Fashion Innovation Through Innovation Ecosystem – A Research Agenda

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This paper employs the paradigm of innovation ecosystem in an effort to stimulate fashion innovation. This study applies an integrative literature review on fashion innovation, innovation ecosystem, and policy-driven innovation, proposes a theoretical framework – fashion innovation ecosystem, and streams future research directions. The findings of this paper suggest innovation ecosystem as an inclusive, constructive, and systematic lens, contributes to the management of fashion innovation. A mechanism of policy-driven fashion innovation is hypothesized to shed light on the role of government as a key actor in the fashion innovation ecosystem. It identifies five research directions from the theoretical framework of the fashion innovation ecosystem, namely fashion innovation measurement, research methodology, policy-driven fashion innovation, fashion sustainability innovation ecosystem, and open innovation. The study contributes to the theoretical development of fashion innovation management and innovation ecosystem. It also has practical implications for innovation strategy in the fashion sector. Finally, the study will benefit policymakers in formulating policy and fostering the institutional environment.

Keywords: fashion innovation; innovation ecosystem; policy-driven

Subject classification codes: include these here if the journal requires them

1. Introduction

‘Fashion is accompanied by a process of continuous innovation in which new designs are developed’ (Pesendorfer, 1995). The lifecycle of fashion items was short, with rapid replacement of different styles. While fashion was asserted to be ‘non-innovative novelties’ because of the absence of technology advancement (Piatier,1984). However, innovation was captured in the fashion industry, introducing computer technology in design, machine, and retail stock in the knitwear industry, and yielding low-cost designs (Walsh, 1996). Digital technology secured seasonal fashion innovation, namely fashion collection (Baraldi & Nadin, 2006). The phases of textile innovation in a linear progression were elaborated to identify innovation sources (McAdam & McClelland, 2002). Some innovation studies employed fashion or apparel as examples, although one of which was an unsuccessful clothing project (Cozzarin, 2006; Na et al., 2017; Roy & Riedel, 1997). A specific case was the Mini skirt in the 1960s, which was regarded to be the result of meaning-driver rapid innovation (Alberthy Alysson Coelho & Wellington Gomes de, 2021; Norman & Verganti, 2014).

Given thriving innovation research in the management field and the fact that fashion is one of the most innovative industries, research on fashion innovation has recently begun, albeit in a fragmental state (Raustiala & Sprigman, 2006). Fashion innovation featured both incremental changes in embellishments, colors, and fabrics, as

well as disruptive changes in materials and function (Dalla Chiesa et al., 2022). Although researchers have examined fashion innovation from various dimensions, such as function, material, and style, few studies have attempted to investigate fashion innovation in a generalized and holistic manner and explore the strategy for fashion innovation from a management perspective, including its drivers and facilitators.

Regarding who facilitates product innovation, a prior study established a conceptual taxonomy of actors' roles and their interactions in the context of local innovation (Guercini & Runfola, 2015). Customers and the government have been extensively addressed as crucial actors (Evans & Chisholm, 2016; Rahman et al., 2020). It informed actors such as firms, users, universities, organizations, and government via the lens of innovation ecosystem (Adner, 2017; Carayannis & Campbell, 2009). In the fashion sector, a study on brokerage as an actor was investigated during London Fashion Week; it was the only research that referenced innovation ecosystem in the context of fashion (Lin, 2018). Government played a key role in the fashion industry's innovation process and issued policies to support marketing activities (Guercini & Runfola, 2010). As a governmental measure in innovation ecosystem, policy intentionally stimulated innovation and was extensively used in the medical field and the energy industries (Quitzow, 2015). Although policy-driven innovation in fashion

was integrated in fiber invention, fashion designer knowledge transfer, and industrial development, it is unclear how policy was enforced in the lens of innovation ecosystem.

The term 'Ecosystem' of 'innovation ecosystem' has gained popularity because of its metaphor as a relationship and network reflecting an integrative and co-evolving phenomenon of external and internal entities for innovation, value capture, and value creation (Adner, 2006; Baiyere, 2018; Hou & Shi, 2021; Jacobides et al., 2018; Moore, 1993). In the innovation field, the attachment of 'ecosystem' has been demonstrated to be a success in explaining disruptive or incremental development scene and proposing relation-based development strategies (Adner, 2017; Baiyere, 2018; Ghazinoory et al., 2020; Ritala & Almpanopoulou, 2017). As such, 'ecosystem' has become a sophisticated strategy for the development of traditional textile and fashion entrepreneurship (Brydges & Pugh, 2021; Ramachandran et al., 2012). However, only one study attempted to explain one aspect of the innovation ecosystem in the fashion industry, namely the brokerage (Lin, 2018). There appears to be a dearth of research on theoretical and empirical investigations of innovation ecosystem in the fashion domain. To explore and elucidate the intricate phenomenon of fashion innovation, an inclusive and holistic mechanism should be proposed, namely fashion innovation ecosystem, which comprises fashion innovation, actors, and activities, viewed from the ecosystem-as-structure perspective (Adner, 2017; Hou & Shi, 2021).

