The Technological Forecasting and Social Change editorial

Impacts and investigations of disruptive technologies for Industry 4.0

We live in an information age where massive amounts of data are being produced to improve our daily lives. Trillions of data and messages can be generated and exchanged daily. Therefore, high computational demands are required to extract and understand the important messages hidden within the data and service interactions enabled by disruptive technologies, which is a collective term to refer to technologies behind Industry 4.0 to offer innovation and enable us to change the way we work. The paper from Abdel-Basset et al. (2020) has explained what disruptive technologies are, what they can offer in emergency situations such as COVID-19, and how the COVID-19 diagnosis and analyses can be improved and become better by the use of disruptive technologies.

The advancement and wide adoption of disruptive technologies can allow all businesses, cities and societies to be competitive and progressive. Disruptive technologies are necessary to improve the speed, efficiency, effectiveness, quality, and safety of real-time data analysis and meet user expectations. Disruptive technologies for Industry 4.0 can address new needs of individuals, businesses and society. They often include innovative products and services never used before. The right type of dissemination and strategies can lead to a rapid rise in popularity and adoption. Therefore, investigating disruptive technologies and understanding their impact on Industry 4.0 has become strategically important.

Disruptive technologies can offer a great extent of innovation to integrate different services seamlessly and improve the quality, effectiveness, efficiency and safety of services. High-tech services, seen in fictional movies 30-50 years ago, are now possible and available in real life. This includes the wide use of the internet on smartphones, smart devices and services such as smart homes, smart hospitals, and smart cities enabled by destructive technologies in Industry 4.0. At the same time, knowing and implementing the most up-to-date recommendations, best practices and lessons learned for developing real-world solutions have become important when making progress in Industry 4.0. In summary, disruptive technologies can be crucial to improving the quality of life, regional economy, and interactions between different communities to provide incentives and improvement to our quality of life and Industry 4.0 development moving towards the 5.0 era.

This special issue is targeted at disruptive technologies for Industry 4.0. Best paper winners and top authors from FEMIB 2020 http://femib.scitevents.org/ (Online Streaming, 5-6 May 2021) and IIoTBDSC 2020 http://iiotbdsc.com/ (Online streaming, 15-17 September 2020) have been invited. We also very welcome all the authors of unpublished work and high-quality outputs to submit.

Paper selection:

We seek the papers demonstrating **theoretical and practical contributions, solutions and real use cases** for industry 4.0. Real-world examples and demonstrations of real-world solutions are welcome, particularly investigations of its impacts, current status, futuristic and advanced services are required. Please note that TFSC is not a technical computing science journal and it is essential that authors know the types of content suitable for TFSC. These can be known as important destructive technologies for Industry 4.0 related to the following areas. We selected papers based on quality, relevance, research contributions, written English and novelty. They are summed up as follows.

Measuring the perceived benefits of implementing blockchain technology in the banking sector

The adoption of Blockchain technology within the banking ecosystem is changing the way companies manage their business. This technology offers solutions to enhance both security and efficiency. Garg *et al.* (2021), in the article "Measuring the perceived benefits of implementing blockchain technology in the banking sector", provides a foundational view linking the needs to the potentials advantages of using blockchain solutions. This research also provides the banks with a better understanding of how they can optimize the cost for implementing such technology. Finally, by adopting blockchain, the banking sector can propose services to their customers that can be improved and increase satisfaction by offering satisfying quick and transparent services.

An ethical framework for big data and smart cities

The advent of disruptive technologies raised emerging issues such as the potential ethical challenges regarding the data analytics applications applied, for example, to smart cities. The paper from Chang (2021) on "Ethical framework for big data and smart cities" addresses these ethical concerns highlighted through the analysis of six smart cities with a focus on public transportation systems. An ethical framework is proposed for Big Data analytics and Smart cities management to raise public and government awareness by synthesizing benefits and risks driven such as individual privacy, data integrity and social equity. In comparison, policymakers should prevent risks by boosting the pace of legislation on these emerging topics to reinforce their ethical practices and policies and reinsure individuals on sensitive data management.

