonomy to take part in processes of rapid change. Transformative learning theory also entails normative considerations to achieve social action. Moreover, transformative learning is not limited to individual learning; it is also about learning with a profound impact on shaping our society. This means that transformative learning shares common premises and goals with sustainability transformation.

The critical issue is to understand how transformative learning contributes to sustainability transformation. The systematic literature review (see *article 1*) shows that most research on transformative learning and sustainability is placed in formal and higher education settings (Rodríguez Aboytes and Barth, 2020b). Although the importance of higher education in achieving a sustainable world is out of doubt, there is a lack of research in other settings in which processes of sustainability transformation occur, such as institutional, industry, technology and innovation settings. In this sense, sustainable entrepreneurship renders a vital bridge between transformative learning and sustainability transformation because it aims for radical change and impacts through innovation and venturing. What differentiates entrepreneurs from other actors in processes of sustainability transformation is that entrepreneurs are not simply doers or makers but rather reflective practitioners (Cope, 2005).

One significant finding from this doctoral work is that transformative learning theory is a suitable framework to study the learning processes of sustainable entrepreneurs. Both transformative learning and entrepreneurship are a continuum of individual and social learning experiences, processes and cycles and are constituted by learning phases that are evolving, recursive and spiral in nature (Taylor, 1997). On the one hand, the empowerment of individuals in transformational scenarios is reflected in the sustainable entrepreneurial journey: Entrepreneurship is not a solo endeavour; it is characterised by social relations, collaboration and the formation of networks. In this sense, entrepreneurs also progress from individual learning towards social learning. On the other hand, transformative learning is not only an individual process. It takes place in particular social settings, especially in the phases of discourse and critical reflection.

One problem in sustainability transformation is that it lacks a theoretical reference to approach learning phenomena, that is, the learning processes necessary to achieve the so-called paradigm and mental model change are not known. By identifying the analytical elements of transformative learning processes and going beyond the classical model of the eleven phases of transformation of Mezirow, it is possible to understand and intervene in learning processes of sustainability transformations. Here, three elements stand out:

> First, the hands-on notion and learning by doing are often referred to in entrepreneurship literature and transitions research. Testing and experimentation are crucial activities for entrepreneurs to articulate preferences and expectations with other actors and users. Transformative learning provides a better understanding of how learning-by-doing needs critical reflection, as it shares theoretical elements with experiential learning.
>
> The second element are disorienting dilemmas, which can be referred to broadly as (external) disturbances in a system. They may represent major barriers for entrepreneurs and overall processes of transformation; for instance, a negative turn of expectations may stop the experiments with innovations, business models and markets and thus, cause negative influences on entrepreneurs' expectations. That is why it is crucial to know where these disturbances come from and how to cope with them. However, learning outcomes that do not fulfil the expectations or represent a failure of the innovations are also helpful because they represent experiences that can be learned from (Hoogma *et al.*, 2002).
>
> Third, discourse is a core element of transformative learning that is often overlooked. As many actors in sustainability-related niches have different conceptions, perspectives, capabilities, and practices regarding sustainability, discourse processes are necessary for their articulation (Smith, 2007). This is a critical phase in which individual transformative learning becomes transformative social learning. New

paradigms and mental models do not simply emerge; they are constructed in discourse processes either in physical or virtual spaces.

Knowing that paradigm change is an indicator of transformative learning, it is still important to acknowledge the broad spectrum of other learning outcomes accompanying that process, ranging from acquiring knowledge and skills, changing attitudes, developing competencies, to reconstructing values and perspectives (Rodríguez Aboytes and Barth, 2020b). In this sense, instead of labelling any learning outcome as transformative, one can infer that a transformative learning process took place by assessing the learning outcomes altogether. Considering this array of learning outcomes as a reference, it should be easier to plan, implement and evaluate learning interventions in the context of sustainability transformations.