Compared to the relatively established topics on ecosystem, such as entrepreneurship and platform, innovation ecosystem (IE) in the fashion sector has gained less attention (Gu et al., 2021). Since innovation ecosystem in the fashion sector is an emerging topic, there is a need to synthesize literature in the aforementioned fields in order to explore the new phenomena in the specified context, e.g. fashion innovation ecosystem (Torraco, 2005).

The purpose of this study is to develop a conceptual framework for fashion innovation ecosystem to answer the research question 'How does innovation ecosystem play a role to stimulate fashion innovation?'. It attempts to capture fashion innovation within literatures, establish the framework of fashion innovation ecosystem, and explore the government's involvement. Furthermore, new research could be identified based on fashion innovation ecosystem. This research presents an opportunity to advance fashion innovation and innovation ecosystem theory. It will provide policymakers with valuable insights into the role of government in fashion innovation ecosystem. It will make a contribution to fashion product development and innovation management strategy on the practical level.

2. Methodology

The integrative literature review was employed in three main fields. The three-step

method consisting of reviewing, critiquing, and synthesizing the literature, generates a new framework and research agenda on the topic (Torraco, 2005).

The precise steps began with the identification of target literature using Web of Science for its rich metadata and high influence on academics. The literature was retrieved without a specific timeframe for a generally completed outcome. The search utilized a topic search which covered title, keyword, and abstract. The first field included keywords ‘fashion’ and ‘innovation’, the second field included keywords ‘innovation ecosystem’, and the third field included keywords ‘policy-driven’ and ‘innovation’. Three researchers conducted a staged review. First, three researchers examined the title and retained only those that were pertinent to the research question focusing on fashion innovation, general theory of innovation ecosystem, and policy-driven innovation. Particular attention was paid to high-citation literature and review articles in the innovation ecosystem field. Then, keywords and abstracts were initially read for further discarding. Based on the reduction result, the introduction, methodology, and findings received further investigations. More scrutiny was completed by reading the entire article. During the initial review and comprehensive review, themes were identified and critically evaluated.

Regarding the organizing of all literature, three sessions were woven into one theoretical model guided by the innovation ecosystem paradigm in order to address the

research question ‘How does innovation ecosystem play a role to trigger fashion innovation?’ (Adner, 2017).

3. Result

The first theme is fashion innovation which highlights three main categories of fashion innovation within innovation ecosystem. The second session examines innovation ecosystem and provides a holistic and historical perspective from structure to successful factors, ultimately leading to a contextual fashion innovation ecosystem. The third theme focuses on policy-driven-innovation related studies that are relatively dispersed across disciplines and geographic settings and are indispensable when discussing innovation ecosystem.

3.1 Fashion Product Innovation

Based on the impetus, innovation by design in the fashion industry can be categorized into five types, including product-driven innovation, process-driven innovation, technology-driven innovation, culture-driven innovation, brand-driven innovation, and consumer-driven innovation (Hodges & Link, 2018). Another paper outlined four stages of fashion innovation based on the circular economy: textiles innovation, design innovation, relationships innovation, and commerce innovation (Sugg, 2022). Extant fashion studies that claimed their research was innovation or

innovative relevance were in a vast amount and dispersed throughout numerous academic domains.

Technology-driven fashion innovation explicitly presents a prevalence, typically those related with digital technology. Although technology adoption strategy rather than technology innovation benefited the fashion industry in Bangladesh, fifteen types of technology related to automation, computer, robots, IoT, and management were embraced by the fashion industry (Park-Poaps et al., 2021). It was believed that Industry 4.0 was integrated into the fashion sector, particularly in terms of digital technology(Bertola & Teunissen, 2018). Diversified software such as 3D software has been proven to facilitate more efficient and effective traditional product development (Davis et al., 2020; Koncic & Scapec, 2018; Popescu et al., 2017; Popescu et al., 2019; Shin & Westland, 2017). IoT has been demonstrated to be a powerfully functional and innovative tool for advancing marketing and consumer study via social media and apps (Khaire & Hall, 2016; Moodley, 2003; Rossol & Lapolla, 2020; Soni et al., 2019; Torres & Arroyo-Canada, 2017). Other digital technologies including intelligent technology, interactive technology, and big data prompt innovation (Fu & Liu, 2019; Wang et al., 2018; Yu et al., 2021). One benchmarking fashion innovation was the smart garment, which was inseparable from wearable technology (Barile & Sugiyama, 2020; Cerqueira et al., 2020; Mo et al., 2020; Stankeviciute, 2020; Yang et al., 2017).