Do news media and citizens have the same agenda on COVID-19? an empirical comparison of twitter posts

Social media has already been shown to be a disruptive technology. Big data analytic adds to this disruption of social media by providing insights into how news organizations' posts influence the content of subsequent posts by citizens. The article "Do news media and citizens have the same agenda on COVID-19? An empirical comparison of twitter posts" by Han *et al.* explores how official news outlets, using social media, present breaking news about COVID-19 how this influences the response of citizens. The article reveals that there is a distinct difference between the two groups. The news outlets are reporting facts and the citizens are focused on personal feelings, with only a few topics in common, demonstrating the agendas of the two groups are not a good match. This research can provide official news outlets insights into strategies for using social media to engage with citizens.

The impact of transparent money flows: Effects of stablecoin transfers on the returns and trading volume of Bitcoin

Digital currencies such as stablecoin, attached to non-volatile values such as fiat currency, provide transparency as all the transactions are registered on a public blockchain. Ante, Fiedler and Strehle (2021), in their article on "The impact of transparent money flows: Effects of stablecoin transfers on the returns and trading volume of Bitcoin," suggest that stablecoins can enhance market efficiency by influencing the trading volume and cryptocurrency returns, within financial markets. Indeed, significant positive abnormal trading volume and abnormal returns have been highlighted. By proposing traceability and disclosure in real-time, the cryptocurrency market can better understand previous or future market events than traditional markets.

Augmented reality is human-like: How the humanizing experience inspires destination brand love

Marketing green tourist destinations and making that emotional connection to that destination through humanizing the experience has been difficult during the pandemic. Disruptive technologies, such as Augmented Reality, have come to the forefront during this time. The journal article "Augmented reality is human-like: How the humanizing experience inspires destination brand love" by Huang *et al*. has provided a solution to this problem through humanizing the digital experience. These aspects of humanization identified in the article can guide the creation of a digital experience using emerging disruptive technologies. The results presented in this article can be used by the traditional tourism industry to meet its digital transformation goals through the use of disruptive technology. The technology provides the potential tourist with a more intimate interactive experience with the green destination, increasing the love for the brand. This allows the digital tourism industry to shape green destination brand love in contactless ways during a pandemic.

A sustainable Blockchain framework for the halal food supply chain: Lessons from Malaysia

The use of blockchain technologies has the potential to be disruptive in the way that the information in the food supply chain is managed, especially in its ability to provide transparency and immutable traceability for food safety. The journal article "A sustainable Blockchain framework for the halal food supply chain: Lessons from Malaysia" by Ali *et al*. explores some of the issues surrounding the adoption and implementation of blockchain technologies by Small and Medium Size Enterprises in a halal food supply chain. The article presents a framework of challenges faced by SMEs when implementing blockchain technologies into the supply chain. As well as the changes, the articles also present the key enablers and practical implications of using disruptive technologies in the food supply chain, such as blockchain technologies.

Mutli-layered coding based study on optimization algorithms for automobile production logistics scheduling

In order to stay competitive and enhance efficiency, the Automotive manufacturing industry must always improve their processes, especially in the production and management domains, moving to factory 4.0 by using disruptive technologies (Artificial Intelligence, Internet of Things, .etc.) The identification, analysis and resolution of production/logistic schedule issues remain essential to limit production costs. Indeed, companies must quickly find relevant solutions by, at the same time, reducing completion time and minimizing the equipment and total workloads. In their study Yue, Tailai and Dan (2021) aim to present solutions to optimize multi-objectives and propose mathematical models developed and calculated by a generic algorithm to answer issues raised. Indeed, the multi-layered coding algorithm combined with disruptive technologies can enhance the performances.