The array of learning outcomes, conditions and specific elements of transformative learning processes can also be incorporated into other learning approaches and theories such as competence development, experiential learning or social learning. In other words, transformative learning as a meta-theory does not exclude other learning approaches from sustainability transformation. For instance, the development of competencies for sustainability is key in the formation of change agents such as entrepreneurs that will lead the path of sustainability transformation. Moreover, social learning can also be coupled with transformative learning because it transcends the individual sphere; that is, transformative learning occurs in relation to others. For instance, an outcome of transformative learning can be forming and strengthening relationships, networks, and communities. This is essential for sustainability transformations because an individual can change their mental model, but a social group can also experience a mind shift.

The achievement of sustainability transformation will require new modes of production and consumption rooted in shared and articulated visions. The transformative learning journey of sustainable entrepreneurs can shed light on how far individual actors can contribute to transformation and how the dynamics of transformation shape the frames of reference of actors. Transformative learning and sustainability transformation entails a cycle of prior learning, perspective transformation, action engagement, disorienting dilemmas, critical reflection and discourse that accompany the evolution of sustainability niches into new regimes.

5.5 Reflection upon the research design and methods used

Sustainability science as a field of knowledge represents a new paradigm in science as it seeks to address the complexity of sustainability (Martens, 2006); however, sustainability science faces some epistemological challenges. Firstly, sustainability science is not a discipline on its own; it is at least the combination of different disciplines and other forms of knowledge. Secondly, it has a strong normative and problem-solution orientation (Spangenberg, 2011; Miller *et al.*, 2014). This means that conventional approaches to science (mode-1/normal science) fall short, while other attributes and considerations are needed (mode-2/post-normal science). In this sense, the general research approach in this doctoral work was exploratory.

In exploratory research studies, theories are not tested or used to confirm a hypothesis; instead, they are introduced to see the extent to which they can provide robust explanations for a given phenomenon (Reiter, 2017). These explanations are necessary since some theories have not been considered in studying a specific phenomenon. For instance, transformative learning theory has been little considered in the field of sustainability transformation despite their common construct 'transform-'. In further phases of this work, transformative learning was also articulated with sustainability transitions research, entrepreneurship and innovation, sustainability niches and entrepreneurs' expectations. However, a crucial component in this exploratory approach is constructing an initial theoretical base, which was done via a systematic literature review in this project.

As presented at the beginning of this chapter, the conceptual map (Figure 4) reflects the effort to navigate through and put together coherent narrative elements from different disciplines. One way to achieve that is to systematically build theoretical bridges between different fields of knowledge. The systematic literature review (*article 1*) renders an effort in understanding the intersection between transformative learning theory and sustainability. Although there were already common elements between these fields, the lack of a systematic understanding hindered the understanding of crucial learning mechanisms for developing successful learning interventions.

Systematic literature reviews, beyond providing an overall look at what has been done in a particular field, are also a way to explore how other scholars approach and link specific theories, models and frameworks. For instance, one particular interest in this doctoral work was to understand the usage of the term transformative learning. In this sense, a systematic review assists in identifying potential buzzwords and in the organisation of different theoretical streams. Conducting a systematic literature review was a priority in this doctoral work as it was essential to untangle what is meant by transformative learning in sustainability.

Systematic literature reviews also explore, map, organise and delimit boundary objects. Especially in sustainability science, there is a constant emergence of boundary objects as more disciplines and fields intersect. Figure 6 is a perfect example of potential boundary objects that would require respective literature reviews. Ultimately, by analysing and categorising different concepts, models, methods, and empirical findings, this type of reviews serves as a toolbox for researchers and practitioners to better engage in sustainability interventions. By bringing order to chaos, systematic literature reviews make knowledge more accessible.

Returning to exploratory research, this approach provides additional perspectives and angles from which to analyse the phenomenon (Reiter, 2017). Based on empirically collected data, the proposed theories and the resulting explanations are adapted, refined, or reformulated. This makes the research process and findings more consistent by putting them in relevant contexts (Reiter, 2017). Nonetheless, one of the main challenges in this approach is sampling and data collection.