Materials innovation in the fashion sector stretched from fibre through finishing, aligning with the production process. Extensive research has engaged in electronic optical fiber (Bai et al., 2015; Chan et al., 2018; Wang et al., 2012). User-oriented materials that prioritized comfort by improving thermal and respiratory properties contributed to human health (Glovinsky & Zavrel, 2018; Jakubas & Lada-Tondyra, 2018; Matusiak & Fracczak, 2017; Wickramarathne & Al Mahmud, 2021). Green technology such as natural dyeing (Agrawal & Chopra, 2020; Linton, 2020), self-grown bacterial cellulose (Ng & Wang, 2016), and local resources (Wickramarathne & Al Mahmud, 2021) resulted in environmental innovation that was similar to other industries. The sustainability goal was implicitly interwoven, but no study specifically addressed it.

The subcategory of product development had a critical role in fashion innovation. The framework or mechanism for fashion product development was created using diversified dimensions (de Araujo et al., 1998; Sokolowski, 2020; Tran, 2010). Actors included communities, fashion designers, and fashion consultancies were investigated (Maria & Finotto, 2008; Rieple et al., 2015). Cooperation with users is synonymous with open innovation and has been examined by many authors in the fashion field (Baker et al., 2019; Gordon & Guttmann, 2013; K. Morris & S. Ashdown, 2018; K. D. Morris & S. P. Ashdown, 2018). In accordance with sustainability, users on

an online innovation platform could co-develop items throughout the innovation process, from idea generation and prototype to actual use (Vehmas et al., 2018).

There is still a wealth of literature related to fashion innovation. For instance, scholarly interest has been shown in design outsourcing and network structure in relation to fashion innovation (Delbufalo, 2015; Shen et al., 2016). Innovation regarding management and business were beyond the scope of this paper.

From the standpoint of product innovation, it sheds light on three main categories, namely technology, material and product development, which involved different actors, such as fashion designers, consumers, suppliers, and digital service providers, as well as different activities, such as R&D, outsourcing and marketing, different interactions, such as cooperation. However, few studies have studied fashion innovation comprehensively and systematically, much alone from a strategy management perspective (Hodges & Link, 2018; Sugg, 2022). This literature analysis on fashion product innovation provided an overview of fashion innovation, urging the exploration of fashion innovation ecosystem in order to investigate who facilitates fashion innovation and how it is enabled.

3.2 Innovation Ecosystem

Regarding how to achieve innovation, Adner stated that 'successful innovation requires tracking your partners and potential adopters as closely as your track your own

development process' (Adner, 2006). Granstrand & Holgerson defined innovation ecosystem as 'the evolving set of actors, activities, artifacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors' (Granstrand & Holgersson, 2020). The concept of a national design innovation ecosystem is coined by integrating innovation ecosystem with the design discipline as 'the actors, context(s) and interactions required to support design as an enabler of people centred-innovation' (Evans & Chisholm, 2016).

In the sense of an infinite reciprocal cycle or co-evolution, which was analogous to the biological meaning in nature, the ecosystem lens was more suitable to innovation management than a system or a network lens (Jacobides et al., 2018; Moore, 1993; Ritala & Almpanopoulou, 2017). Oh et al. criticized innovation ecosystem as a metaphorical and fuzzy-logic term, as opposed to a rigorous construct, and did not contribute substantially to the innovation management field (Oh et al., 2016). Ritala & Almpanopoulou responded with the paper titled 'In defense of 'eco' in innovation ecosystem' which referred back to Moore's point of view on co-evolution among interdependent entities and the boundaries issue that could be identified by geographical scope, temporal scale, openness and flow types (Moore, 1993; Ritala & Almpanopoulou, 2017). Moreover, Oh et al. failed to acknowledge Adner, an academic

pioneer in innovation ecosystem who almost simultaneously articulated the distinction between ‘ecosystem’ and various alternative structures such as platforms, networks, supply chain, and industrial architecture (Adner, 2006, 2017). This study intends to examine the fashion sector and will therefore leverage the consolidated, mature, and widely accepted innovation ecosystem paradigm (Ferasso et al., 2018; Granstrand & Holgersson, 2020; Jacobides et al., 2018).

