



DURBAN UNIVERSITY OF TECHNOLOGY
INYUVESI YASETHEKWINI YEZOBUCHWEPHESHE

DURBAN UNIVERSITY OF TECHNOLOGY

Towards a Transformative Higher Education Curriculum Model in Smart Tourism within the Fourth Industrial Revolution for Accommodation Establishments in KwaZulu-Natal

By

Student Name: Fathima Razack

Student Number: 19653464

**A thesis submitted in fulfilment of the requirements for the
Doctor of Philosophy in Business and Information Management,
Faculty of Accounting and Informatics, Department of Information and
Corporate Management, Postgraduate Studies**

2025

Supervisor: Professor Nalindren Naicker

Signature:

Co-Supervisor: Professor Reshma Sucheran

Signature:

DECLARATION

I, Fathima Razack, declare that:

- (i) The research reported in this thesis, except where otherwise indicated, is my original research.
- (ii) This thesis has not been submitted for any degree or examination at any other university.
- (iii) This thesis does not contain other persons' data, pictures, graphs, or other information unless specifically acknowledged as being sourced from other persons.
- (iv) This thesis does not contain other persons' writing unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:
 - Their words have been rewritten, but the general information attributed to them has been referenced.
 - Where their exact words have been used, their writing has been placed inside quotation marks and referenced.
- (v) This thesis does not contain text, graphics, or tables copied and pasted from the Internet, unless specifically acknowledged and the source is detailed in the thesis and the Reference Section of this thesis.

Signature:

Date: 4 September 2025

DEDICATION

Dedicated to my late dad, Abdul Kalick Razak, my inspiration

This thesis is dedicated to my father, who has been the greatest inspiration in my life and in my passion for lifelong learning. He inculcated values of discovery, curiosity and critical thinking in me. From a young age, he would say, "Fathima, remember education is the key to a bright future and it is something nobody can take away from you". These words resonate with me so much more now than they did when I was younger. Education has been instrumental in my life's success stories and has helped me navigate some of the most tumultuous challenges I have faced. The values that my dad instilled in me did not die because the seed of hope, love for family, and wanting a better future still live in me.

Dad, this one is for all that love you planted in my siblings and Mum.

I will always love you; not a day goes by without me thinking of you.

Your memory lives on in our hearts.

Thank you, Dad.

I dedicate this study to you.

ACKNOWLEDGEMENTS

With immense gratitude, my sincerest appreciation goes to the following individuals who provided me with unwavering support throughout my studies.

First and most importantly, I thank Allah, my creator, who gave me the wisdom and strength to complete this journey, which would have been impossible without his divine guidance.

To my dearest Ma, Mrs. Anis Khatoon Razak, and in loving memory of my late dad, Mr. Abdul Kalick Razak, there are no words to express my utmost appreciation for the values you have instilled in me that have moulded me into the person that I am today. Your prayers and firm support have been my pillars of strength. I hold your lessons dear in my heart, and this achievement is as much yours as it is mine.

To my wonderful and supportive husband, Riaz Dawood Ismail, thank you for believing in me and pushing me to accomplish this dream. You have been my greatest inspiration and motivation in this journey, and words can never express just how grateful I am for your continued support.

To my sons, Mohamed and Zidaan, your sacrifices allowed me to pursue this dream and your unwavering support contributed to my perseverance. You have been and continue to be the reason I never lost sight of my goal. May this accomplishment remind you that faith and determination allow one to conquer anything.

To my esteemed supervisor, Professor Nalindren Naicker, and my co-supervisor, Professor Reshma Sucheran, your expertise, support, and dedication have shaped this research. You challenged me to push beyond my limits and made me realise my fullest potential. I will always hold dear the invaluable knowledge and mentorship you have instilled in me.