Data collection was preceded by snowball sampling techniques, which also allowed the mapping of different actors involved in the sustainable fashion niche in Mexico; however, this technique may constrain the sample universe and not consider other informants unknown to the former. Because this research project is pioneering in exploring this field of transformative learning and sustainability transformation in the Mexican textile-fashion sector, snowball sampling renders an excellent technique to gather informants, especially on social media. As many entrepreneurs and projects in this niche are visible only through websites and social media, snowball sampling was adapted to identify entrepreneurs irrespective of whether they knew each other. Since social media such as Instagram are social networks themselves, there are many possibilities to access informants, identify networks and carry out snowball sampling.

The next epistemological challenge in this work was collecting evidence regarding transformative learning. The identification of transformative learning mechanisms, outcomes and conditions had to be done through semi-structured interviews. Semi-structured interviews allow for collecting both specific and context data and profound responses regarding a given phenomenon. In terms of empirical exploration, interviews of this kind serve as a first approach to the phenomenon. The challenge with these interviews in exploratory work is that the testing and validation of the interviews has to be done as part of the data collection itself; that is, the interview guide and structure cannot be tested with similar subjects from the same context.

Moreover, what was collected as data was entrepreneurs' past experiences. In this respect, data collection relied on what the informants could remember at the precise moment of the interviews. Regardless of how well designed the interview guide is, there will always be missing pieces of information. Due to the complexity of transformative learning, it is always problematic to find adequate evaluation tools that allow inferring whether transformative learning has taken place.

Parallel to semi-structured interviews, data mining was used as an emergent technique to get data from social media. Given the increasing volume of information in social media, data scraping and mining techniques help researchers save time and effort by automatising data collection routines. In this work, data scraping was very helpful in collecting data from brands' Instagram pages. To address privacy concerns, all data scraped was from public pages and encompassed only Instagram posts (images or videos and their description), date of posting, and number of likes. Information about other users, i.e., the brand's customers, was not collected. Ultimately, data scraping is an auxiliary in characterising the communication narratives of people, projects, brands, and companies. Although it does not represent a direct means of identifying transformative learning, it helps to understand the conditions under which transformative learning occurs.

6 Conclusions

This doctoral work has investigated the interrelation between sustainability transformation and transformative learning, the latter being a necessary condition to achieve the former. Due to the lack of a theoretical bridge between sustainability transformation and transformative learning, this research informs how transformative learning theory contributes to understanding learning phenomena in the context of sustainability transformation, specifically regarding learning mechanisms, outcomes and conditions at both individual and social levels. On the other hand, with sustainability transformation being an emerging context of research on transformative learning, there is also a need to know how this area enhances the theory of transformative learning.

With a particular focus on sustainable entrepreneurship in the development of sustainability niches, the central finding of this work is that transformative learning plays a crucial role in the formation process of entrepreneurs, in shaping their experiences and further practices with their ventures, thus affecting the trajectory in the niche. Moreover, the dynamics between landscape, regime, and niche form a space of learning that enables or hinders entrepreneurs' transformative learning processes.

6.1 Scientific contributions

This doctoral work is of great value as it is pioneering in different aspects. It combines different research fields to understand complex phenomena related to sustainability, e.g., the textile-fashion industry. The research fields involved in this work are sustainability transitions research (multi-level perspective model, strategic niche management), sustainable entrepreneurship (and entrepreneurial learning), transformative learning (and social learning), and sustainability communication (including social media) (see Figure 4). This shows the value of and needs for interdisciplinary mindsets for studying and intervening in complex systems.

