

Unleashing the Potential of Industry 4.0: Analyzing Pakistan's Tourism in the Global Arena

 Mehar Tahir Farid¹

 Munazza Rashid²

 Kiran Manzoor³

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Abstract

Research on Pakistan's Tourism Development has increased in recent years. Nevertheless, there is a scarcity of quantitative investigations on Pakistan's tourism development for many reasons, including a need for more infrastructure and incorporation of the digital Industry. However, in recent years, many research publications in this area, a bibliometric analysis of 500 publications collected from the Scopus database. Biblioshiny and RStudio software tools were used for descriptive and network analyses. Regarding publications and citations, Sustainability and Journal of Cleaner Production have earned the top rankings among journals. China currently holds the leading position in both Industry 4.0 and tourism. University Utara Malaysia has published 22 articles and maintains its dominance in this field. From 2015 to 2023, Fig. 11 shows that China and Pakistan have emerged as the frontrunners in research article publications related to Tourism and Industry 4.0. Pakistan shares the second position with Saudi Arabia, having a significant number of publications. The research results showed that the overall publication trend in this domain increased. According to the World Tourism Organization's report, the number of international tourists who reached their destinations in 2019 reached 1.5 billion, reflecting 4%. The tourism industry played a substantial role in the worldwide economy during the year 2018, constituting 10.4% of the global Gross Domestic Product (GDP) and generating job opportunities for an estimated 319 million people across the globe. Pakistan can potentially improve its digital marketing efforts, incorporate virtual and augmented reality experiences, establish intelligent tourism infrastructure, and promote contactless payments and digital services as per the analysis. Moreover, leverage data analytics for personalized marketing, and prioritize sustainability by analyzing the strategies implemented by countries like Singapore, the United Arab Emirates, and Japan. The adoption of cutting-

¹Department of Knowledge Research Support & Services, University of Management and Technology, Lahore, Pakistan

Corresponding Author: Mehar.farid@umt.edu.pk

²University of Home Economics, Lahore

³NFC Institute of Engineering and Technology



edge technologies has the potential to establish Pakistan as a prominent tourism destination, leading to the promotion of economic growth and societal advancement. The study will contribute toward a better understanding of the existing tourism in Pakistan and its impact on the economy of Pakistan. By researching and exploring, we have concluded that the adoption of cutting-edge technologies has the potential to establish Pakistan as a prominent tourism destination, promoting economic growth and societal advancement.

Keywords: Tourism, Industry 4.0, Pakistan, Global World, Challenges, Opportunities

1 Introduction

The term "Industry 4.0," often known as the "fourth industrial revolution," describes incorporating digital technologies into traditional production and operating procedures (Koh et al., [2019](#); Petrillo et al., [2018](#)). Industry 4.0, aka the "4th industrial revolution", is referring to the digital world entering and shaping standard manufacturing and operational processes (Miah et al., [2024](#)). The utilization of this technology within the tourism sector holds promise for augmenting customer satisfaction and optimizing operational efficacy (Buhalis, [2020](#)). The modern revolution is distinguished by the emergence of innovative production facilities and intelligent logistics networks, resulting in heightened efficiency, productivity, and quality in the manufacturing process (Kolasani, [2024](#); Zhong et al., [2017](#)). Industry 4.0 has significantly disrupted conventional business models, prompting a fundamental restructuring of firms' operational methodologies. Consequently, these entities have acquired an increased competitive edge in the global market (Roblek et al., [2021](#); Schmidt et al., [2021](#)).

It is 2013 bounding tourism for the future to be used as part of the strategy to bring about customer satisfaction and better operations. The evolution revolves around novel production sites featuring smart logistics becoming the standard and resulting in increased efficiency, yield and quality in industry (Alsulaimani & Islam, [2022](#)). We now live in a world where Industry 4.0, a phrase that refers to automated systems and manufacturing processes, has been coined to describe new technologies and processes (Frank et al., [2019](#)). These disrupt traditional business models but allow enterprises to outperform competitors in the world market (Olabode et al., [2022](#)). Industry 4.0 has the potential to enhance the tourism industry by utilizing data analytics, artificial intelligence, (Bilotta et al., [2022](#)) and the Internet of Things to facilitate improved decision-making, process optimization, and the provision of personalized services. The amalgamation of intelligent products, advanced manufacturing techniques, and inventive services within Industry 4.0. Integrating intelligent products, smart manufacturing, and innovative services within the framework of Industry 4.0 can facilitate the development of a more interconnected and efficient tourism ecosystem (Gomes et al., [2024](#)). Innovative products, including wearable technology and intelligent luggage, can gather customer data and offer customized recommendations (Nayak et al., [2019](#)). The implementation of innovative manufacturing techniques has the potential to enhance production process efficiency and quality. Additionally, innovative services, such as augmented and virtual reality experiences, can augment customer engagement and satisfaction (Buhalis, [2020](#)).

The impact of the fourth industrial revolution on the tourism sector has been significant (Pencarelli, [2020](#)). The present industry is undergoing a swift surge in demand, ascribed to the proliferation of the worldwide middle class and the escalating prominence of air transportation. The preceding occurrence has resulted in the emergence of innovative tourist spots, the expansion of the mutually beneficial consumption framework, and the adoption of advanced technologies that boost the standard of the tourist experience. According to the World Tourism Organization's report, the number of international tourists who reached their destinations in 2019 reached 1.5

billion, reflecting a 4% increase from the previous year (Kumar & Nafi, 2020). The tourism industry in Pakistan demonstrates the considerable potential to leverage the opportunities presented by Industry 4.0 (Rahman et al., 2022). However, the industry faces significant competitive, infrastructure, and sustainability challenges. Pakistan has undergone a complex historical trajectory that has given rise to political instability, concerns regarding security, and economic obstacles (Akram, 2023). Despite this, the country boasts a noteworthy cultural heritage, diverse geographical features, and notable historical landmarks that offer substantial prospects for the tourism sector (Sánchez-Martín et al., 2020). Industry 4.0 also presents opportunities for tourism businesses to innovate and differentiate themselves in an increasingly competitive market while improving sustainability and reducing environmental impact (Buhalis, 2020). The government of Pakistan has recognized the importance of promoting the tourism industry and has implemented strategies to facilitate the development of this sector (Manzoor et al., 2019). Even with the potential advantages, the integration of Industry 4.0 in the tourism industry is accompanied by certain disadvantages (Sony, 2020). These include the need for significant investment in new technologies and infrastructure and the potential for job displacement as automation and robotics become more prevalent (Fuchs et al., 2019). The financial consequences of tourism have been noteworthy in numerous countries globally.

The socio-economic sector is the third largest sector, contributing around 9% to the global economy's Gross Domestic Product (GDP) (Alaloul et al., 2021). Empirical evidence suggests that the tourism sector positively impacts diverse aspects of society, such as fostering capital inflows, creating avenues for employment, encouraging business innovation, and maintaining cultural patrimony and customary norms (Khanal et al., 2022). The tourism industry faces notable challenges in developing nations, specifically in Pakistan. The main aim of this study is to examine the various factors that influence the tourism industry and highlight the correlation between tourism and economic development in Pakistan (Khan et al., 2022). The objective of researching shifting the tourism sector of Pakistan towards Industry 4.0 is based on the opportunities that the field provides and the unmatched chances this industrial system holds, with its glorious cultural heritage and a variety of stunning landscapes waiting to be explored. However, Pakistan's tourism industry has been underdeveloped due to political instability and security concerns (Arshad et al., 2018). This study aims to provide a holistic exploration of how Industry 4.0 can serve as an influential change agent for a thriving tourism sector that can survive this period of turmoil. The emphasis on Pakistan is also suitable given that the country is exerting efforts to promote safety and stability; therefore, it can serve as a point to exploit the potential benefits of digital transformation.

This paper looks at how, as posited by Jagatheesaperumal et al. (2022), Industry 4.0 technologies derived from data analytics, artificial intelligence, and the Internet of Things can be used to achieve more effective and more efficient decision-making processes, better optimization, and customer satisfaction in the tourism industry. Such technologies have everything to make a global and well-connected tourism infrastructure in Pakistan, mentioned in self-sustained products used in wearable technologies and intelligent luggage that can elevate the experience of a person who travels through specialty services. The repercussions of this investigation are ultimately worldwide, with the conclusions guiding the creation of analogous adaptations in other ingredients sharing the same geopolitical and economic landscape. This research focuses on recent studies and developments to provide a novel take on Industry 4.0 integration in emerging tourism markets (Harish & Thomas, 2023), thereby contributing to the knowledge base in the field. The study aims to identify the targeted sectoral coverage, pinpoint the technological and plan the implementation process of these interventions, and gauge their economic and social impact outcomes. By the end of the study, we look forward to uncovering the pitfalls and victories of Industry 4.0 technological adoption in our tourism sector and how local and international travelers, traders, artisans, and local

community members can benefit from such technological advancement.

2 Theoretical Background

Industry 4.0, so worthy of the mark "digital, physical, and biological systems fusion" status, is the beginning of the future of human industries, as it is the milestone for industry changes (Kalsoom et al., [2021](#)). Industry 4.0 is associated with emerging technologies such as AI, IoT, robotics, big data, and cloud computing, which essentially lead the way forward (Javaid et al., [2022](#)). More and more of those technologies are appearing, creating highly productive, readily adaptable, and individually tailored intelligent manufacturing plants and logistic chains is more than possible. More and more frequently, they amplify organizational performance by accepting and processing large amounts of data, thereby providing more accurate guidance and capabilities for the application of predictive analytics (Bahrin et al., [2016](#)).