To my colleagues at the Durban University of Technology, thank you for your emotional support and continuous encouragement, which helped to keep me sane during this journey. Lastly, a special thank you goes to the management and staff of the Accommodation establishments based in KwaZulu-Natal, who generously participated in this study

"The power to question is the basis of all human progress." ~ Indira Gandhi

ABSTRACT

The swift progression of Fourth Industrial Revolution (4IR) technologies has revolutionized operations within the Tourism sector, generating an urgent requirement for higher education institutions (HEIs) to integrate digital competencies into Tourism curricula. Guided by the Technology Acceptance Model (TAM) and the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development, this study sought to develop a Transformative Higher Education Curriculum Model for the integration of 4IR into Smart Tourism education in KwaZulu-Natal (KZN). Five research objectives guided the study, emphasizing Smart Tourism adoption in accommodation establishments, the essential 4IR skills for employability, curriculum alignment within higher education institutions, and industry perceptions of Tourism graduates' technological preparedness. A mixed-methods explanatory sequential design was utilized. In Phase 1, quantitative data were gathered via a structured survey distributed to staff within accommodation establishments in KZN. In Phase 2, qualitative data were collected via semi-structured interviews with accommodation managers and through a document analysis of Tourism curriculum programs provided by universities in KZN. Survey data were analyzed employing both descriptive and inferential statistical methods, whereas interview transcripts and university handbooks were examined through thematic and content analysis. Triangulation improved the validity and comprehensiveness of the findings. The findings indicate that, although Smart Tourism and Fourth Industrial Revolution technologies such as artificial intelligence, the Internet of Things, and digital marketing tools are progressively adopted within the accommodation sector, tourism graduates exhibit notable skills deficiencies, especially in computer literacy, industry-specific software, and digital competencies. Curriculum analysis further emphasizes a discrepancy between current higher education institution offerings and industry requirements, highlighting a pressing need for curriculum reform. The primary contribution of this study is the development of a Transformative Curriculum Model for incorporating the Fourth Industrial Revolution into Smart Tourism education, which advocates for the integration of digital competencies throughout core, major, and elective modules, enhanced by experiential learning, industry collaborations, and internationalization. Furthermore, a prototype mobile application was created to evaluate employees' technological preparedness within accommodation establishments, providing practical benefits to the industry. Overall, the study offers a strategic framework for higher education institutions to cultivate digitally adaptive graduates prepared for a Fourth Industrial Revolution-driven tourism economy.

TABLE OF CONTENTS

DECLARATION.....	ii
ACKNOWLEDGEMENTS	iv
ABSTRACT	v
TABLE OF CONTENTS	vi
LIST OF TABLES	xiv
LIST OF FIGURES	xvi
LIST OF ACRONYMS	xviii
LIST OF TERMINOLOGY.....	xix
CHAPTER ONE: INTRODUCTION TO THE STUDY	1
1.1 Introduction	1
1.2 Statement of the Problem	2
1.3 Aim and Objectives	3
1.4 Significance of the Study	4
1.5 Scope and Delimitations of the Study	5
1.6 Research Output	5
1.7 Process Model of the Study.....	6
1.8 Structure of the Thesis.....	7
1.9 Chapter Summary.....	8
CHAPTER TWO: LITERATURE REVIEW.....	9
2.1 Introduction	9
2.2 Digital Ecosystem.....	10
2.3 The Digital Economy in the Tourism Industry	11
2.4 4IR Technologies	13

2.4.1	Emerging Technologies in the Tourism Industry	14
2.5	The Phenomenon of Smart Tourism	19
2.6	Smart Tourism and 4IR in the existing Higher Education Curriculum .	21
2.6.1	The Concept of Smart Tourism in Higher Education	23
2.6.2	The Synergistic Relationship between Smart Tourism and 4IR	23
2.6.3	Global Integration of 4IR into the Curriculum in Higher Education.....	24
2.6.4	Local Integration of 4IR into the Curriculum in Higher Education.....	25
2.6.5	The Evolution of Curricula in Response to Industry Demands	26
2.7	Training Needs of Accommodation Establishments.....	26
2.8	Industry Perceptions of the 4IR Competencies and Skills of Tourism Graduates	28
2.8.1	Industry Demand for Digital Literacy.....	29
2.8.2	Adaptability and Technological Ability.....	29
2.8.3	Interdisciplinary and Collaborative Skills	29
2.8.4	Ethical Considerations and Sustainability	30
2.9	Alignment of Graduate Attributes towards the Tourism Businesses.....	30
2.9.1	The Relationship between HEIs and Employability	31
2.9.2	Graduate Employability in the Tourism Accommodation Sector.....	33
2.10	Chapter Summary.....	35
CHAPTER THREE: THEORETICAL FRAMEWORKS AND CONCEPTUAL MODEL		36
3.1	Introduction	36
3.2	Rationale for the chosen Theoretical Frameworks.....	36
3.3	Technology Acceptance Model.....	37
3.3.1	Foundations of Technology Acceptance Model	37