Specifically, several contributions to the different research fields can be devised:

This work provides more clarity about the meaning of transformation in the field of sustainability. By revisiting the concept of transformation, the differences concerning similar concepts such as change or transitions were made clear. While sustainability transformation makes the urgency for radical and profound change explicit, sustainability transition research refers to these intermediate processes requiring specific interventions to achieve sustainability. This will reduce the risk of uncritical usage of the word transformation in education, learning and sustainability discourses, which can hinder successful interventions and changes towards sustainability.

The second contribution is that this work approaches the field of sustainability transformation from a learning angle, where despite its importance, the learning aspect had not been enough conceptualised nor operationalised. This work has addressed the insufficient understanding of transformative learning theory and its role in sustainability transformation by coupling it with other frameworks and models, e.g., entrepreneurial learning and multi-level perspective models. Beyond the concepts of single, double and triple-loop learning, this work will serve as a reference for those interested in studying learning phenomena in the context of sustainability transformations and transitions.

The third contribution is the highlighting of specific models from sustainability transitions research. This work confirmed the usefulness of the multi-level perspective model to understand and characterise complex sustainability phenomena. The differentiation of the three levels allows for analysing a target system (regime), external factors or conditions (landscape) and a set of solutions or new systems (niche), and visualising the dynamics among them over time. Moreover, this model also permits the inclusion of theoretical perspectives, which in this case, was learning. However, other possibilities exist, such as management, governance, etc.

A fourth contribution relates to the pertinence of using transformative learning theory as an analytical framework in sustainability transitions research. Different approaches such as the multi-level perspective or strategic niche management can benefit from this learning theory by using different conceptual elements. Due to the lack of a specific learning approach in transitions research, transformative learning, as demonstrated in this work, is suitable to approach the study of transition processes in which learning figures prominently.

Although there is an implicit connection between (sustainable) entrepreneurship (and entrepreneurial learning) and transformative learning, this work has contributed to forging these two fields in expanding the notion of the learning processes involved. In conjunction with the multi-level perspective, this work contributes to situating entrepreneurs in the development of sustainability niches and acknowledging their role as change agents.

A sixth contribution refers to the widening of knowledge about the textile-fashion industry in Mexico. Although it is one important sector in Mexico, it has remained overlooked in terms of sustainability research. This work has opened this case to scientific interest and advanced the knowledge in terms of how this sector is structured and which transformation processes are currently occurring.

This work also contributes to the further development of transformative learning theory. Despite its very specific focus on ventures in sustainability niches, this work might clarify the debate around the classical model of transformative learning. For instance, although Mezirow's transformative learning model (Mezirow, 1994a, 2003) is contested because of its phases, it still contains the core conceptual elements. Another issue confirmed by this research is that transformative learning is not a finite experience (Newman, 2010); it is spread along different individual life stages. Moreover, it was confirmed that transformative learning goes beyond the individual sphere and has social implications. Another aspect is that transformative learning had not been empirically documented in sustainability transformation processes, especially in other contexts than formal educational settings. This work has shown that, for example, transformative learning in sustainable entrepreneurship offers many possibilities for studying these learning processes, outcomes and conditions in other educational settings.

One final contribution of this work is method-related: As digitalisation advances and sustainability transformation takes a digital dimension, it is necessary to innovate and integrate other research methods. In this work, it was shown how relevant Instagram is for entrepreneurs as a business platform. Now that many brands and businesses can only be reached through social media, it is important to consider methods such as data mining in sustainability research. Social media is becoming either an object of study in sustainability or a vital setting related to sustainability phenomena.

6.2 Implications for practice

Even though this work is positioned in a more theoretical realm, some practical implications deserve to be underscored.

First, the systematic literature review serves as a map that orientates educators and practitioners interested in transformative learning and sustainability. *Article 1* offers a set of literature collected and classified according to the theoretical use of transformative learning. In this sense, educators and practitioners can locate easier those studies that employ transformative learning as their central or core framework. Moreover, the review and this work also help introduce people to transformative learning theory by synthesising its implications, criticism, and primary literature sources.