Innovation ecosystem was investigated from a structural standpoint, and four elements were identified: activities, actors, positions and links (Adner, 2017). On the basis of ‘ecosystem as affiliation’, organizations and individuals from the public and private sector participated as an organism (Adner, 2017; Moore, 1993; Ritala & Almpanopoulou, 2017). Specifically, actors included suppliers, producers, competitors, users, industrial companies, government agencies, universities, and research institutions with a focal value objective (Adner, 2017; Moore, 1993; Yaghmaie & Vanhaverbeke, 2020). The boundary of ecosystem would be broken by the continuous expansion of participants. For example, innovation ecosystem evolved from ‘Triple Helix’ supported innovation by connecting industry, government, and academia, to ‘Quadruple Helix’ which incorporated the public as the fourth helix (Carayannis & Campbell, 2009). A case study from EU elaborated framework entities and incorporated the natural

environment as a key actor (Fernández et al., 2019). Coopetition and interdependence among actors affected the equilibrium of innovation ecosystem (Valkokari et al., 2017).

When dealing with elements or components, several researchers sought to map innovation ecosystem in a linear fashion, beginning from project innovation and ending with consumers, or from inputs to outputs in a value-added model (Adner, 2006; Arena et al., 2021). A parallel frame was an option for emphasizing the equilibrium of the network(Fernández et al., 2019; Suseno & Standing, 2018). The holistic research simultaneously explored activities, actors, and themes (Granstrand & Holgersson, 2020). All kinds of resources, including finances, suppliers, customers, and information, were captured (Ferasso et al., 2018). Resources were allocated within the actor network (Ferasso et al., 2018). Factors contributing to successful innovation were identified to be resources, governance, strategy and leadership, organizational culture, human resources management, people, technology, futures, and clusters (Durst & Ståhle, 2013; Evanschitzky et al., 2012; Johne & Snelson, 1988).

Oh et al. acknowledged that quantitative indicators such as licensing income were unreliable and invalid as metrics due to the non-linear and co-evolutional nature of innovation ecosystem (Oh et al., 2016; Ritala & Almpanopoulou, 2017). Nine highly-cited papers on innovation ecosystem employed qualitative investigation as evidence of methodology (Feng et al., 2021).

As the target of innovation ecosystem, innovation is further delineated by sector, context, and boundary in terms of its applications and subcategories. According to the boundary framework, innovation ecosystem can be categorized as global innovation ecosystem, national innovation ecosystem, regional innovation ecosystem city-based innovation ecosystem and enterprise innovation ecosystem, sectoral or industrial innovation ecosystem, and open innovation ecosystem (Feng et al., 2021; Ferasso et al., 2018; Fernández et al., 2019; Granstrand & Holgersson, 2020; Oh et al., 2016; Ritala & Almpanopoulou, 2017; Suseno & Standing, 2018). Consequently, in the fashion sector, fashion innovation ecosystem can be proposed based on Adner's 'ecosystem as structure' standpoint (Adner, 2017).

3.2.1 Fashion Innovation Ecosystem

The majority of innovation ecosystem research has been conducted in the setting of high technology. As for the low-tech industry, there have been few researchers participating (Chandna & Salimath, 2020; Ghazinoory et al., 2020). Even less is known about innovation ecosystem in the fashion sector. It should be noted that the sole paper that mentioned innovation ecosystem investigated the role of brokers in the diffusion of fashion design innovation (Lin, 2018). One similar study was the application of entrepreneurial ecosystem (EE)to the Toronto fashion industry (Brydges & Pugh, 2021). After developing the market and organization along an unintentionally problem-solving

path, a producer ecosystem for impoverished handloom artisans was built (Ramachandran et al., 2012). Similarly, the function of design in entrepreneurship ecosystem was underlined in the context of less developed countries (Nthubu, 2021; Nthubu et al., 2022). The fragmentation and deficiency of research informed that there is a need to build a fashion innovation ecosystem in order to investigate the profound fashion innovation process, inputs and outcomes, the relationships and interactions between various actors, as well as activities and events based on the aforementioned result of fashion innovation. In addition to existing theories in the fashion sector, such as supply chain and industry cluster, etc., the alternative theoretical orientation, namely fashion innovation ecosystem, may help policymakers and practitioners embed and engage fashion innovation from an open, cross-disciplinary, and co-evolutionary perspective.