3.3.2	Core Constructs of the Technology Acceptance Model	40
3.3.3	Usefulness of the Technology Acceptance Model in this Study	41
3.4	Innovative Technologies Framework for Hospitality and Tourism Curriculum Development	42
3.4.1	Framework Components	43
3.5	Usefulness of the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development towards the Study	46
3.6	Application of Theoretical Frameworks	46
3.6.1	Mapping Theoretical Insights to the Research Aim	46
3.6.2	Analysis of Frameworks Guiding the Investigation into Usage, Perception and Curriculum Integration	48
3.7	Emergent Multi-Dimensional Conceptual Model.....	49
3.7.1	Challenges and Usefulness of the Emergent Multi-Dimensional Conceptual Model.....	51
3.7.2	Strategies for Curriculum Transformation offered by the Emergent Multi-Dimensional Conceptual Model	53
3.8	Validating the Emergent Multi-Dimensional Conceptual Model	55
3.9	Chapter Summary	55
CHAPTER FOUR: RESEARCH METHODOLOGY		57
4.1	Introduction	57
4.2	Philosophical Worldview	59
4.2.1	Pragmatism	59
4.3	Strategy of Inquiry.....	61
4.3.1	Qualitative and Quantitative Methods	61
4.3.2	Explanatory Sequential Mixed Method Design.....	62
4.3.3	Data Collection Phases	64

4.3.4	Data Collection Tools	66
4.4	Data Analysis	69
4.5	Reliability and Validity	72
4.6	Population and Sampling	73
4.6.1	Population	73
4.6.2	Sampling method	73
4.6.3	Inclusion and exclusion criteria	75
4.7	Ethical Considerations.....	76
4.7.1	Recruitment of Participants.....	76
4.7.2	Informed Consent.....	77
4.7.3	Anonymity and Confidentiality	77
4.8	Chapter Summary.....	77
CHAPTER FIVE: PRESENTATION OF THE QUANTITATIVE RESULTS.....		78
5.1	Introduction	78
5.2	The Sample.....	79
5.3	The Research Instrument.....	79
5.4	Reliability Statistics.....	80
5.5	Factor Analysis.....	81
5.6	Section Analysis Results	88
5.6.1	Section A Analysis.....	88
5.6.2	Section B Analysis: Usage of Smart Tourism and 4IR Applications in Accommodation Establishments	94
5.6.3	Section C Analysis: Assessing 4IR Skills and Training Needs for Employability	110

5.6.4	Section D Analysis: Exploring the Perceptions of General Staff on their 4IR Competencies.....	120
5.7	Cross-Tabulations.....	125
5.7.1	Cross-Tabulation: “I am familiar with the concept of Smart Tourism” vs “Age”.	125
5.7.2	Cross-Tabulation: “Perception of Graduate Preparedness” vs “Gender”	126
5.7.3	Cross-Tabulation: “Examining and Interpreting Data related to Tourism to Gain Business Insights” vs “Highest Qualification in Tourism”	128
5.7.4	Cross-Tabulation: “Perception of Graduate Preparedness” vs “Digital Literacy”	130
5.8	Correlation Insights on Smart Tourism and 4IR in KZN Accommodation Establishments	132
5.9	Measurement Model and Structural Equation Modelling (SEM).....	136
5.10	Chapter Summary.....	139
CHAPTER SIX: PRESENTATION OF THE QUALITATIVE RESULTS.....		140
6.1	Introduction	140
6.2	Visualisation of Key Concepts from the Interview Data	141
6.3	Involvement of Stakeholders.....	142
6.4	Outcome of the Coding Process	143
6.5	Summary of Themes and Sub-Themes	144
6.6	Theme 1: Gaps in Graduate Readiness for the 4IR Tourism Workplace	147
6.6.1	Sub-Theme 1: Limited Foundational Digital Skills.....	147
6.6.2	Sub-Theme 2: Inadequate Knowledge of Industry-Specific Systems	148
6.6.3	Sub-Theme 3: Deficiency in Soft Skills	149
6.6.4	Sub-theme 4: Disconnect Between HE Curriculum and Industry Demands ...	150