With the era of development of the digital industry, the Internet of Things (IoT) and big data driven by Industry 4.0 enhance the tourist experience and operational efficiency of companies involved in the tourism industry (Rosário & Dias, [2024](#)). The development of virtual reality (VR) and augmented reality (AR) enables customers to enjoy vivid virtual environments, which are simulations of traveling physically to destinations before the actual trip. Online travel agencies (OTAs) have grown in popularity fast. Access to travel-related information and the burgeoning booking world has been diversified, and services are personalized. This would seem unattainable in the traditional travel service paradigm, where options were simple and reserved for the rich (Adedoyin et al., [2020](#)). To underpin the principle of technological advancement within a theoretical framework, this paper uses the Diffusion of Innovations theory, which explains how and at which rate a new idea, product, and service diffuses through cultures. In an attempt to contextualize this theory as relevant to the adopting of Industry 4.0 within the context of the tourism sector as given by (Dibra, [2023](#)), the study gets into the detail of the variables responsible for the uptake of new technologies and this, in turn, causes changes in the sector.

One of the reasons for integrating Industry 4.0 and the tourism industry exemplifies some significant outcomes that are the primary drivers of the world's output (Ramos & Brito, [2020](#)). In 2018, the World Tourism Organization reported that tourism made up about 10.4% of the global GDP and provided jobs for about 319 million people worldwide, recorded by Sävan et al. ([2020](#)). The sector is altered with the application of technology, as reflected by the rise in global tourist arrivals as compared to 1999, which then increased from 674 million to 1.5 billion in 2019; the Asia Pacific region enjoys the highest growth rate in comparison to the rest of the world (Zhang & Liu, [2019](#)). Devoting its attention to Pakistan, the World Tourism Organization said there are an additional 200 thousand from last year, around 1.9 million people in 2019 visited Pakistan (Torres et al., [2021](#)). As opposed to India and Sri Lanka, the figures from Pakistan are quite small making clear the difficulties to overcome and underutilized possibility by the country's tourism. The World Travel and Tourism Council opined that the travel and tourism industry directly contributed Rs.1.4 trillion to the national GDP in 2020, which was a negative impact from the previous years, and this downfall was largely due to the Covid-19 pandemic (Kulkarni et al., [2022](#)).

This component introduces the relevant theoretical framework and empirical study findings and examines the possibilities and bottlenecks of integrating Industry 4.0 in the tourism sector, specifically in developing economies like Pakistan. Along the way, the obstacles to application, which are the direct consequences of the failures in digital infrastructure and the disparities in economic levels and the society as a whole, require a big capitalization in digital infrastructure and a deeper education among the officials of the matter to fully take advantage of the leading trending technologies (Vermesan & Friess, [2022](#)). Putting more and more money and time into this issue and spreading knowledge about digital potential will benefit the tourism industry not only in Pakistan but also in the whole world. ***Tourists visited Pakistan from 2017 to 2022.***

Pakistan has immense tourism potential, with its diverse landscapes, rich cultural heritage, and warm hospitality. The country has been promoting tourism and improving its infrastructure to attract more visitors. The number of tourists visiting Pakistan has steadily increased but due to Covid-19 a hell of difference came in the overall world. However, the outbreak of COVID-19 in 2020 has severely impacted the global tourism industry, and Pakistan was no exception. The number of tourists visiting Pakistan in 2020 was lower than in the previous year, and the trend continued in 2021. COVID-19 not only hit the tourists but also affected our GDP in this span of time because due to tourism Pakistan earns a lot of income. See, the Information is given below:

Pakistan Key Data		
2019	2020	2021
Total contribution of Travel & Tourism to GDP:		
 5.8% of Total Economy PKR 3,051.4BN (USD 18,727.7MN)	3.9% of Total Economy PKR 2,020.4BN (USD 12,400.0MN) Change: -33.8% Economy change: -1.3%	3.7% of Total Economy PKR 2,080.6BN (USD 12,769.5MN) Change: +3.0% Economy change: +6.0%
Total contribution of Travel & Tourism to Employment:		
 3.89MN 6.1% of total jobs	3.36MN 5.2% of total jobs Change: -13.7%	3.34MN 5.1% of total jobs Change: -0.5%
Visitor Spend:		
International:		
 PKR 178.5 BN 3.6% of total exports (USD 1,095.2MN)	PKR 134.8 BN 2.8% of total exports (USD 827.5MN) Change: -24.4%	PKR 138.8 BN 2.9% of total exports (USD 852.1MN) Change: +3.0%
Domestic:		
 PKR 2,134.5 BN (USD 13,100.2MN)	PKR 1,292.5 BN (USD 7,932.4MN) Change: -39.4%	PKR 1,396.2 BN (USD 8,568.8MN) Change: +8.0%

Figure 1: Pakistan Key data regarding Industry 4.0

The pandemic has brought significant challenges for the tourism industry worldwide, including Pakistan, and has highlighted the need for a more sustainable and resilient tourism model.

Despite the challenges posed by the pandemic, Pakistan can still leverage its tourism potential by investing in innovative solutions, promoting domestic tourism, and adopting sustainable tourism practices. The government has taken several initiatives to support the tourism industry, such as promoting tourism through digital platforms, improving tourism infrastructure, and providing incentives to tour operators and investors. In conclusion, Pakistan's tourism industry has significant potential, and the country can take advantage of it by adopting innovative solutions and sustainable practices. While the pandemic has brought challenges to the industry, it also presents an opportunity to transform and build a more resilient tourism sector. The country faces several challenges concerning competitiveness, infrastructure, and sustainability, which have hindered the industry's growth potential.

2.1 Competitiveness

Pakistan's tourism sector faces significant competitive challenges, which hinder its ability to realize its full potential. Per the Travel and Tourism Competitiveness Index (TTCI) formulated by the World Economic Forum, Pakistan has secured the 122nd position among 140 nations regarding its competitiveness within the travel and tourism industry. The country's unfavorable ranking can primarily be ascribed to its insufficient infrastructure, transportation networks, aviation facilities, and accommodations. Pakistan must overcome security challenges that have deterred international tourists from visiting the country (TTCI, [2013](#)).

2.2 Infrastructure

The development and progress of the tourism sector rely on appropriate infrastructure that enables

easy access to tourist destinations and elevates the overall quality of tourists' experiences. Pakistan's tourism sector faces a challenge due to inadequate infrastructure, as indicated by deficient road networks, limited air connectivity, and a shortage of high-quality lodging facilities. Inadequate infrastructure has led to an unfavorable visitor experience, characterized by extra travel times, inadequate sanitation conditions, and limited access to amenities, among other difficulties for tourists (Arshad et al., [2018](#)).

2.3 Sustainability

The tourism sector is increasingly prioritizing sustainability in response to the heightened consciousness among tourists regarding the environmental impact of their travel decisions. Pakistan's tourism sector faces sustainability challenges in preserving natural resources and maintaining cultural heritage. The industrial sector has been scrutinized due to its contribution to environmental deterioration and negative impact on adjacent communities (Manzoor et al., [2019](#)). Developing innovative services in Pakistan's tourism industry presents a noteworthy obstacle. At the outset, there needs to be more infrastructure and technological advancements essential for implementing intelligent products, advanced manufacturing, and innovative services. The tourism industry in Pakistan primarily depends on traditional methods and exhibits a limited focus on incorporating advanced technologies. In addition, adopting these technologies may be significantly hindered due to the financial costs involved. The tourism industry in Pakistan is primarily governed by small and medium-sized enterprises, which may face financial constraints when investing in technological advancements. Furthermore, a lack of knowledge and understanding regarding the potential benefits of innovative services might hinder their incorporation. Additionally, the sociocultural factors in Pakistan may hinder incorporating innovative services in the tourism industry. Adopting specific technologies, such as augmented and virtual reality, may encounter opposition related to the traditional values deeply embedded in society. Despite these challenges, Pakistan's tourism industry has great potential to benefit from the opportunities presented by Industry 4.0. Adopting innovative technologies can help overcome some of the challenges faced by the industry, enhancing competitiveness, improving infrastructure, and promoting sustainability. For example, the use of IoT sensors can facilitate the efficient management of tourist flows and the optimization of resource utilization. Digital platforms can also enhance the tourist experience by providing personalized recommendations and enabling seamless booking and payment processes.

2.4 Potential of Innovative Industry by Analyzing the World's Tourism Industry

The fourth industrial revolution's incorporation of technological advancement and cutting-edge innovations offers substantial prospects for the tourism industry to augment its growth, efficiency, and dedication to tourists. By examining the integration of Industry 4.0 principles within the tourism industry across various nations, significant knowledge can be acquired about the advantages of these advanced technologies. This analysis aims to comprehensively examine the growth of tourism industries in diverse regions, emphasizing statistical data.

The United States presents a diverse array of tourism opportunities that attract visitors from different regions of the world—according to the 2020 report of the World Tourism Organization, the United States experienced the arrival of approximately 79.3 million international tourists in 2019, resulting in a 2.9% contribution to the country's Gross Domestic Product. Incorporating Industry 4.0 technologies, particularly augmented reality (AR) and data analytics, has facilitated the development of immersive attractions and the delivery of customized travel suggestions (Buckley, [2020](#)).

China has become a notable player in the global tourism industry. The World Tourism Organization (2020) reports that China's GDP received a boost of 11.4% from the approximately 65.7 million international tourist arrivals in 2019. China has implemented Industry 4.0 technologies, such as artificial intelligence (AI) and facial recognition systems, to enhance

security measures and provide tailored services to visitors (Zhang et al., [2019](#)). Singapore has become a prominent participant in intelligent tourism, utilizing advanced technologies to offer visitors a smooth and convenient experience. The nation's tourism industry has experienced substantial expansion. 2019 Singapore recorded 19.1 million international tourist arrivals, representing a 3.3% increase from the previous year. The observed expansion can be partially ascribed to adopting Industry 4.0 technologies, which have effectively optimized operational efficacy and augmented the visitor experience holistically. (Han et al., [2020](#)). The United Kingdom's rich historical heritage, iconic landmarks, and varied cultural celebrations make it a popular tourist destination. As per the World Tourism Organization report in 2020, the United Kingdom witnessed an influx of approximately 40.9 million international tourists in 2019, thereby making a 3.9% contribution to the nation's Gross Domestic Product. The United Kingdom is implementing Industry 4.0 technologies to enable immersive storytelling at historical sites by utilizing augmented reality and location-based services. This approach aims to augment visitor understanding of historical events (Sertkan et al., [2020](#)).