3.3 Policy-driven innovation

According to its drivers, innovation can be categorized as technology-driven, design-driven, market-driven, and customer-driven, responded to the three main categories of fashion innovation (Norman & Verganti, 2014; Verganti, 2008, 2011). Utilizing stakeholder theory in innovation ecosystem research facilitates the comprehension of governance structure and value creation (Freeman, 2010). Innovation ecosystem comprised of firms, users, universities, research institutes, and the

government as actors (Adner, 2017). Triple Helix and the consequent Quadruple Helix demonstrated that the government's inclusivity encouraged innovation and innovation ecosystem (Carayannis & Campbell, 2009; Etzkowitz & Leydesdorff, 2000). The relationship between government policy and innovation has been the subject of fruitful research, and innovation played a crucial role in policy-making (Whitham et al., 2019; Xiong & Xia, 2020). However, little research has been conducted on how policy and government influence fashion innovation.

Clusters research explicitly clarified the policy-driven connotation by comparing it to the spontaneous one. The policy-driven type was formed as a result of government's initiatives, whereas the spontaneous type was prompted by actors acting spontaneously in a specific region (Chiaroni & Chiesa, 2006; Hassan & Abu Talib, 2015; Huang et al., 2012; Su & Hung, 2009). Another policy-driven viewpoint was obtained by contrasting it with a researcher-driven way (Moatti et al., 1994). Regarding the impact of policy-driven innovation, firm innovation was inhibited by the moderating effect of energy policy in a relatively mild institutional environment (Zhang et al., 2020). Using patent data, catching up rather than incentive also demonstrated a policy-driven effect on innovation (de la Tour et al., 2011).

The policy-driven research field has expanded globally and been empirically validated, such as in Malaysia and Croatia (Anić et al., 2019; Hassan & Abu Talib,

2015; Omar et al., 2017). Some countries such as EU member states and China produced most of the studies in the policy-driven field. EU took advantage of policy-driven practice and enticed researchers to explore and exploit the policy-driven study. A national level of research networks effectively illustrated the EU policy-driven model of Framework Programmes (FPs) in terms of participant involvement, evolutionary approach, and innovation. China, as an emerging country, has transferred from innovation follower to innovator through government intervention (Georghiou, 2001; Marin et al., 2015; Quitzow, 2015; Yi et al., 2020). Hong Kong and Singapore were compared to demonstrate the impact of government intervention on innovation, with more intervention having a positive effect in Singapore (Wang, 2018). Scholars in Malaysia have been enthusiastic about policy-driven research due to Multimedia Super Corridor (MSC Malaysia) (Hassan & Abu Talib, 2015; Omar et al., 2017).

From the industrial perspective, research concentrated on biomedical, energy, electric vehicle, and environment, and utilized a supply-demand paradigm. Particularly, photovoltaics (PV) was believed to be a policy-driven industry that influenced the market from the supply side (Quitzow, 2015; Wang et al., 2017). The same demand-supply model was employed to compare design policies between UK and China and revealed that demand-side policies were more effective (Sun, 2010). The integration of demand-pull and government policy, i.e. the government acting as a customer,

stimulated both customer-driven and policy-driven innovation (Omar et al., 2017). The objective of 'Innovation-demand-policy' (IDP) framework was to explore drivers of innovation ecosystem in the new energy vehicle industry, which compassed technology innovation, the market, and policy (Wu et al., 2018). 'Industry-specific institutional policy' strengthened innovation performance (Yi et al., 2020).

Regarding one of the components of innovation ecosystem, actors, the policy-driven interaction between university and industry, different levels of government contributed distinguished performance to the regional innovation system, which demanded balanced growth with policy support (Sohn et al., 2009). Moreover, the coordination of actors required a policy-driven agency or policy-driven brokers (Hernández-Chea et al., 2021; Klitkou & Godoe, 2013; Leick & Gretzinger, 2020). As a policy-driven tool, Industry 4.0 institutionalized an innovation system with a Triple Helix model comprising of firms, academia, and the government (Reischauer, 2018). The structure and composition of two policy-driven innovation networks could be evaluated in the emerging technologies using social network analysis (van der Valk et al., 2011). Specifically, a policy-driven innovation ecosystem was proposed and validated in the context of vaccine development, shedding light on the path of policy-driven fashion innovation within fashion innovation ecosystem (Li & Garnsey, 2014).