This doctoral work also offers practitioners a roadmap to the sustainable fashion niche in Mexico. They can track the most relevant practices and processes occurring in the niche. Moreover, the snowball sampling through Instagram offers a way to locate new ventures and brands in this niche. As this niche has remained unexplored,

practitioners can realise the power of social media in the development of ventures. The data scraping code (see *article 3)* can be further refined for either practical or research purposes.

A further potential implication of this work relates to the organisation and management of the niche. Now that this research has modelled the development of the sustainable fashion niche in Mexico, it would be a point of reference for practitioners who decide to intervene at a meta-level in creating and formalising a network of ventures. Furthermore, after having presented entrepreneurs' learning processes and outcomes, tailored educational programs could be designed and implemented to enhance entrepreneurs' competencies in managing their ventures.

6.3 Research limitations

The following limitations in this work are acknowledged:

- This research's exploratory nature did not allow a further engagement with practitioners and entrepreneurs. In this sense, implementing learning interventions could have aided in comparing learning processes, outcomes and conditions among entrepreneurs and ventures.
- The assessment of transformative learning is an epistemic challenge as it is difficult to be assessed. Qualitative interviews were the only sources to collect data and infer transformative learning. This might have limited the collection of empirical evidence regarding transformative learning and portraying of the learning process and outcomes.
- The sustainable fashion niche identified in this work resulted from snowball sampling techniques, which depended on initial seeds contacted via the internet. In this sense, other important projects or ventures might have been left out, thus limiting the estimation of the size of the niche population.
- The focus on the learning and entrepreneurial aspect of sustainability transformations led to a lack of empirical exploration of other crucial aspects in the development of niches and transitions, such as policy and governance.
- Focusing only on empirical work at the niche level without complementing it with empirical research at the regime level could have restricted the narrative only to the niche side. In other words, a good complement would have been the consideration of regime actors' perspectives.

6.4 Further research and recommendations

Given that this doctoral project is exploratory, many research streams are open for further work:

Systematic literature reviews examining the overlap of the different research fields mentioned above, e.g., sustainable entrepreneurship and sustainability transitions, expectations in sustainable entrepreneurship, or entrepreneurial learning and transformative learning, are promising future research endeavours. Figure 4 provides an indirect outlook of potential systematic reviews, which can contribute to building a basis, which helps to understand learning in sustainability transformations and transitions.

Research is needed to study further interventions in the Mexican textile-fashion industry. Interventions in this sense could take the approach of real-world experiments and real-world laboratories (RwL) (Bergmann *et al.*, 2021; David and Gross, 2021). Taking transdisciplinary as a core research mode in RwL's, and transformative learning as a theoretical axis for learning interventions, there could be a collaboration between researchers and social actors, leading to social change and the empowerment of stakeholders. In addition, the solutions generated in specific processes or settings can be transferable and up scalable to other scenarios, contexts or conditions. One of the essential characteristics of an RwL is that it provides space for dialogue, reflection and learning (Luederitz *et al.*, 2017).

These RwL's would help to build a sustainable domestic supply chain of textiles in Mexico on a major scale. As new business models appear at a smaller scale, it would be worth testing them along with their innovations. It could be asked: To what extent do these models contribute to sustainability transformation? How are users' perceptions changed? What is the social media effect on that? Nonetheless, there are still preliminary issues, such as the study of habits and practices of Mexican users regarding fashion.

Specific elements of this doctoral work could be extrapolated to other sectors such as sustainable mobility, sustainable energy, urbanisation, local food production and supply chains, etc. There is a strong presence of entrepreneurs working to transition to a sustainable regime in these sectors (see Weber *et al.* (2020)).

Now that digitalisation is becoming an essential topic on several research agendas, further research inspired by this work could also explore the interrelation between social media and sustainable transformations and transitions. Since social media is in constant change, longitudinal analyses would be required to track the impact on production and consumption systems.

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