Product innovation in entrepreneurial firms: How business model design influences disruptive and adoptive innovation

If entrepreneurial organizations are to experience the growth and increased profits from using disruptive technologies in their products and services, they often are required to develop a new business model. Blockchain technology is such a disruptive technology if supported by an appropriate business model. The journal article "*Product innovation in entrepreneurial firms: How business model design influences disruptive and adoptive innovation*" by Zheng *et al*. examines the relationship between the novel business model and disruptive product innovation. The article highlights the link between disruptive product innovation and business model designs and the conditions surrounding

such designs. This journal article illustrates that an entrepreneurial organization can effectively use distributive technologies in product adoption through an appropriate business model, such as blockchain technologies. It also demonstrates the importance of combining the resource-based views and transaction cost logics in product development.

Research on collaborative recommendation of dynamic medical services based on cloud platforms in the industrial interconnection environment

Increasingly the medical industry must face issues regarding the reduction of the efficiency of information resource flow when businesses are interconnected. Indeed they must face a lag regarding the medical resource recommendation time. The article "Research on collaborative recommendation of dynamic medical services based on cloud platforms in the industrial interconnection environment" by Jianjia, Gang, Xiajun and Tingting (2021) propose, using a theoretical mathematical model, to implement industrial interconnection nodes, to share resources and construct dynamic multi-service resources within the medical supply chain. The implementation of such a solution could reduce operating costs and enhance efficiency in the case of industrial interconnections. Nevertheless, the ethical side must be considered to avoid problems such as economic losses and a threat to life or individual safety in a worthy cause.

Prior Knowledge, Industry 4.0 and Digital Servitization. An Inductive Framework

The present article investigates the roles and impact of a company's prior technological knowledge on digital servitization strategies. The focused literature review demonstrated that, in general, research into the influence of prior experience on the implementation of I4.0 technologies for developing service-oriented business models is rather scarce. We would like to fill this gap in the current research and investigate how companies capitalize on their previous relevant experience, including technological preparedness and prior customer knowledge. Their research is based on multiple case studies. After collecting primary and secondary data, the authors analyzed business models of four Italian medium-to-large-sized enterprises that implemented digital servitization recently. The findings describe different impacts of the adopted technological solutions on the companies' business models. Authors propose an inductive matrix presenting four ideal-typical different business models: expert industrializer, explorative 'solutioner', explorative industrializer and expert 'solutioner', resulting from the analysis.

Is Bitcoin Rooted in Confidence? – Unraveling the Determinants of Globalized Digital Currencies

The adoption of Bitcoin, cryptocurrency considered as a disruptive technology, is directly linked to the level of confidence, trust and the perceived security of users. The public valuation of such currency depends on the user community perception and motivations (Utilitarian or speculative). Several research papers highlight the influence of sentiments or feelings on Bitcoin price. However, the literature on the measurement of sentiments and their impacts over time is incomplete. Gaies, Sahbi Nakhi, Sahut and Guesmi (2021), in their article, aim to fill the gap by identifying the determinants of Bitcoin price. Their findings confirm the relevance of the Bitcoin Mystery Index (BMI), mobilize as a sentiment indicator, measure the impact of sentiments on the bitcoin price, and predict potential fluctuation. Nevertheless, this impact seems to be asymmetric as negative shocks have less impact than positive one in the short run and the opposite result was found in the long run.

The Spatial Neural Network Model with Disruptive Technology for Property Appraisal in Real Estate Industry

The valuation of real estate is a complex economic activity, as the valuation is based on a number of factors. The factor that significantly influences the evaluation is the facilities surrounding the real estate being evaluated. Identifying these facilities is traditionally achieved using official records, which may not be up to date or even just missing. The article "Spatial Neural Network, Real Estate Valuation, Spatial Information, Class Activation Mapping, Disruptive Technology, Deep-Automated Optical Inspection (AOI)" by Regina Fang-Ying Lin et al. looks to use spatially related information to distribute the current approach. The authors have described the weakness of current approaches and proposed and evaluated a solution to automate real estate valuation.