6.6.5	Sub-theme 5: Inconsistent Application of 4IR Skills amongst Graduates.....	150
6.7	Theme 2: Adoption and Application of Smart Tourism and 4IR Technologies	151
6.7.1	Sub-theme 1: Use of Booking and Property Management Systems	152
6.7.2	Sub-theme 2: Integration of Travel and Navigation Applications.....	153
6.7.3	Sub-theme 3: Social Media as a Marketing and Engagement Tool.....	154
6.7.4	Sub-theme 4: Emergence of AI-Driven Technologies and Chatbots.....	154
6.7.5	Sub-theme 5: Disparities in Technological Adoption.....	155
6.8	Theme 3: Institutional and Individual Challenges to 4IR Skills Development	156
6.8.1	Sub-theme 1: Time and Resource Constraints.....	156
6.8.2	Sub-theme 2: Limited Access to Ongoing Training	157
6.8.3	Sub-theme 3: Organisational Readiness for Digital Training.....	158
6.8.4	Sub-theme 4: Cybersecurity and Data Privacy Challenges	159
6.9	Theme 4: Curriculum Reform and the Future Role of 4IR in Tourism Education	160
6.9.1	Sub-theme 1: Real-World System Training Requirements	160
6.9.2	Sub-theme 2: Suggested Curriculum Inclusions.....	161
6.9.3	Sub-theme 3: Vision of 4IR in Higher Education.....	162
6.9.4	Sub-theme 4: Importance of Cybersecurity Education.....	163
6.10	Thematic Document Analysis: University Curricula and 4IR, Smart Tourism.....	164
6.10.1	Theme 1: Lacking in Graduate 4IR Readiness	166
6.10.2	Theme 2: Curriculum does not align with Industry Technologies	167
6.10.3	Theme 3: Lack of Smart Tourism and AI in Curriculum Content.....	167
6.10.4	Theme 4: Limited Interdisciplinary and Experiential Learning	167

6.10.5	Theme 5: Limited References to AI, Data and Innovation Ecosystems	168
6.11	Chapter Summary.....	171
CHAPTER SEVEN: TRIANGULATION AND MODEL DEVELOPMENT.....		173
7.1	Introduction	173
7.2	Triangulation of Quantitative and Qualitative Findings	173
7.2.1	Structural Equation Model Findings.....	177
7.3	Proposed Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education	177
7.3.1	Conceptual and Empirical Foundations	178
7.3.2	Model Domains and Integration	179
7.4	Mobile Application - Technology Readiness Index (TRI) for Smart Tourism in Accommodation Establishments.....	184
7.5	Chapter Summary	193
CHAPTER EIGHT: CONCLUSIONS AND RECOMMENDATIONS.....		195
8.1	Introduction.....	195
8.2	Conclusions of the Study	195
8.2.1	Research Objective 1 [RO1].....	195
8.2.2	Research Objective 2 [RO2].....	196
8.2.3	Research Objective 3 [RO3].....	196
8.2.4	Research Objective 4 [RO4].....	197
8.2.5	Research Objective 5 [RO5].....	197
8.3	Recommendations of the Study	198
8.4	Recap of Significant Contributions to the Body of Knowledge.....	200
8.5	Implications of the Study	202
8.6	Limitations of the Study	203

8.7 Future Research	203
8.8 Chapter Summary	203
REFERENCES.....	205
ANNEXURES.....	231
Annexure A: Research Project Plan	231
Annexure B: Turnitin Report Cover Page	232
Annexure C: Letter of Information and Consent and Indemnity Form.....	233
Annexure D: Institutional Ethical Clearance.....	238
Annexure E: Letter to the Gatekeeper	239
Annexure F: FEDHASA Approval to Conduct the Study.....	240
Annexure G: Ethics Certificate.....	241
Annexure H: Mini Delphi Questionnaire for the Proposed Multi-Dimensional Conceptual Model.....	242
Annexure I: Survey Questionnaire	243
Annexure J: Interview Schedule.....	252
Annexure K: Alignment of the Research.....	254
Annexure L: Certificate of Language Editing	257
Annexure N: Cross Tabulation for Table 5.15	259
Annexure O: Cross Tabulation for Table 5.16	261
Annexure P: Cross Tabulation for Table 5.17.....	263