The tourism industry in the United Arab Emirates, specifically in Dubai, has undergone significant changes due to the implementation of digitalization and automation approaches, resulting in substantial financial investments. The endeavors mentioned above have produced noteworthy outcomes. As per the statistical data published by the Dubai Department of Tourism and Commerce Marketing, the number of visitors who stayed overnight in Dubai surpassed 16.73 million in 2019, indicating a 5.1% rise compared to the preceding year. Implementing Industry 4.0 technologies has facilitated the expansion of the tourism industry by providing streamlined services and distinctive opportunities for travelers (Arzaghi et al., [2023](#)). Integrating advanced technologies has facilitated substantial growth in Japan's tourism industry. The year 2019 witnessed a remarkable surge of 31.88 million foreign tourists in Japan, indicating a significant rise of 2.2% from the preceding year. Incorporating Industry 4.0 technologies, including robotics, artificial intelligence, and immersive experiences, has significantly contributed to enhancing the attractiveness of tourism and elevating travel experiences in Japan (Arzaghi et al., [2023](#)).

The Australian tourism sector has incorporated Industry 4.0 technologies to provide distinctive and captivating tourist encounters. Based on the 2019 data, the nation observed a surge of around 9.3 million foreign tourists, indicating a rise of 3% compared to the preceding year. The Australian tourism industry has successfully incorporated technological advancements such as augmented reality, artificial intelligence-powered Chatbot for customer support, and data analysis for personalized recommendations to enhance the overall quality of visitor experiences and promote industry growth (Wadewitz, [2023](#)). France has leveraged Industry 4.0 technologies to enhance its well-established tourism sector. The nation observed a rise of 1.7% in the number of international tourists in the year 2019, resulting in a cumulative count of 89.4 million travelers. The data presented indicates an increase in tourism compared to the preceding year. According to estimates, France receives around 11 million international business travelers annually. By 2028, France's travel and tourism sector is expected to generate a direct contribution of roughly 104.3 billion euros towards the country's gross domestic product. Integrating technological innovations, such as virtual reality simulations, museum interactive exhibits, and digital platforms for tourism-related information, has considerably improved the overall tourist experience in France. The abovementioned factor has played a pivotal role in the sustained expansion of the nation's tourism sector, establishing it as a prominent international hotspot.

Following an analysis of various nations that have incorporated Industry 4.0 principles into their tourism sectors, notable advancements and favorable results have been observed. Based on statistical analysis, implementing modern technology has resulted in a rise in the number of visitors, enhanced operational efficacy, and increased visitor satisfaction. The statement above

emphasizes the significance and potential advantages of incorporating Industry 4.0 into the tourism sector of nations.

2.5 About the Bibliometrics R package

Bibliometrics involves applying quantitative analysis and statistical methods to scrutinize publications, particularly journal articles, and their citation counts. This technique is commonly employed in diverse scientific fields to assess factors such as growth, maturation, top authors, conceptual and intellectual maps, and the direction of a scientific community. Furthermore, bibliometrics evaluates research performance (Aria & Cuccurullo, [2017](#)).

3 Method and literary synthesis span

3.1 Databases Search and Keywords Mapping

To obtain pertinent literature, we targeted Scopus databases. In accordance with the study's objectives, the terms "Industry 4.0," "Pakistan," "Innovation," and "Tourism," along with the phrase "Industry 4.0," were incorporated into a single search. Only titles, abstracts, and keywords were scrutinized to prevent the omission of significant research on smart products. Every effort was made to avoid overlooking any essential literature on the subject.

For data collection, choose the Scopus database in this study; the reason to select the Scopus database is for the following reasons. 1) Scopus provides reliable data for bibliographic analysis. 2) Scopus provides detailed data, such as time coverage and citations, besides databases like Web of Science. 3) Moreover, data exported from Scopus can be easily uploaded in the same format as bibliometric software.

3.2 Data collection

Industry 4.0 is an emerging phenomenon in the existing world. Initially, I got more than 4045 articles according to the research keywords. All articles are included in this analysis. After the cut in some sections, such as select years 2015 to 2023, discipline social science and management sciences, English language, and final publications, the researcher has 709 articles. After reading titles and abstracts, the researcher excluded more than 200 irrelevant papers. Finally, 500 articles were exported in CSV with a comma-separated file upload for bibliometrics analysis. Therefore, we resorted to the well-established alternative approach of ancestry mapping, which involves searching for related articles by examining references in a subset of papers.

3.3 Article Selection Process

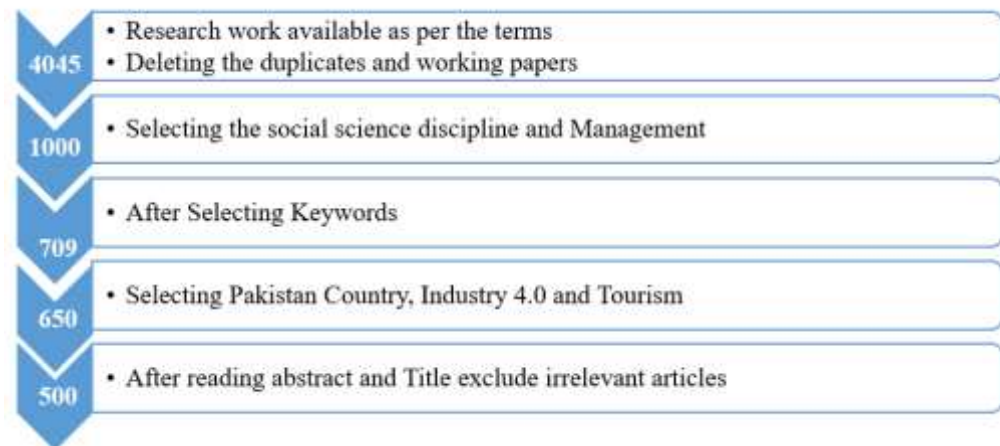


Figure 2: Detailed Article Selection Process of Industry

We narrowed it down to 499 relevant articles. It is beneficial to take a step back and assess the

broader picture before delving into the details of examining the connections between Tourism, Pakistan, and development approaches for Industry 4.0.

4 Results

4.1 Descriptive Analysis

This research performed bibliometrics analysis on Research articles of 2015 to 2023. Fig. 1 shows the key information of the scientific research like, trend, citations, total documents, keyword, Annual Growth rate, and sources. Author's Articles, Countries, keywords, and Journals were also examined. Network analysis, co-occurrence of keywords, cluster analysis, and thematic analysis also performed.



Figure 3: Provides a comprehensive overview of Scopus publications analyzing the intersection of Industry 4.0 and tourism from 2014 to 2023.

4.2 Annual scientific production

Till 2018, minor growth was observed in this area of research, but after 2018, fast development has been recorded in Industry 4.0 and tourism. The emergence of Industry 4.0 and the growth of the tourism industry have led to a significant increase in the number of scientific articles focused on this subject. To gain a better understanding of this area, we will conduct a review of 400 scholarly articles. An image that shows the number of publications in year wise

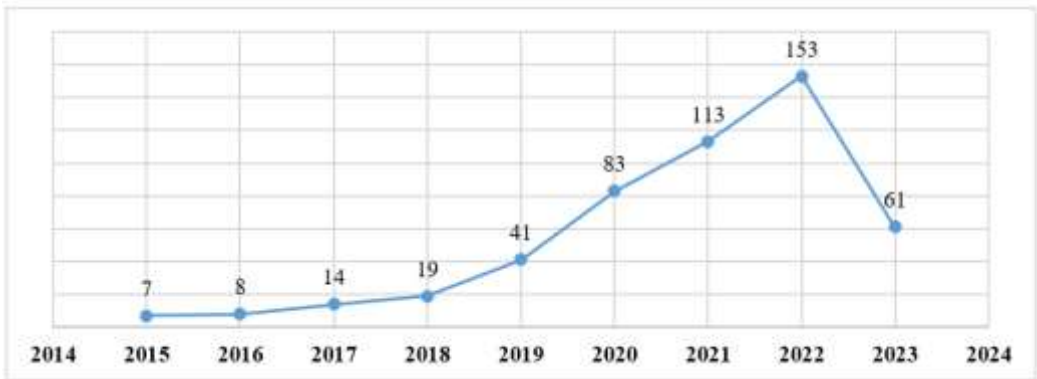


Figure 4: Scopus publications on the analysis of Industry 4.0 and tourism from 2014 to 2023

Fig. 1 shows the scientific research on the topic of Industry 4.0 and Tourism. It is evident that the number of publications was higher in 2022 than in any other year.

4.3 Source Dynamics

A total of 209 journals are publishing research articles in this area, but this graph shows the top

six journals in this domain. Sustainability (Switzerland) has a more positive contribution to the publication on this specific topic than other articles.