Curvature-based Feature Selection with Application in Classifying Electronic Health Records

In many parts of the world, patient records are now being stored on Electronic Health Records (EHRs) systems. EHRs provide some structure in the way the data is collected (controlled fields), but the content is highly unstructured, with missing values, redundancy in the data being recorded, which leads to a data set that is imbalanced, inherent heterogeneity and high-dimensional. While they provide many advantages to the individual patient, EHRs also provide the medical researcher with a readily available data set, consisting of many hundreds and thousands of individual EHRs, which is disrupting the speed at which research on patient care can be conducted. Research of this nature also brings ethical consideration to the fore, not least the confidentiality of the patient. In their paper on "Curvature-based Feature Selection with Application in Classifying Electronic Health Records, "they present a novel filter-based feature selection method, CFS, that can be used for classification performance of clinical (EHR) data sets. The work was evaluated using four well-known data sets and compared against several similar techniques and was shown to give the best performance overall.

Triggering disruptive technology absorptive capacity by CIOs. Explorative research on a micro-foundation lens

Authored by Scuotto, Magni, Palladino and Nicotra (2021), the article entitled "Triggering disruptive technology absorptive capacity by CIOs" explores the effective use of disruptive technologies by individual technology absorptive capacity (TAC) in the industry 4.0 arena. Such TAC is led by chief information officers (CIOs) who took part in the empirical analysis of the present study. By adopting a micro-foundation lens, the study provides a quantitative analysis of a large-scale sample of 754 CIOs of knowledge-intensive SMEs drawn from the World Bank Enterprise Survey. As it emerged, a CIO has a double role in intercepting the suitable disruptive technologies for a business and augmenting investments in research and development within SMEs. In this sense, the article enhances the management literature on disruptive technology and offers practical implications in showing the effective role of the CIO to better exploit such technologies either at individual or organizational levels.

Future directions for disruptive technologies

As disruptive technologies can play an important role in our day-to-day activities, they will have significant impacts on people and societies. Based on observations from the guest editor team and selected authors, we have the following insights as follows.

Integrated forms of disruptive technologies in a growing number of sectors and services – As there are more services offered by Artificial Intelligence (AI), Internet of Things (IoT), Big Data and Blockchain, the integrated forms of such services will be more available and pervasive to our day-to-day lives. What has happened between the Year 2019 and 2021 - the main difference includes the frequent use

of remote meeting tools and remote working. The integrated forms of disruptive technologies can enhance the quality of remote meetings and working efficiency.

More adoption in a growing number of sectors – As all the selected groups of authors have demonstrated, disruptive technologies have been used extensively in banking, manufacturing, healthcare, real estate, food, automobile, SMEs, tourism, smart cities and business sectors. They will be increasingly used with growing levels of importance across different sectors.

The possibility of revolutionizing digital transformation - More services and data can be integrated to produce greater impacts and benefits. This is particularly true for smart cities, where transportation, healthcare, financial and education data can be linked and may provide more services and greater capabilities than a single service that disruptive technologies offer. Predictive modeling has increased their overall quality and accuracy. Services can be offered in real-time. Therefore, all these existing and new approaches can provide a pathway for revolutionizing digital transformation.

Challenges of using disruptive technologies – Challenges such as the ethics of handling sensitive data should be closely aligned with the regional data protection legislation. Privacy and security for both users and data should be greatly enhanced and integrated with disruptive technologies.

Conclusion

All the selected papers have ensured a high quality of academic rigor and justifiable contributions satisfying the requirements of the journal and the vigorous peer-review process. We are grateful for the opportunities to serve the TFSC community and will be delighted to serve the community again in the near future. We particularly thank former Editor-in-Chief, two new Editors-in-Chief, special content Associate Editor, journal manager, reviewers and all contributors to make our special issue happen.

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