LIST OF TABLES

Table 2.1: Summary of the 4IR Technologies in Smart Tourism.....	18
Table 2.2: Summary of Smart Tourism Phenomena.....	21
Table 2.3: Summary of Graduate Attributes for the Tourism Industry	34
Table 4.1: The Distribution and Response Rate for Pre-Testing the Questionnaire.....	68
Table 4.2: Establishing Sample Size from a Given Population.....	74
Table 5.1: Reliability Statistics	80
Table 5.2: KMO and Bartlett's Test	82
Table 5.3: Rotated Component Matrix Section B1.....	83
Table 5.4: Rotated Component Matrix Section B2.1 to 2.7.....	84
Table 5.5: Rotated Component Matrix Section B3.1	86
Table 5.6: Rotated Component Matrix Section C1.....	86
Table 5.7: Rotated Component Matrix Section C2.....	87
Table 5.8: Rotated Component Matrix Section D	88
Table 5.9: Gender Distribution by Age.....	89
Table 5.10: Current Role of Respondents.....	93
Table 5.11: Usage of Personalised Recommendation Systems Based on User Preferences and Behaviour.....	99
Table 5.12: Usage of IoT-Enabled Smart Room Technologies	101
Table 5.13: Usage of AI-driven Chatbots for Customer Support	103
Table 5.14: Big Data Analytics to Analyse and Make Decisions on Tourism Trends	105
Table 5.15: Perceived Benefits and Challenges with the Adoption of Smart Tourism and 4IR Applications	107
Table 5.16: 4IR Skills for New Graduates.....	111
Table 5.17: Importance of Various 4IR Skills for Current Positions in Accommodation Establishments	115
Table 5.18: 4IR Skills Most Essential for the Tourism Industry	117

Table 5.19: Perceived Competence of Graduates in Various Smart Tourism Skills	120
Table 5.20: Perceived Competence of Graduates in Various 4IR Skills	123
Table 5.21: Cross Tabulation: “I am familiar with the concept of Smart Tourism” vs “Age”	125
Table 5.22: Cross Tabulation: “Perception of Graduate Preparedness” vs “ Gender”	126
Table 5.23: Cross Tabulation: “Examining and Interpreting Data related to Tourism to Gain Business Insights” vs “ Highest Qualification in Tourism”	129
Table 5.24: Cross Tabulation: “Perception of Graduate Preparedness” vs “ Digital Literacy”	131
Table 5.25: Correlations.....	133
Table 6.1: Stakeholders Interviewed for the Study.....	143
Table 6.2: Thematic Clustering and Alignment with Research Aim.....	144
Table 6.3: Themes, Sub-Themes and Framework Alignment	145
Table 6.4: Technology-Related Modules in Tourism and Hospitality Programmes at Selected Universities in KwaZulu-Natal	164
Table 7.1: Triangulation of Key Findings from Quantitative, Qualitative, and Document Analysis.....	174
Table 7.2: Output - Technology Readiness Index (TRI) for Smart Tourism in Accommodation Establishments.....	190

LIST OF FIGURES

Figure 1.1: Study Process Model	6
Figure 2.1: Overview of Literature Review	9
Figure 2.2: The Digital Ecosystem Framework Pillars.....	11
Figure 2.3: Emerging Technologies in the Tourism Industry.....	15
Figure 3.1: Technology Acceptance Model.....	39
Figure 3.2: Innovative Technologies Framework for Hospitality and Tourism Curriculum Development	42
Figure 3.3: Multi-Dimensional Conceptual Model for Integrating 4IR Skills into Tourism Curricula	49
Figure 4.1: Research Methodology Roadmap for the Study.....	58
Figure 4.2: Explanatory Sequential Mixed Method Design	63
Figure 5.1: Explanatory Sequential Representation of Study.....	78
Figure 5.2: Length of Service of Respondents.....	90
Figure 5.3: Respondents' Highest Qualification in Tourism.....	91
Figure 5.4: Familiarity with and Awareness of Smart Tourism and 4IR Applications	94
Figure 5.5: Usage of 4IR Technologies or Smart Tourism Applications	96
Figure 5.6: Usage of Mobile Applications Providing Destination Information	98
Figure 5.7: Usage of Facial Recognition, Security and Personalised Services within Accommodation Establishments.....	102
Figure 5.8: Usage of AI-driven Chatbots for Customer Support.....	106
Figure 5.9: Perceived Competence of Graduates in Various 4IR Skills.....	123
Figure 5.10: Structural Equation Model Illustrating the Relationships Among Smart Tourism Usage, Skills and Training Needs and Perceptions of Graduate Competencies.....	136
Figure 6.1: Explanatory Sequential Representation of the Study	140
Figure 6.2: Word Cloud Representing Frequently Used Words.....	142