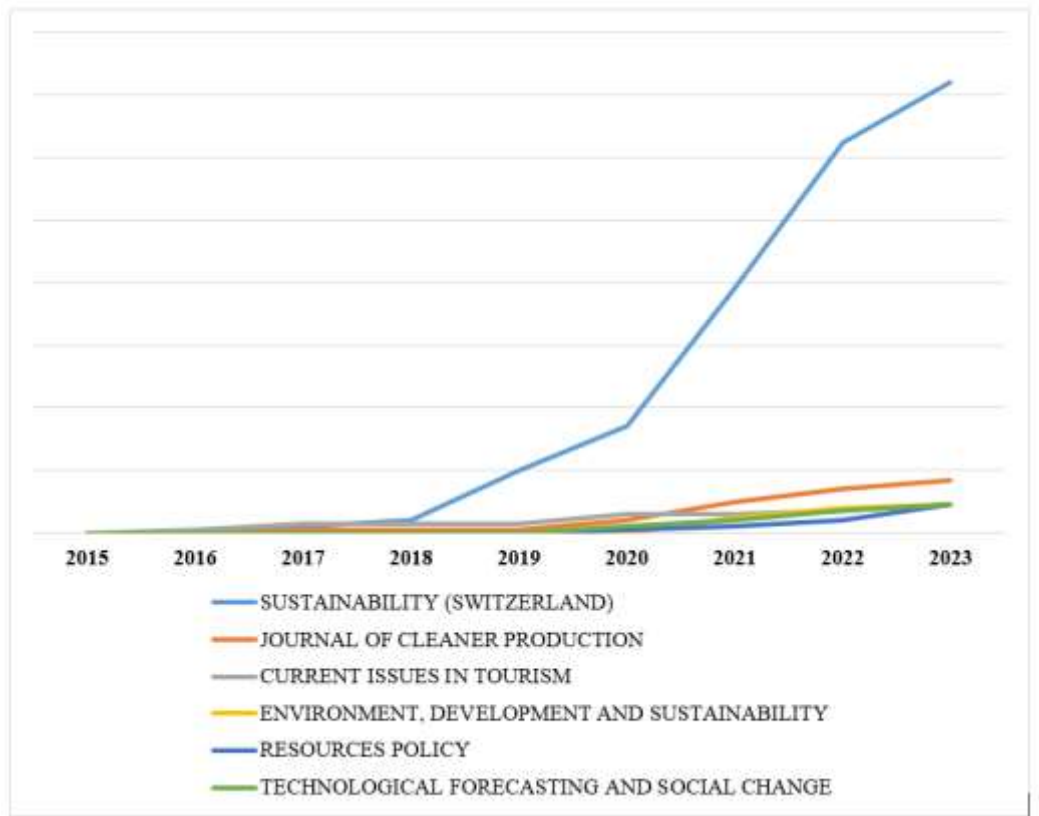


Figure 5: Reveals top journals in the selected subject area with a high volume of related articles.

4.4 Country Scientific Production

Investigating the scientific output of various countries is another significant field of research. Research indicates that scholars from Pakistan (480 articles), China (410 articles), Malaysia (131 articles), and India (60 articles) have significantly contributed to scientific production on Industry 4.0 and Tourism.

Table 1: Country scientific production in studies with Industry 4.0 and Tourism

Region	Freq	Region	Freq
Pakistan	480	Jordan	6
China	410	Mexico	6
Malaysia	131	Cameroon	5
India	60	Lithuania	5
Saudi Arabia	58	Morocco	5
UK	57	Cyprus	4
Indonesia	49	Ghana	4
Spain	42	Netherlands	4
Italy	40	New Zealand	4
South Korea	35	Norway	4
Australia	33	Iraq	3

Czech Republic	28	Sweden	3
Romania	28	Austria	2
Turkey	28	Bahrain	2
Hungary	27	Colombia	2
Portugal	26	Denmark	2
USA	26	Libya	2
Egypt	25	Serbia	2
United Arab Emirates	24	Singapore	2
Thailand	23	Slovakia	2
South Africa	22	Slovenia	2
Philippines	20	Sri Lanka	2
Nigeria	18	Tanzania	2
Poland	18	Tunisia	2
Bangladesh	15	Zimbabwe	2
Brazil	15	Argentina	1
Iran	15	Bulgaria	1
Canada	14	Germany	1
Ecuador	13	Iceland	1
Greece	13	Moldova	1
Croatia	10	Nepal	1
Chile	9	Peru	1
Oman	7	Qatar	1
Finland	6	Somalia	1
France	6	Switzerland	1
Japan	6		

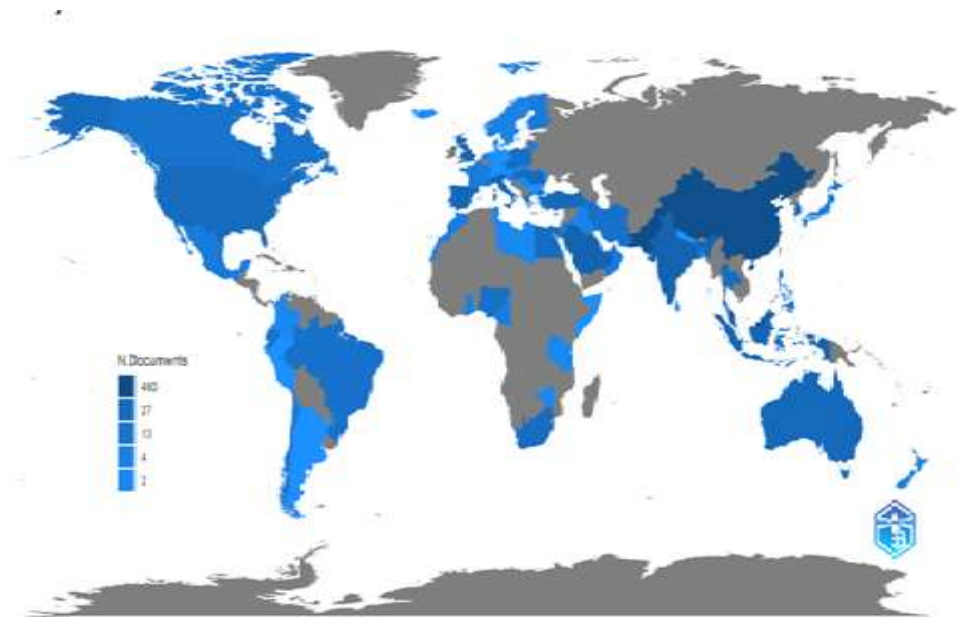


Figure 6: Country Scientific Production on Map

4.5 Corresponding Author's and Countries

Below table are showing how authors has been work done in the same subject within country and with other countries.

Table 2: Corresponding Author's

Country	Articles	Country	Articles
China	116	Cameroon	2
Pakistan	83	Cyprus	2
Malaysia	27	Ecuador	2
United Kingdom	15	Ghana	2
India	14	Japan	2
Spain	11	Philippines	2
Korea	10	Poland	2
Turkey	10	Portugal	2
Czech Republic	9	Serbia	2
Indonesia	9	Slovakia	2
Italy	9	Slovenia	2
Australia	6	Zimbabwe	2
Hungary	5	Argentina	1
Iran	5	Canada	1
Nigeria	5	Chile	1
Romania	5	Denmark	1
Saudi Arabia	5	Finland	1
South Africa	5	Georgia	1
Bangladesh	4	Hong Kong	1
Egypt	4	Mexico	1
Thailand	4	Moldova	1
Brazil	3	New Zealand	1
France	3	Norway	1
Greece	3	Oman	1
United Arab Emirates	3	Sri Lanka	1
USA	3	Vietnam	1

Single Country Publication: SCP

Double Country Publication: DCP

Figure 7 shows the collaboration of the authors with other countries on the topic of Tourism and

Industry 4.0.

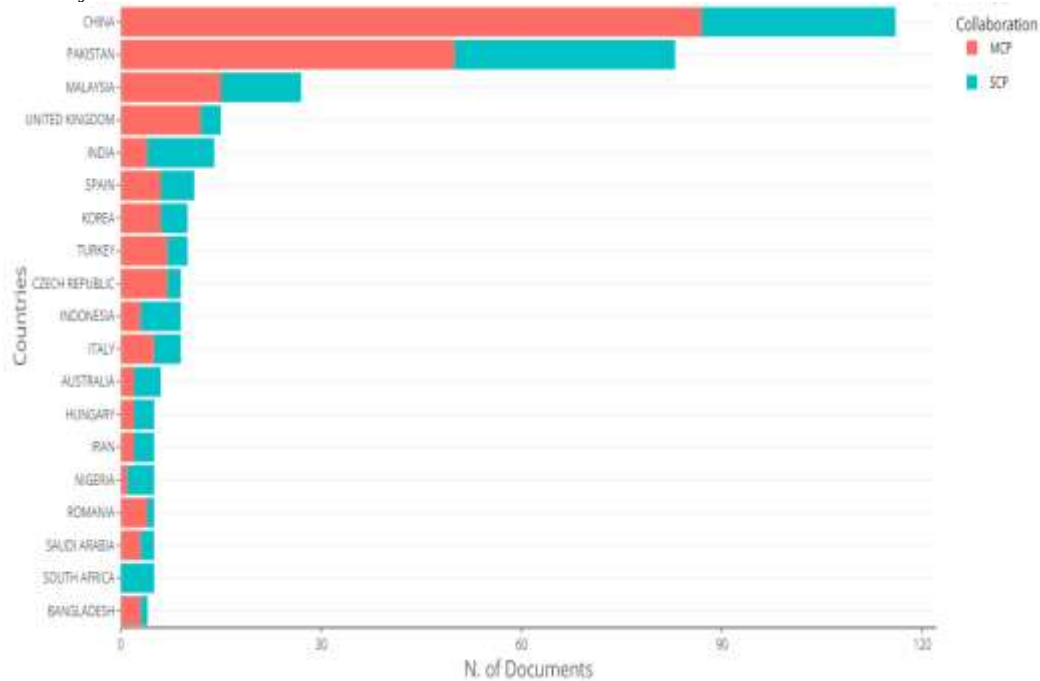


Figure 7: Corresponding Author’s Country

4.6 Most Cited Countries

Analyzing the nations with a significant impact on science production reveals that the United States is the foremost leader in this domain, followed by France, Canada, and the United Kingdom. The findings indicate that these dominant countries account for over 70% of the total number of references.

