Editorial
Impacts of Technology Management on the Apparel Retailing and Manufacturing Industry

I. Apparel Retailing and Manufacturing in the Digital Era

THE apparel retailing and manufacturing (ARM) industry has entered the digital age, in which data analytics [1] and other disruptive technologies have become crucial [3]. There is no doubt that intelligent technologies are playing a critical role. Artificial intelligence (AI), 3-D orienting (also called additive manufacturing) [2], blockchain, platforms, mobile technologies, etc., are all playing important roles in ARM.[1] Mckinsey reports that fashion companies on average invest up to 1.8% of their incomes in technologies, and this expense is predicted to "double" and reach around 3+% by 2030.[2]

The recent COVID-19 pandemic has also enticed apparel companies to better utilize different technological tools and consumers are more technologically ready. For example, the fashion retailer Timberland has used the WhatsApp platform as a way to keep its stores and continue to sell products during the COVID-19 pandemic [5]. Online shopping is also being the prominent way of purchasing for fashion apparel. For instance, according to RetailEconomics.com, two types of shoppers called "digital embracers" (DMs) and "digital dabblers" (DDs) have emerged over the COVID-19 pandemic. Here, DMs are the consumers who have voted for shifting to online purchasing permanently whereas DDs are the shoppers who accept online shopping and are open to shopping online more. In the survey conducted by RetailEconomics.com, it is found that among apparel shoppers in Europe, DMs and DDs occupy 30% and 18%, respectively.[3]

At the same time, owing to problems such as city-lockdown under the COVID-19 pandemic as well as extreme weathers and unpredictable disasters, apparel supply chains face disruptions. The way to deal with supply disruptions is to have contingency plans and also be able to "sense-and-respond" to these sources of disruptions as soon as possible. There is no doubt that digital technologies would play a critical role.

Motivated by the importance of digital technologies and engineering management tools for ARM industry, we have organized this Special Section. Table I shows the featured papers, which includes analytical modeling-based theoretical papers, empirical and data analytics related studies, as well as one insightful review paper. The topics cover a wide spectrum of problems that are timely and important in the ARM industry.

II. Future Research Agenda and Conclusion

After reading the state-of-the-art research published in this Special Section as well as examining the latest industrial challenges, we come up with a few future research directions. We discuss them as follows.

Modern slavery and CSR: The ARM industry is one of the most labor-intensive industries in the world. It is also the sector in which modern slavery[4] and CSR problems deserve close examinations. One key challenge behind the proper management in having an ethical apparel supply chain is the lack of transparency. Thus, the use of technologies, such as blockchain-based systems, would be able to enhance product provenance information. As a result, all supply chain stakeholders, governments as well as consumers, will be able to see through the apparel supply chain. This will effectively improve CSR and fight against the modern slavery problem. More research can be conducted on the value of this type of information transparency systems as well as the corresponding effectiveness.

New normal: COVID-19 pandemic is basically over. In the new normal, various challenges emerge. How digital technologies play a role to support business operations in the ARM industry is a pertinent issue. Important topics include the following:

1) the proper use of data analytics tools, especially social media analytics [6], for ARM;
2) the technology acceptance models for data analytics by apparel companies [4];
3) the project management schemes to effectively implement new technologies while facing business downturn in the postpandemic era.

Industry 5.0: The AMR industry has actively engaged in many intelligent production and operations systems with various popular technologies. One challenge, unfortunately, arises, which points to the conflicts between humans and machines. This issue is especially important for the AMR industry because of its highly labor-intensive nature. To address this key challenge, the concept of Industry 5.0 [7] is proposed in which humans and machines need to find a way to establish a harmonic working

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[1]Accessed: Oct. 29, 2022. [Online]. Available: https://www.tycoonstory.com/technology/technology-trends-revolutionizing-the-fashion-industry-in-2022/

[2]Accessed: Oct. 29, 2022. [Online]. Available: https://www.mckinsey.com/industries/retail/our-insights/state-of-fashion-technology-report-2022

[3]Accessed: Oct. 29, 2022. [Online]. Available: https://www.retaileconomics.co.uk/retail-insights-trends/covid-19-impact-&-shift-to-online-retail-apparel-EU

[4]Accessed: Oct. 29, 2022. [Online]. Available: https://www.unseenuk.org/modern-slavery-in-fashion/

TABLE I
SUMMARY OF THE PAPERS FEATURED IN THE SPECIAL SECTION

Type	Paper title
Review	Analytics Applications in Fashion Supply Chain Management– A Review of Literature and Practice
Analytical studies	Production Sourcing Strategy for an Apparel Original Brand Manufacturer in the Presence of Technology Spillover
	Demand Learning Through Social Media Exposure in the Luxury Fashion Industry: See Now Buy Now vs. See Now Buy Later
	Applications of Blockchain Technology in Sustainable Fashion Supply Chains: Operational Transparency and Environmental Efforts
	Small Apparel Retailer's Procurement Outsourcing Under Weather-Related Demand Uncertainty
	Value of Initial Coin Offerings in the Fashion Industry
Empirical and Data Analytics	Shopping Hard or Hardly Shopping: Revealing Consumer Segments Using Clickstream Data
	The Impact of Information Technology Investment on the Performance of Apparel Manufacturing Enterprises: Based on the Moderating Effect of Equity Concentration
	A Semi Supervised Approach for Data Driven and Consumer Oriented Sizing System in the Clothing Industry

environment and achieve "human–machine reconcile" [3]. This is a very timely and new area, which deserves deeper explorations in the future.

Multimethod studies: Among the featured papers, we observe that multiple methods have been applied separately. To improve research rigor, it is desirable to include multiple research methods [8] together in a single study. This will lift the study to be more scientifically solid.

Before we stop, we would like to express our sincerely thanks to the Editor-in-Chief, Professor Tugrul Daim, for his big support for our organization of this meaningful Special Section in IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT. We are also indebted to all the authors for their fine contributions to the Special Section. We also thank all the reviewers for their critical, timely and helpful comments. Last but not least, we thank all readers and hope they will enjoy this Special Section!

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[4] N. Rahman, T. Daim, and N. Basoglu, "Exploring the factors influencing Big Data technology acceptance," *IEEE Trans. Eng. Manage.*, to be published, doi: 10.1109/TEM.2021.3066153.

[5] T. M. Choi and S. P. Sethi, "Innovative service operations for survivals of SMEs under COVID-19: Two cases in Hong Kong," *IEEE Eng. Manage. Rev.*, vol. 49, no. 1, pp. 50–54, Jan.–Mar. 2021.

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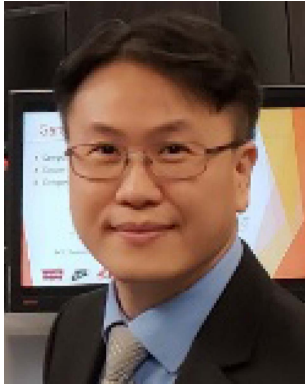
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