Figure 6.3: Visual representation of Theme 1 and Sub-themes.....	147
Figure 6.4: Visual Representation of Theme 2 and Sub-Themes	152
Figure 6.5: Visual Representation of Theme 3 and Sub-Themes	156
Figure 6.6: Visual Representation of Theme 4 and Sub-themes	160
Figure 7.1: Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education	178
Figure 7.2: Technology Readiness Index Start Up Screen	185
Figure 7.3: Technology Readiness Index User Information Screen	186
Figure 7.4: Google Maps, Apple Maps, TripAdvisor, Roadtrippers and Social Media Adverts	187
Figure 7.5: Facebook, Pinterest, Airbnb, LinkedIn, YouTube	187
Figure 7.6 Real-Time Analytics Dashboard, Digital Identity for Travel Documents, Smart Contracts for Automated Bookings, Digital Literacy, Data Analysis	188
Figure 7.7 Automated Climate Control, Personalised Lighting, Employee Authentication, AI- Driven Chatbots for Customer Support, AI-Based Analytics for Decision Making	188
Figure 7.8 Artificial Intelligence Integration, Virtual Reality and Augmented Reality, Cybersecurity, Remote Collaboration.....	189
Figure 7.9: Technology Readiness Index Score – Good Skills	191
Figure 7.10: Technology Readiness Index Score – Minimal Skills.....	192
Figure 7.11: Technology Readiness Index Score – No Skills	193

LIST OF ACRONYMS

The most important and frequently used acronyms in this study are listed below:

4IR	Fourth Industrial Revolution
5G	Fifth Generation of Cellular Technology
AI	Artificial Intelligence
AR	Augmented Reality
CRS	Computer Reservation System
DENA	The Digital Environment Nation Assessment
GDS	Global Distribution System
HEI	Higher Education Institution
ICT	Information and Communication Technologies
IoT	Internet of Things
KZN	Kwa-Zulu Natal
MOOC	Massive Open Online Courses
NFC	Near Field Communication
SEM	Structural Equation Model
SPSS	Statistical Package for Social Sciences
TAM	Technology Acceptance Model
UoT	Universities of Technology
VR	Virtual Reality

LIST OF TERMINOLOGY

The following terminology is defined for this study:

Accommodation Establishment: an establishment that offers lodging services, including hotels, bed and breakfasts, resorts, guesthouses and motels.

Curriculum Model: a structured framework that guides the design and implementation of curricula.

Curriculum Transformation: this includes revising curricula to align with societal needs, developments in digital technology and the integration of teaching methods to ensure that the education provided is relevant and practical.

Digital Skills: the usage of technology and digital tools.

Digital Transformation: includes incorporating digital technologies in a business's operations to offer customers value.

Fourth Industrial Revolution: the increased usage of advanced technologies, such as artificial intelligence, the Internet of Things, cloud computing and robotics, which allows for enhanced productivity in our lives.

Information Communication Technologies: includes a range of technologies that allow for communication, data sharing and collaboration.

Smart Technologies: Digital systems that leverage automation, artificial intelligence (AI), the Internet of Things (IoT), data analytics, and linked networks to improve efficiency, responsiveness, and real-time decision-making. Smart technologies enable tourism functions such as personalized services, digital communication, automation, and intelligent resource management.

Smart Tourism: the innovative usage of information and communication technologies in the tourism industry to improve the quality of the tourism experience.