Table 3: Most Cited Countries

Country	TC	Average Article Citations
China	3034	26.20
Pakistan	1351	16.30
United Kingdom	882	58.80
Malaysia	408	15.10
France	401	133.70
India	252	18.00
Slovenia	252	126.00
Spain	249	22.60
Turkey	219	21.90
Korea	180	18.00
Iran	146	29.20
Czech Republic	127	14.10
Slovakia	112	56.00
Australia	80	13.30
Egypt	78	19.50
Brazil	74	24.70

South Africa	69	13.80
Cyprus	66	33.00
United Arab Emirates	61	20.30
Italy	60	6.70
Romania	46	9.20
Hungary	38	7.60
Serbia	37	18.50
Indonesia	30	3.30
Bangladesh	29	7.20
Thailand	27	6.80
Usa	26	8.70
Nigeria	25	5.00
Ecuador	21	10.50
Japan	18	9.00
New Zealand	18	18.00
Vietnam	18	18.00
Cameroon	17	8.50
Chile	17	17.00
Canada	15	15.00
Moldova	15	15.00
Portugal	12	6.00
Saudi Arabia	12	2.40
Norway	10	10.00
Greece	9	3.00
Hong Kong	8	8.00
Poland	7	3.50
Denmark	6	6.00
Sri Lanka	5	5.00
Philippines	3	1.50
Oman	2	2.00
Georgia	1	1.00
Argentina	0	0.00
Finland	0	0.00
Ghana	0	0.00
Mexico	0	0.00
Zimbabwe	0	0.00

Below fig. 8 is showing the countries that working on this discipline, line China, Pakistan, and United Kingdom top of the list.

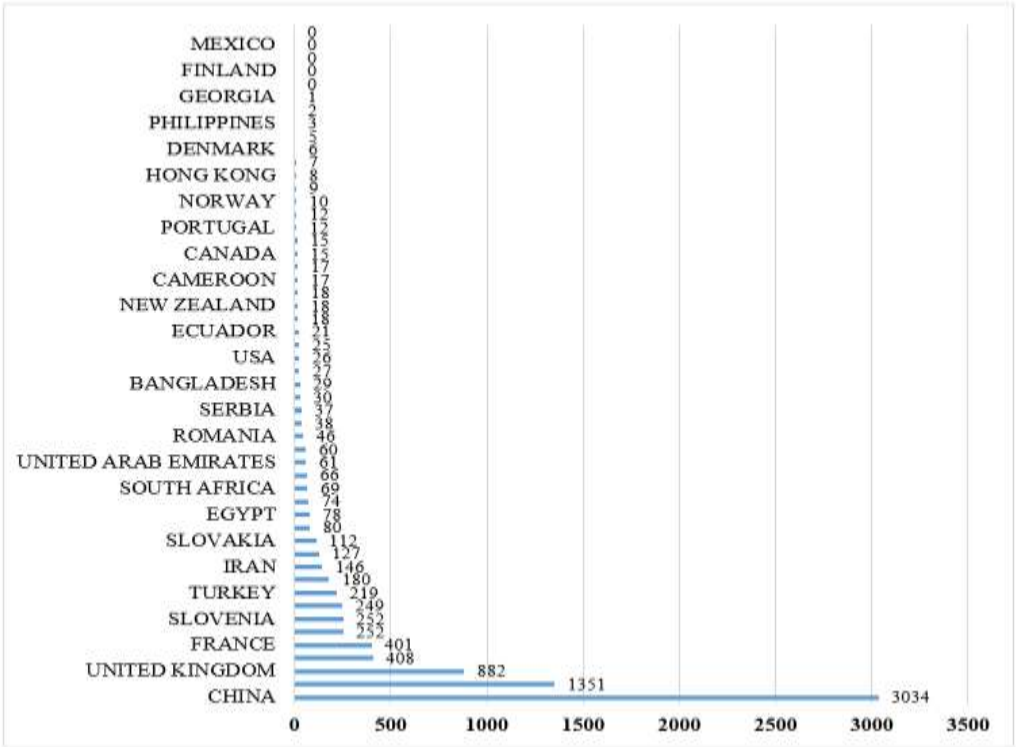


Figure 8: Most Cited Countries

4.7 Most Relevant Author’s

The findings emphasize the top ten authors who have published a greater number of papers compared to other authors. Notably, author Khan A stands out as a prominent contributor in the field of Tourism and Industry 4.0.

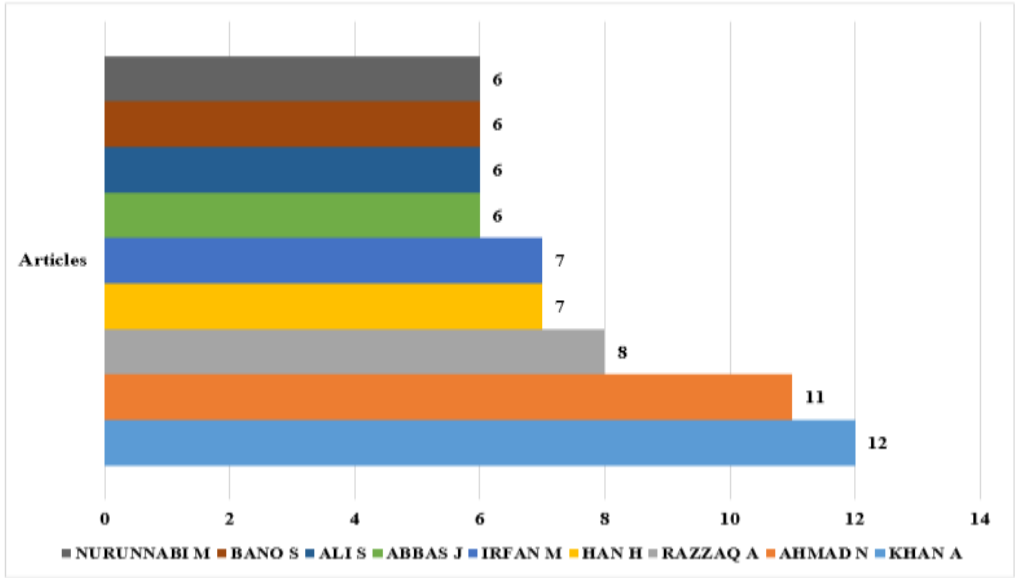


Figure 9: Top 10 Authors

4.8 Most Relevant Affiliation

More than 200 Universities has been identified through bibliometrics that are showing interest to publish articles on this domain. Below fig. 7 is showing top ten universities that published more articles than other universities, like, University of Utara Malaysia - 22, Zhejiang University - 21, North China Electric Power University – 20, Comsats University Islamabad – 20, Hungarian University of Agriculture and Life Sciences – 18, University Sains Malaysia – 18, Iqra University – 17, University of Central Punjab – 17 Article Published and so on.

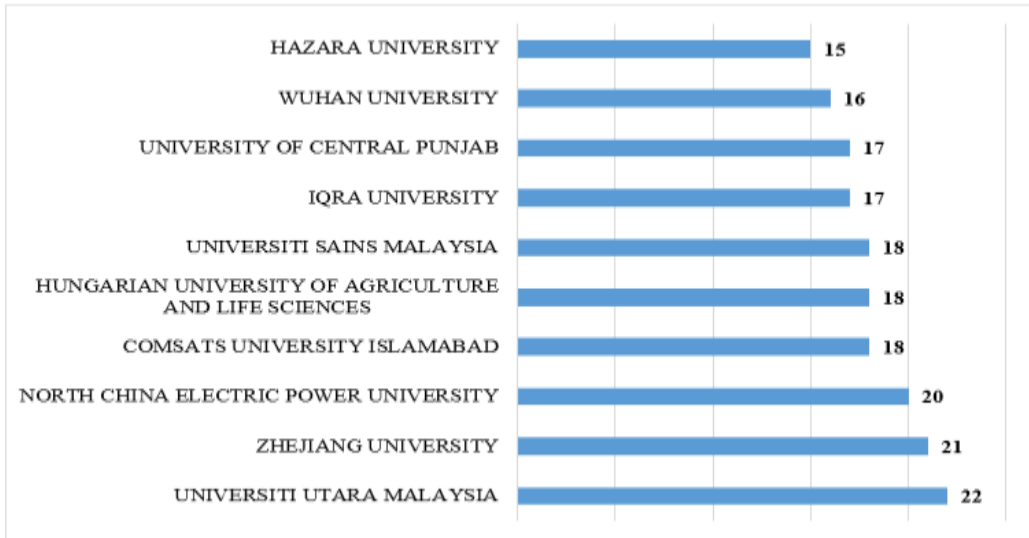


Figure 10: Relevant Affiliation

4.9 Most Frequent Keyword's

Table 4 is showing most common keywords that used in the studies that related to the Industry 4.0 and Tourism Pakistan. Table. 4 Demonstrate words 'Pakistan, Sustainable, Tourism, Innovation are the most common keyword's in the literature. Below usually use words list available.

Table 4: Most Common Keyword's

Words	Occurrences	Words	Occurrences
Pakistan	132	Economic Development	10
Sustainability	60	Entrepreneur	10
Sustainable	57	Resource Management	10
Development			
Tourism	54	Structural Equation Modeling	10
Tourism Development	49	Supply Chain Management	10
Innovation	28	Human Resource	9
China	26	Manufacturing	9
Hotel Industry	26	Natural Resource	9
Economic Growth	25	Psychology	9
Corporate Social Responsibility	24	Technology Adoption	9
Questionnaire Survey	23	Tourism Market	9
Business	21	Banking	8
Covid-19	20	Competitiveness	8

Ecotourism	20	Developing Countries	8
Small and Medium-Sized Enterprise	19	Green Economy	8
Hospitality Industry	18	Management Practice	8
Leadership	18	Regression Analysis	8
Spatiotemporal Analysis	18	Stakeholder	8
Developing World	17	Student	8
Marketing	17	Workplace	8
Globalization	16	Conceptual Framework	7
Literature Review	16	Detection Method	7
Perception	16	Energy Utilization	7
Carbon Emission	15	Finance	7
Decision Making	15	Human Experiment	7
Numerical Model	15	Information and Communication Technology	7
Consumption Behavior	14	Learning	7
Employment	14	Least Squares Method	7
Industry 4 0	14	Organizational Framework	7
Knowledge	14	Theoretical Study	7
Empirical Analysis	13	Tourism Economics	7
Environmental Economics	13	Artificial Intelligence	6
Social Media	13	Climate Change	6
Strategic Approach	13	Ecological Footprint	6
Carbon Dioxide	12	Economic Analysis	6
Economic And Social Effects	12	Economic Growths	6
Economics	12	Economic Impact	6
Human	12	Education	6
Punjab [Pakistan]	12	Environmental Degradation	6
Tourism Management	12	Ethics	6
Tourist Destination	12	Globalization	6
Alternative Energy	11	Industrial Economics	6
Article	11	Industrial Performance	6
Environmental Management	11	Investment	6
Performance Assessment	11	Kuznets Curve	6
Policy Making	11	Lahore	6
Research Work	11	Leisure Industry	6
Business Development	10	Project Management	6
Economic Development	10	Public Attitude	6
Entrepreneur	10	Qualitative Analysis	6

Fig. 11 shows, "Tourism", "Sustainability", "Pakistan", "Corporate Social Responsibility", "Covid-19", "Industry 4.0" are the main area of research that used in many research projects

4.11 Thematic Map

In thematic analysis generate themes, co-word makes a cluster and these clusters makes a theme. In Thematic map, vertically side measure the density and strengthen the internal links within cluster that make a Theme. Second, horizontally axis shows the uniqueness and find the strengthen between themes and other themes in the map. In Bibliometric analysis we analyze themes from thematic analysis through four different Quadrant.