Policy and innovation were integrated with resource theory. Based on resource-based theory, policy embeddedness built a regional network of knowledge exchange in ICT (Larty et al., 2017). Based on resource dependence theory, innovation in small firms in Taiwan would benefit relatively more from policy-driven parks (Huang et al., 2012); credibility and legitimacy played a crucial role in the policy-driven innovation network in the Dutch electric vehicle industry (van Rijnsoever et al., 2014). Using the resource-based view, a framework for evaluating the performance of innovation network was developed and compared two policy-driven innovation networks in the emerging technologies (van der Valk et al., 2011).

In the fashion-related industry, there are few scattered studies that haven't formed a mechanism or pathway. The environmentally sensitive fiber was acknowledged as a type of policy-driven innovation (Geum et al., 2016). An extreme instance of oligarchy in Indonesia resulted in the disparate development of the clothing business in two provinces (Achwan, 2013). It was also demonstrated that, despite the government's establishment of an R&D centre to incentivize textiles and clothing research, Hong Kong's patent production as a measure of innovation did not substantially surpass Singapore's due to insufficient policies (Wang, 2018). In order to promote the growth of the fashion industry, British policy advocated the cross-border

knowledge transfer, such as the mobility of fashion designers and through the education system (McRobbie, 2016).

Although policy-driven innovation and related issues have been extensively investigated, regardless of whether the policy-driven influence was positive or negative and despite the intimate relationship between fashion and politics, few studies have examined policy-related fashion innovation and fashion innovation ecosystem. This multidisciplinary path combining policy, resources, innovation, and fashion functions as a black box and necessitates study to decipher (Teixeira & Silva, 2013). Since the government is a critical actor, one of the goals of the research is to address this research gap and embed the channel from government to innovation into fashion innovation ecosystem.

4. Theoretical framework

The multidisciplinary literature review in three fields is synthesized, and a theoretical framework is proposed based on 'ecosystem as structure' view and the research question 'How does innovation ecosystem play a role to stimulate fashion innovation?', as shown in figure1 (Adner, 2017). The conceptual map combines and visualizes pertinent themes, including fashion innovation and innovation ecosystem (Maxwell, 2013). It presents two primary parts: the left part focuses on fashion innovation that

necessitates a comprehensive investigation from an overview perspective because different categories of fashion innovation are composed of distinctive actors, activities and links; the right part explores fashion innovation ecosystem comprising of actors, activities, and links that can contribute to fashion innovation. These two parts are connected by the logic that actors, links and activities in the proposed fashion innovation ecosystem will depend on what fashion innovation in the left part is, as indicated by the arrows pointing to the right. For instance, the material category of fashion innovation requires actors such as scientists, raw material suppliers, and yarn manufacturers, as well as activities such as R&D in the fashion innovation ecosystem paradigm. It is not about the specifics of fashion innovation, such as the technical path, but rather fashion innovation from the perspective of strategic management. In reverse, all left-pointing arrows imply that actors, links and activities of the proposed fashion innovation ecosystem, will motivate fashion innovation categories at the left part.

A conduit from the government in fashion innovation ecosystem to fashion innovation will foster the policy-driven fashion innovation. The relationship between the government and other actors, together with activities such as financial support provide both essential and complementary resources to stimulate fashion innovation categories identified in the preceding literature analysis.

[Figure 1 near here]

5. Future research

The conceptual framework throws new light on fashion innovation research and expands the context of innovation ecosystem. The study also responds to a special editorial in JPIM on the development of product design research in a new lens of innovation ecosystem (Swan & Luchs, 2011). In the subsequent sessions, several research directions derived from the theoretical framework will be discussed.

5.1 Fashion Innovation Measurement

Because the current arguments present a multidimensional explication of the construct in the available literature, the key construct lacks a precise and succinct definition. There is a need to properly define the focal construct and variable of fashion innovation. Future research should attempt to explicate the concept of fashion innovation and its dimensions.

It has been pointed out that product innovation performance could be measured from three perspectives, namely function, appearance, and ergonomics (Moon et al., 2015), as well as from an emotional cognitive dimension (Gilal et al., 2018). Due to the challenges created by aesthetic intricacy and the subjective meaning of fashion products, scanty investigations have contributed to the assessment of fashion

innovation; only the process and model of stylistic innovation have been proposed (Cappetta et al., 2006; Tran, 2010).