Smart Skills: The technical, cognitive, and digital skills needed to effectively utilize, manage, and adapt to smart technology. These skills include digital literacy, data interpretation, social media competency, problem-solving in technology-mediated contexts, creativity, flexibility, and the capacity to deal with AI, IoT, or data-driven systems.

Smart Teaching: A pedagogical approach that combines smart technologies with data-driven methodologies to improve education, personalize learning, and encourage active, technology-enabled involvement. It entails the use of digital tools, simulation-based learning, intelligent systems, and ICT-supported instructional methodologies.

CHAPTER ONE: INTRODUCTION TO THE STUDY

1.1 Introduction

The Fourth Industrial Revolution (4IR) is a transformative era characterised by the integration of advanced technologies, including artificial intelligence (AI), the Internet of Things (IoT), big data analytics and blockchain across various sectors. Amongst the industries undergoing profound changes, Tourism is one of the most dynamically evolving fields. This phenomenon, often called "Smart Tourism", harnesses these cutting-edge technologies to enhance and revolutionise the travel experience. Intelligent technologies have transformed how individuals travel, organise holiday arrangements and explore various destinations. Given this shift, Higher Education Institutions (HEIs) must ensure that Tourism curricula adequately prepare students for technology-driven industry environments. A Transformative Higher Education Curriculum Model is therefore required to integrate emerging technologies and equip students with the essential competencies needed in the era of Smart Tourism.

While global 4IR disruptions shape broad educational trends, these developments hold particular significance for South Africa's higher education landscape. As a developing country with a rapidly evolving tourism sector, South Africa faces distinctive pressures to align its curricula with emerging digital competencies and industry expectations. Understanding how global 4IR shifts translate into the South African HE context is therefore crucial for situating the curriculum challenges experienced in Tourism programmes and for identifying the specific gaps this study seeks to address.

Higher education globally is undergoing rapid transformation due to technological advancements, requiring innovative pedagogical approaches that support effective knowledge acquisition. However, scholarly literature indicates that academics encounter challenges when incorporating technology into teaching and learning (Chugh, Grose and Macht, 2021:983; Mercader and Gairin, 2020:2). While Tourism education increasingly relies on technology-enhanced learning, few pedagogical frameworks guide educators in integrating 4IR-related techniques to support students' development of essential digital competencies (Bilotta et al., 2021:2).

Competitiveness within the Tourism industry has intensified due to the widespread adoption of digital technologies, placing pressure on HEIs to embed relevant digital literacy skills in their programmes. HEIs must therefore collaborate with industry to identify priority skills and ensure that academics possess the digital capabilities needed to prepare graduates effectively (Adeyinka-Ojo *et al.* 2020:120). Smart Tourism, which encompasses the application of ICTs to enhance tourism operations and services, plays a central role in shaping this pedagogical shift (Garanti, 2023:468).

1.2 Statement of the Problem

The advent of 4IR has caused significant disruptions in conventional industries and instigated a fundamental transformation in the operational dynamics of businesses and how individuals engage with technology (Adeyinka-Ojo *et al.* 2020:117). The Tourism industry has adopted the notion of Smart Tourism to utilise advanced technologies to enhance customer experiences, implement sustainable practices and manage destinations more effectively (Czyz and Javed, 2025:446). However, HEIs are encountering a significant obstacle in the process of revising their curriculum models to effectively equip students with the necessary skills and knowledge to navigate the intricacies of Smart Tourism in the context of 4IR (Aydin and Sirkeci, 2024:49).

Li (2024:134) argued that HEIs must replace old teaching and learning methods with innovative techniques when delivering tourism-related programmes. Moreover, graduates should be equipped with smart skills that would enable them to cope with the technological advancements in the Tourism industry (Li, 2024:137). However, graduates with tourism-related qualifications appear to lack smart skills in the workplace (Razack, Naicker & Sucheran, 2025). These smart skills include using smart technologies, digital literacy, employability, social media and ICT (Chugh *et al.* 2021:984; Li, 2024:135).