- Q1: Upper-Right – Motor Theme
- Q2: Lower-Right – Basic Theme
- Q3: Lower-left - Emerging and Disappearing Themes
- Q4: Upper-Left – Very specialized Themes

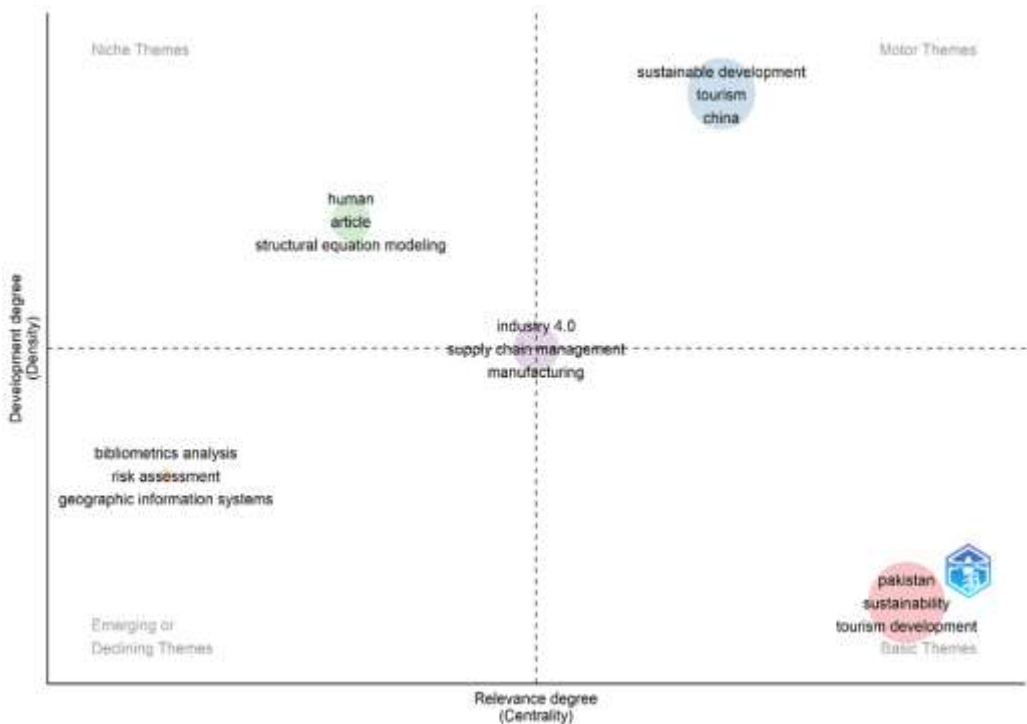


Figure 14: Thematic Map

The motor theme quadrant exhibits a significant concentration of researchers working in the domain of sustainability in tourism. The second stream, considered a fundamental theme, highlights the current publication trend in Pakistan, specifically focusing on sustainability topics related to tourism, industry 4.0, corporate social responsibility, business, and innovation. This shift in focus is notably observed following the impact of the Covid-19 pandemic. The third quadrant represents emerging themes such as artificial intelligence, machine learning, and remote sensing. The fourth quadrant emphasizes human research as a targeted area of interest. At the center of attention lies the central theme of industry 4.0, manufacturing, and supply chain management, reflecting the current trend among researchers.

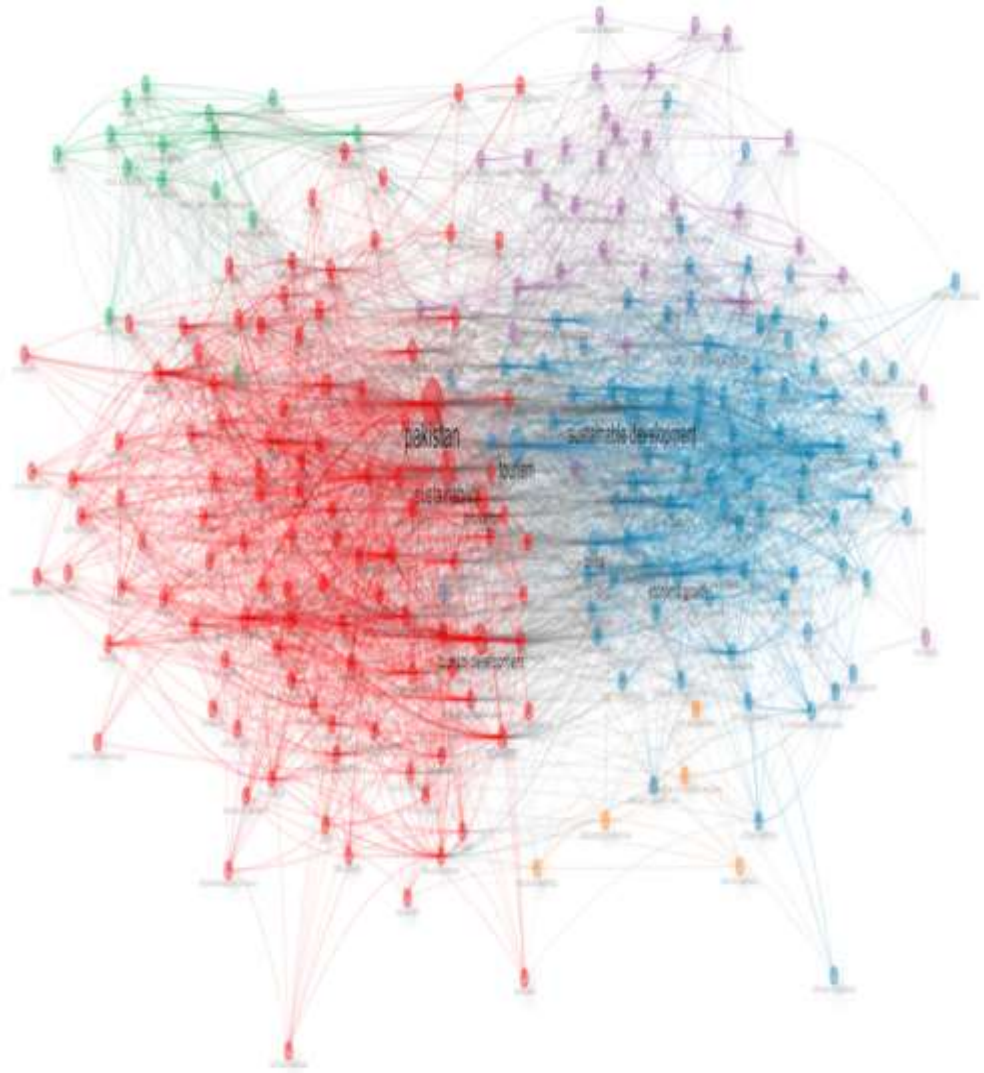


Figure 15: Thematic Map

4.12 Countries Collaboration

Within the timeframe of 2015 to 2023, Fig. 11 demonstrates that China and Pakistan have emerged as the leading countries in terms of publishing research articles on the subject of Tourism and Industry 4.0. Pakistan holds the second position alongside Saudi Arabia, with a notable number of publications. The trend continues with other countries following suit in terms of their research output.

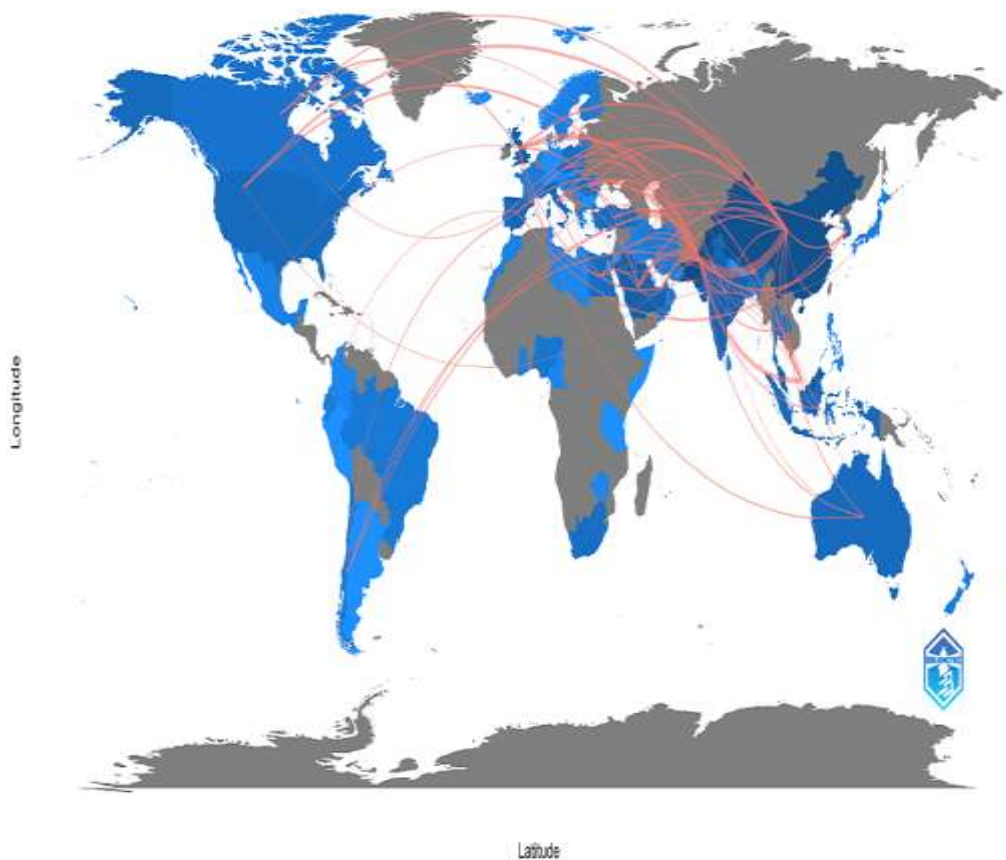


Figure 16: Countries Collaboration in the specific Discipline

Table 5 is showing those countries that collaborate with each other and publish not only scientific but also theoretical article publish in Industry 4.0 and Tourism.