In fashion marketing research, product innovation was evaluated by asking customers questions containing the phrases ‘unique’, ‘hard to find’, ‘novel’, and ‘special’ (Torres & Arroyo-Canada, 2017). Aesthetic, expressive, and functional factors were used to access customer satisfaction with 3D printing fashion (Cui et al., 2022). However, the Chair of Ernesto Gismondi Artemide’s words ‘Market? What market? We do not look at market needs. We make proposals to people’ was quoted to distinguish design-driven innovation from the market- or customer-centred innovation, more research is needed to explore how to measure fashion innovation that do not focus on consumer response (Verganti, 2011).

Regarding the above discussion, an objective, rational and professional measurement of fashion innovation should be identified in order to better capture activities and actors related within fashion innovation ecosystem.

5.2 Methodology

Because innovation ecosystem was a non-linear and co-evolutional paradigm, quantitative indicators such as license venue were unreliable and invalid as metrics (Oh et al., 2016; Ritala & Almpanopoulou, 2017). Being evidence, nine highly cited papers on innovation ecosystem employed qualitative investigation (Feng et al., 2021). Future

research will comply with the previous studies by using qualitative methodology to explore fashion innovation ecosystem. Regarding fashion innovation, it is suggested that fashion innovation could be clarified and conceptualized quantitatively based on abundant research on innovation and new product development measurement (Moon et al., 2015).

Due to the multidisciplinary feature of the conceptual framework, multiple approach strategy will be appropriate (Kawamura, 2011). A generalized qualitative study using mixed methods and procedures is a possibility. Moreover, empirical studies, such as case studies and field research using interview and survey, could be employed to validate the conceptual framework and the propositions.

5.3 Policy-driven fashion innovation

As previously discussed, few researches have investigated the impact of policy on the fashion sector. Actually, the government occupied a leading position and behaved as a powerful actor, as stated by 'the government … the key players shaping the fashion industry' (Karadayi-Usta, 2022). It was discovered that the government's effort to achieve sustainability through healthy and safety laws will greatly impact on the supply chain. Sustainable innovation requested governmental regulations and rules in terms of transparency (Jestratijevic et al., 2022). Waste resources would be legally restricted in some countries such as Denmark (Sandvik & Stubbs, 2019). The

government provided training and financial incentives to encourage the use of sustainable technology (Hoque et al., 2022). From the customer's perspective, they would disseminate petitions and vote for a government with sustainability policies (Campos et al., 2022). The Australian government identified and promoted a holistic pathway of sustainability in the fashion sector through investments in technology, procurement, education, and collaboration (Piller, 2022). Another national example was testified that policy could enhance industrial competitiveness in Trinidad and Tobago (Wilson, 2020). However, it can be concluded that most of the research did not use the terms policy-driven or government-driven to describe such practices and did not directly link to innovation.

The theoretical framework will serve as a paradigm to explain policy-driven fashion innovation. Governmental embeddedness provides both essential and complementary activities such as trade fair and fashion week, as well as interactions with other actors such as associations and universities, to stimulate fashion innovation. Input and supply from the government result in sustainable output in fashion innovation regarding economy, society, human being, and environment which will be interests for future research.

5.4 Sustainability fashion innovation ecosystem

Sustainability merits a prominent position in fashion innovation research, despite the fact that many papers have handled it at the micro level without overtly indicating it. For instance, mud-dye in the material category of fashion innovation contributed to the environment, although the research focused on the innovation of intangible heritage (Linton, 2020). Considering this tacit academic trend, the conceptual framework of fashion innovation ecosystem can be trimmed with a focus on sustainability. A actor lens helps to analyze the sustainability in innovation ecosystem within which the circular economy is dependent on activities of actors (Hoque et al., 2022; Whicher et al., 2018). SMEs has been identified as a leading role in circular economy innovation (Piller, 2022). The governmental laid the groundwork for evaluating waste resources (Sandvik & Stubbs, 2019). Moreover, it would to be more objective to incorporate sustainability as an indicator for measuring fashion innovation, or as the output of fashion innovation ecosystem from the input-output perspective (Dong, 2015).

5.5 Open fashion innovation

From a constructivist perspective, innovation ecosystem consists of actors, relationships, and activities (Adner, 2017). Actors broaden the scope of fashion innovation ecosystem in tandem with its dynamic boundary. User or customer

participation is relevant to open innovation. Fashion end-users are the type of actors with a distinctive aesthetic sensibility and physical body who, through social media platforms and online campaigns, co-creates and crowdfunds fashion innovation products (Dalla Chiesa et al., 2022; Roncha & Radclyffe-Thomas, 2016). Open innovation in fashion covers a broad spectrum, from 3D body scan to made-to-measurement garments, from comfort improvement to smart technology (Popescu et al., 2017; Yu et al., 2021). Future research could explore open innovation in the lens of fashion innovation ecosystem, such as its shifting to fashion services, its embodiment within different innovation processes, and its contribution to well-being, etc. (Baker et al., 2019; Chesbrough, 2017; Gordon & Guttmann, 2013; K. Morris & S. Ashdown, 2018; K. D. Morris & S. P. Ashdown, 2018).