Table 5: Collaboration of Countries

From	To	Frequency
Pakistan	China	92
Pakistan	Saudi Arabia	27
Pakistan	Malaysia	25
China	Saudi Arabia	15
Pakistan	United Kingdom	13
China	United Kingdom	12
Pakistan	United Arab Emirates	12
China	USA	10
Pakistan	Italy	10
Pakistan	Korea	10
Pakistan	Romania	8
China	Korea	7
China	Malaysia	7
China	Italy	6
China	United Arab Emirates	6

Pakistan	Oman	6
Pakistan	USA	6
Malaysia	United Kingdom	5
Pakistan	India	5
Pakistan	Spain	5
Pakistan	Turkey	5
Saudi Arabia	United Kingdom	5
China	Australia	4
China	India	4
China	Romania	4
China	Spain	4
China	Turkey	4
India	United Kingdom	4
Korea	Chile	4
Malaysia	Indonesia	4
Pakistan	Chile	4
Pakistan	Czech Republic	4
Pakistan	Egypt	4
Saudi Arabia	Egypt	4
Spain	Korea	4
United Kingdom	Canada	4
China	Canada	3
China	Chile	3
China	Hong Kong	3
China	Portugal	3
China	Thailand	3
India	Turkey	3
Italy	United Arab Emirates	3
Malaysia	India	3
Pakistan	Australia	3
Pakistan	Indonesia	3
Pakistan	Iraq	3
Pakistan	Poland	3

4.13 Highly Cited Papers

Citation of articles are count most important thing in research that decide the impact of paper, evaluating an article's influence solely based on its initial influential works is insufficient. Table 5 provides a summary of the most cited articles in the field. The study by Zeqiri et al. (2020) received the highest number of citations, focusing on the challenges and opportunities of Industry 4.0 and Tourism.

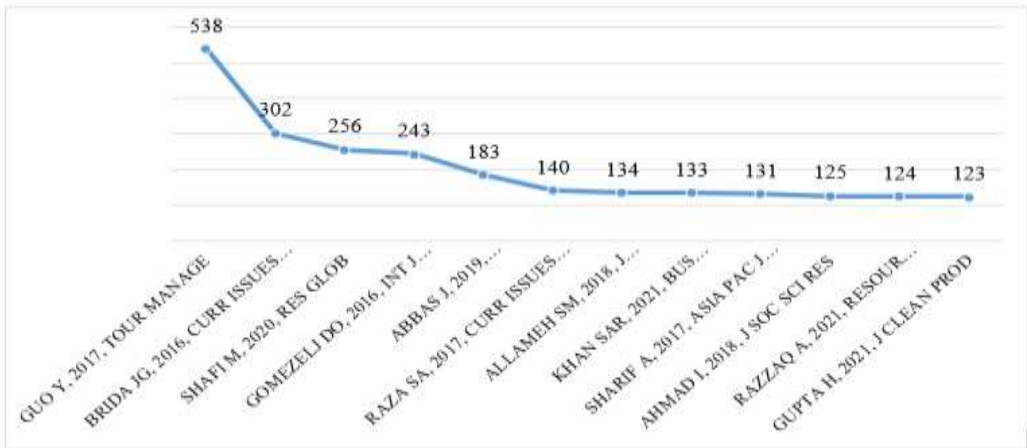


Figure 17: Highly Cited Papers Industry 4.0 and Tourism

Brida et al. (2020) highlighted how we can growth in tourism. Shafi et al., (2020) discuss how countries manage during covid-19 and tested, Impact of COVID-19 pandemic on micro, small, and medium-sized Enterprises operating in Pakistan.

Table 6: Summary of most cited articles

Paper	T. Citations	TC. per Year
GUO Y, 2017, TOUR MANAGE	538	76.86
BRIDA JG, 2016, CURR ISSUES TOUR	302	37.75
SHAFI M, 2020, RES GLOB	256	64.00
GOMEZELJ DO, 2016, INT J CONTEMP HOSP MANAGE	243	30.38
ABBAS J, 2019, SUSTAINABILITY-a-b-c	183	36.60
RAZA SA, 2017, CURR ISSUES TOUR	140	20.00
ALLAMEH SM, 2018, J INTELLECT CAP	134	22.33
KHAN SAR, 2021, BUS STRATEGY ENVIRON	133	44.33
SHARIF A, 2017, ASIA PAC J TOUR RES	131	18.71
AHMAD I, 2018, J SOC SCI RES	125	20.83
RAZZAQ A, 2021, RESOUR POLICY	124	41.33
GUPTA H, 2021, J CLEAN PROD	123	41.00
IKRAM M, 2020, J GLOB RESPONSIB	113	28.25
RAZZAQ A, 2021, SUSTAINABLE DEV	112	37.33
ABBAS J, 2019, SUSTAINABILITY-a-b	101	20.20
ABBASI KR, 2022, TECHNOL FORECAST SOC CHANGE	97	48.50
ABBAS J, 2019, SUSTAINABILITY-a	96	19.20
LIN B, 2017, J CLEAN PROD	96	13.71
MAHMOOD T, 2020, TECHNOL FORECAST SOC CHANGE	89	22.25
RAMZAN M, 2022, J CLEAN PROD	84	42.00
ALI S, 2019, SUSTAINABILITY	80	16.00
CHIAPPETTA JABBOUR CJ, 2020, RESOUR POLICY	77	19.25
SAEED A, 2018, SUSTAINABILITY	76	12.67
BALSALOBRE-LORENTE D, 2021, J CLEAN PROD	72	24.00
KONG L, 2020, J CLEAN PROD	71	17.75
YANG Y, 2018, SUSTAINABILITY	70	11.67
COP S, 2020, BUS STRATEGY ENVIRON	69	17.25

ADEDOYIN FF, 2020, TECHNOL FORECAST SOC CHANGE	67	16.75
AMAN J, 2019, SUSTAINABILITY	64	12.80
DARVISHMOTEBALI M, 2017, INT J CONTEMP HOSP MANAGE	64	9.14
IKRAM M, 2021, J CLEAN PROD	62	20.67
SUN H, 2020, SUSTAINABILITY	62	15.50
KASHIF M, 2015, INT J BANK MARK	62	6.89
BUX H, 2020, CORP SOC RESPONSIB ENVIRON MANAGE	61	15.25
MANZOOR F, 2019, SUSTAINABILITY	61	12.20
SALEM IE, 2021, TOUR MANAGE	59	19.67
PAPARGYROPOULOU E, 2019, SUSTAINABILITY	59	11.80
DURANA P, 2019, SOC SCI	59	11.80
TOOR A, 2017, ASIA J BUS ACCOUNT	59	8.43
SAAYMAN M, 2016, EUR J TOUR RES	59	7.38
JAVED B, 2017, CURR ISSUES TOUR	58	8.29
ALI S, 2021, SUSTAINABILITY	57	19.00
ACIOLI C, 2021, INT J PRODUCT PERFORM MANAGE	57	19.00
JAHANGER A, 2022, J PUBLIC AFF	55	27.50
GOYAL S, 2021, J CLEAN PROD	55	18.33
LU J, 2020, J CLEAN PROD	55	13.75
LIU Y, 2019, TOUR REV	55	11.00
RASHEED MI, 2020, J HOSP TOUR MANAGE	54	13.50
ELKHUESKY Z, 2022, INT J CONTEMP HOSP MANAGE	53	26.50
ABBAS J, 2019, SUSTAINABILITY	53	10.60
AHMED M, 2021, INT J HOSP MANAGE	51	17.00
JAVED B, 2018, J PSYCHOL INTERDISCIPL APPL	51	8.50
CHOFREH AG, 2020, J CLEAN PROD	50	12.50
IMRAN M, 2018, SOC SCI	50	8.33
KHAN SAR, 2022, SUSTAINABLE DEV	49	24.50
IQBAL Q, 2021, SUSTAINABLE DEV	49	16.33
CHENG L, 2020, CURR ISSUES TOUR	49	12.25
ZAHID MM, 2018, CORP SOC RESPONSIB ENVIRON MANAGE	49	8.17
IDREES MD, 2017, SUSTAINABILITY	49	7.00
ELBAZ AM, 2017, TOUR MANAGE	46	6.57
GILAL FG, 2020, SUSTAINABLE DEV	45	11.25
KHAN A, 2020, SUSTAINABILITY-a	45	11.25
RAZZAQ A, 2023, J ENVIRON PLANN MANAGE	44	44.00
LING G, 2022, ENVIRON DEV SUSTAINABILITY	43	21.50
RAUF A, 2021, SUSTAINABILITY	43	14.33
LEE C-C, 2021, J CLEAN PROD	43	14.33
ALFORD P, 2020, TOUR MANAGE	43	10.75
KHAN S, 2021, TECHNOL SOC	42	14.00
KHALID S, 2019, SUSTAINABILITY	42	8.40
LEÓN-GÓMEZ A, 2021, SUSTAINABILITY	41	13.67
QIU X, 2017, SUSTAINABILITY	41	5.86
USMAN M, 2021, TOUR MANAGE	39	13.00
AHMAD N, 2022, J RETAIL CONSUM SERV	38	19.00
ANSER MK, 2020, CORP SOC RESPONSIB ENVIRON MANAGE	38	9.50

HE J, 2021, TECHNOL FORECAST SOC CHANGE	37	12.33
DANISH M, 2019, ECONOMIES	35	7.00
WAHGA AI, 2018, INT J ENTREP BEHAV RES	35	5.83
YOUSAF Z, 2021, SUSTAINABILITY-a	33	11.00
RASHID S, 2020, WORLD J ENTREP, MANAG SUSTAIN DEV	33	8.25
AHMAD N, 2021, SUSTAINABILITY-a	32	10.67
BHUTTO MY, 2021, SUSTAINABILITY	32	10.67
RASHID AG, 2018, J HOSP TOUR INSIGHT	32	5.33
AMANKWAH-AMOAH J, 2021, INT BUS REV	31	10.33
HUSSAIN K, 2020, COGENT BUS MANAG	31	7.75
IQBAL Q, 2019, J SCI TECHNOL POLICY MANAGE	31	6.20
YASIR N, 2021, SUSTAINABILITY	30	10.00
MIR UB, 2020, DIGIT POLI REGUL GOVERN	30	7.50
DONG D, 2019, SUSTAINABILITY	29	5.80
GUO M, 2021, SUSTAINABILITY	28	9.33
AHMED RR, 2020, SUSTAINABILITY	28	7.00
ZOU Z, 2021, SUSTAINABILITY	27	9.00
GUL RF, 2021, FASH TEXT	26	8.67
SUN X, 2021, J ENVIRON PLANN MANAGE	26	8.67
KHALIQUE M, 2020, J INTELLECT CAP	26	6.50
HAQUE AU, 2021, SUSTAINABILITY	25	8.33
RAZA SA, 2022, INT J CONTEMP HOSP MANAGE	24	12.00
ABBASS K, 2022, SUSTAINABILITY	24	12.00
BIBI S, 2022, CURR ISSUES TOUR	24	12.00
MURTAZA SA, 2021, SUSTAINABILITY	24	8.00
HIZAM-HANAFIAH M, 2021, J OPEN INNOV: TECHNOL MARK COMPLEX	24	8.00
TU J, 2020, J DESTIN MARK MANAGE	24	6.00
MALDONADO-ERAZO CP, 2020, SUSTAINABILITY	24	6.00
ZEB A, 2020, WOMEN'S STUD INT FORUM	24	6.00
PHAM LDQ, 2021, J HOSP TOUR MANAGE	23	7.67
SHAKEEL M, 2020, SAGE OPEN	23	5.75
REHMAN A, 2018, ENERGY SUSTAINABILITY SOC	23	3.83
MUKHERJEE D, 2022, J BUS RES	22	11.00
TRAN QX, 2020, INT J CULT TOUR HOSP RES	22	5.50
MISHRA HG, 2022, TOUR REV	21	10.50
DIMA A, 2022, SUSTAINABILITY	21	10.50
KUSI-SARPONG S, 2022, TECHNOL FORECAST SOC CHANGE	21	10.50
SHARIF A, 2020, CURR ISSUES TOUR	21	5.25
AHMAD B, 2019, ASIA-PAC J BUS ADM	21	4.20
BHATTI MH, 2019, SUSTAINABILITY	21	4.20
RAHMAN M, 2022, PROD PLANN CONTROL	20	10.00
XU XL, 2021, ENVIRON DEV SUSTAINABILITY	20	6.67
PUŠKA A, 2021, SUSTAINABILITY	20	6.67
SHOAIB M, 2021, COGENT BUS MANAG	20	6.67
BHATTI MH, 2020, SUSTAINABILITY	20	5.00
KARAMAT J, 2019, SUSTAINABILITY	20	4.00
DIN SU, 2022, INT J EMERG MARK	19	9.50

KUMAR V, 2021, SUSTAINABILITY	19	6.33
RITCHIE BW, 2021, INT J CONTEMP HOSP MANAGE	19	6.33
WASAYA A, 2021, ENVIRON DEV SUSTAINABILITY	19	6.33
AHMAD N, 2021, SUSTAINABILITY	19	6.33
GIACHINO C, 2020, CURR ISSUES TOUR	19	4.75
JAVAID J, 2020, ELECTRON LIBR	19	4.75
SADIQ M, 2022, RESOUR POLICY	18	9.00
YOUSAF Z, 2021, ENG ECON	18	6.00
DE PASCALE G, 2020, ENVIRON IMPACT ASSESS REV	18	4.50
JERMSITTIPARSERT K, 2019, INT J SUPPLY CHAIN MANAG	18	3.60
SAJJAD A, 2018, CORP GOV	18	3.00
SUN H, 2022, BR FOOD J	17	8.50

5 Conclusion

The possible role of Industry 4.0 in Pakistan's tourism industry has been revealed in this study by the fact that ample of opportunities are also associated with certain challenging issues. This research project has determined that the deployment of cutting-edge technologies could be crucial to the improvement of the operational efficiency, to facilitate customer engagement and possibly has a huge positive impact on the economy of tourism. Nevertheless, the industry's impressive potential to encompass these opportunities is suffering from setbacks in infrastructure, competition, and sustainability. By examining existing successful global practices this paper suggests strategic tweaks and recommendations that can be adopted and customized for Pakistan. Such as, we can benefit from knowledge of how data analytics are used in intelligent urban infrastructure of Singapore in Pakistan; these will surely give us the advantage in customer experience and operational efficiency. Beside it, the track record at UAE and South Korea of digital marketing strategies that is suited perfectly with major attractors of Pakistani tourism may be considered as a roadmap for Pakistan to motivate its visitors from international community and explore by and large. What differentiates this paper from others is that it is relevant to the Pakistani context by analyzing the best global practices and specific issues that Pakistan faces while trying to shift toward sustainability. By expounding on the importance of targeted investment in infrastructure, integrating sustainable strategies, and embracing advanced digital technologies, this study highlights a comprehensive approach that all stakeholders need to utilize to reap maximum benefit from the introduction of the fourth industrial revolution. Going on, strategically important areas a collaboration of policy makers and industry leaders lead should be the agenda for Pakistan. Institutional development, which includes road, rail, and other infrastructure buildings, alongside sustainability, becomes a key player in making Pakistan's tourism reach its full capacity. We will not only tackle the existing shortcomings but also spur continued growth in the sector, leading to a more significant economic contribution.

6 Discussion

Literature reviews have generally captured the main transformative effects of Industry 4.0 technologies in global tourism. For example, it has been found that these technologies assist in increasing the number of tourists, enhancing the interaction level of visitors, and making destinations more eye-catching (Beck et al., [2019](#)). Based on the well-established models in the leading tourism markets, which include Singapore, the United Arab Emirates, and South Korea, this paper will outline the ways these tourism economies are embracing these technologies and rebranding their tourism destinations. Efficient approaches with Facebook, Instagram, and proven advertising methods, as well as Search engine optimization, are the best marketing tools for rising

national tourism industry competitiveness. This is particularly interesting for Pakistan, which uses Digital Tourism Think Tank assessments to rank low in digital competitiveness across digital demand. The augmented investments into e-marketing content, as demonstrated by the Singapore Travel campaign (Henderson, 2019), could help Pakistan boost its visibility as a tourism destination among its target audiences. The leading role of VR and AR in elevating tourism experiences in Korea and Japan is proven in research done by Jang et al. (2021), which revealed that these technologies significantly increase tour satisfaction by providing immersive experiences. Recently, the tourism industry of Pakistan has been limited to just the use of conventional means of VR and AR technologies (Kalsoom & Alam, 2022). The sector could transform its promotional techniques by adopting these technologies and overcoming geographical and security concerns (Nayyar & Nguyen, 2018). The smart city systems in Singapore, which have positively impacted the overall traveler experience via efficient allocation of resources and upkeep of the infrastructure (Yu et al., 2021), can provide a model for Pakistan. PTDC's initiatives (smart kiosks and mobile applications) address research outcomes and complement them; however, they should be developed and introduced to fully capture the advantages that smart tourism infrastructure brings.

As Al-Debei et al. (2021) state, digital financial services significantly contribute to customers' experience; the introduction of contactless payments in the UAE is the trend changing through visitor convenience and security, which aligns well with this finding. Given the fact that simple technologies are playing slow but significant in the changing dynamics of travel in advanced tourism destinations, the sooner that this is implemented in Pakistan, the better it is so that it can quickly adapt to the convenience offered by such countries (Rahman et al., 2022). The evidence regarding the role of data analytics in Singapore, in terms of creating unique marketing strategies adaptable to the preferences of tourists, as Khan et al. (2022) suggest, proves the need to advance data analytics capacity in Pakistan's tourism sphere. This approach is a key point in facilitating the construction of efficient policies and promotional activities supported by strong empirical evidence of all the tourism strategies. Sustainable tourism, which embraces eco-tourism initiatives and conservation efforts, is most evidently backed by the literature as an essential piece of modern tourism components. According to Buckley (2020), this is in addition to the development of ecotourism that boosts the eco-conscious travelers' percentage and ultimately strengthens the longevity of even this sector. Through a coordinated effort between Pakistan's tourism development strategy and recognized global standards and research, the country may establish itself in a competitive position among all the other tourist destinations (Sultan, 2022). By relying on abundant evidence from respected sources, this talk advocates the adoption of these technologies and innovations in pursuit of the native tourism sector's overall efficiency and international rating.

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