Based on the elaboration of future research of fashion innovation ecosystem, a theoretical framework for these future research of fashion innovation ecosystem was redesigned mainly with the integration of actors including customers and the government, as shown in Figure 2. The path from users to fashion innovation would generate open fashion innovation, the path from the government to fashion innovation would create policy-driven fashion innovation. The fashion innovation ecosystem could be further developed into fashion sustainability innovation ecosystem. Meanwhile,

fashion innovation must be studied in terms of its measurement in order to identify its pertinent components within fashion innovation ecosystem.

[Figure 2 near here]

6. Conclusion

This paper frames literature on fashion innovation and innovation ecosystem, proposes a conceptual framework – fashion innovation ecosystem, and endeavours to explain the mechanism of fashion innovation within innovation ecosystem domain. Utilizing the government as an example of a key actor, literature review on policy-driven innovation validates the existence of a mechanism from the government to fashion innovation within fashion innovation ecosystem. Future research based on the framework are proposed: open fashion innovation and policy-driven fashion innovation considering actors; the measurement of fashion innovation considering the conceptualization and taxonomy; sustainability fashion innovation ecosystem considering the application and context; applicable methods considering research methodology. The absence of many potential studies appears to be the limitation of this research. Another limitation is that the integrative literature review method has not been combined software to obtain a more robust result via statistical analysis.

The study has significant implications for both theory and practice. From the theoretical perspective, it responds to some recent papers on innovation ecosystem and fashion innovation. It fosters a theoretical agenda of fashion innovation (Hodges & Link, 2018). It expands innovation ecosystem theory in the context of the fashion sector (Baiyere, 2018; Lin, 2018; Luo et al., 2014). It sheds light on policy-driven innovation formerly regarded as a black box or paradox (Xiong & Xia, 2020; Yi et al., 2020). The study fills the research gap of fashion innovation and fashion innovation ecosystem by integrating fashion, innovation ecosystem, and policy into an inclusive and holistic model at a macro level, it contributes to the development of fashion innovation research and innovation ecosystem theory.

The study has practical implications for innovation strategy in the fashion sector. Fashion is a rapidly renewing product, for which continuously newness and novelty are the norm. Fierce competition in the fashion industry seeks both incremental and disruptive innovation along the value chain (Hodges & Link, 2018). The ‘useless’ innovation when compared to technology innovation, necessitates an alternative strategy to reduce time and cost along the product lifecycle (Pesendorfer, 1995). Our research contributes to managers and designers by providing a new innovation paradigm and a governmentally supportive way. The study will benefit policymakers with a

holistic view to design industry-specific regulations and rules that foster an institutional environment.

Disclosure statement

The authors report there are no competing interests to declare

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Figure 1. The theoretical framework of fashion innovation ecosystem.

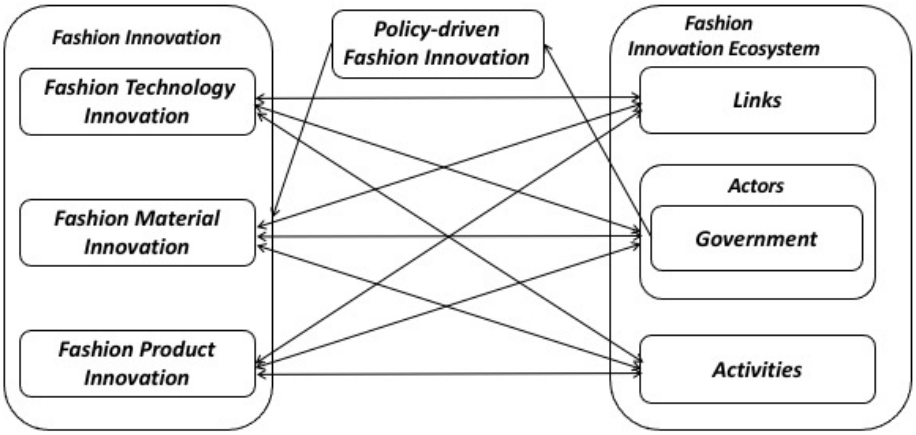

Figure 2. The theoretical framework for research agenda of fashion innovation ecosystem.