The advent of the ‘Smart’ concept in education has significantly transformed various academic domains, including Tourism. Smart teaching encompasses the utilisation of sophisticated technologies, interactive learning resources and data-driven analyses to augment the efficacy and efficiency of the educational endeavour (Chugh *et al.* 2021:990). The integration of intelligent or smart technologies into tourism education has produced numerous benefits, such as increased student engagement, more effective simulation of real-world situations, and the cultivation of digital skills essential for contemporary tourism practices. Nevertheless, despite

these advantages, the deployment of such technologies also encounters challenges, including limited institutional resources, inadequate staff training, and inconsistent technology adoption that may diminish the curriculum's effectiveness and hinder the integration of 4IR-aligned skills (Cinar, 2020:2417).

Kitchen *et al.* (2024:14) observed that the current higher education curriculum models may not be congruent with the ever-evolving requirements of the Smart Tourism industry. Consequently, a potential discrepancy exists between the competencies and knowledge that students acquire and industry demands. Jiang and Zang (2024:17-20) mentioned several significant factors that contribute to this problem, namely: (i) the incorporation of contemporary advancements in smart technologies, data analytics and digital marketing strategies into the Tourism curriculum of numerous HEIs remains insufficient; (ii) the absence of an interdisciplinary approach to Smart Tourism as it necessitates the integration of multiple disciplines such as information technology, business management, sustainable development and user experience design; (iii) the limited industry collaboration has the potential to impede the curriculum's relevance and practical applicability; (iv) technological obsolescence, particularly the presence of obsolete technologies in the curriculum that result in an insufficient readiness of students to adapt to the swiftly changing Smart Tourism environment; and (v) the insufficient emphasis on soft skills, including but not limited to, creativity, adaptability, cultural sensitivity and effective communication.

To address these challenges, a transformative curriculum model is required to support Smart Tourism education in higher education. Such a model should leverage 4IR opportunities, promote interdisciplinary perspectives, encourage industry collaboration, and balance technical and soft skills. Current literature indicates a lack of studies proposing a comprehensive Transformative Curriculum Model for Smart Tourism within 4IR, revealing a gap that this study aims to address.

1.3 Aim and Objectives

The study aims to develop a Transformative Higher Education Curriculum Model in Smart Tourism within the Fourth Industrial Revolution to ensure that higher education is aligned with the technological developments in the Tourism industry.

To address this research aim, the following research objectives (ROs) were established:

- [RO1]:** Investigate the nature and extent of the usage of Smart Tourism and 4IR applications at accommodation establishments based in KwaZulu-Natal (KZN);
- [RO2]:** Determine the 4IR skills and training needed to be employable at accommodation establishments based in KZN;
- [RO3]:** Ascertain the extent to which Smart Tourism and 4IR applications are included in the existing higher education curriculum at universities in KZN;
- [RO4]:** Explore the perceptions of industry stakeholders from accommodation establishments towards the 4IR competencies and skills of Tourism graduates from universities in KZN; and
- [RO5]:** Formulate a model for a Transformative Higher Education Framework for the inclusion of 4IR into the Tourism curriculum.

This study uses an explanatory sequential mixed-method approach, starting with a quantitative survey of accommodation establishments in KwaZulu-Natal and progressing to qualitative interviews with managerial-level participants. This method allows the researcher to detect patterns using statistical analysis and then explain these results in further detail using thematic interpretation. The mixed-method perspective improves the credibility, triangulation, and depth of the research utilized to build the Transformative Curriculum Model.

1.4 Significance of the Study

This study holds considerable importance for several stakeholders in the fields of Tourism and Higher Education. Tourism students will gain from a program that enhances their Smart skills, digital literacy, and competencies connected to the Fourth Industrial Revolution, necessary for accommodation businesses and the broader Tourism sector. Enhancing these abilities improves their employability and preparedness for technology-driven workplaces. The Transformative Higher Education Curriculum Model established in the study offers a pragmatic framework for Higher Education Institutions (HEIs) and curriculum designers to incorporate Smart Tourism and Fourth Industrial Revolution (4IR) technology into academic programmes. This facilitates curriculum revitalization, creative pedagogical methods, and enhanced alignment with industrial requirements.

The proposed Transformative Higher Education Curriculum Model combines 4IR-aligned digital capabilities, smart technology, industry expectations, and pedagogical innovations to

establish a systematic framework for curriculum restructuring. At a conceptual level, the approach is intended to help higher education institutions match tourism education with the technological, operational, and skill-based needs of Smart Tourism settings.

The study offers value to accommodation establishments and tourism sector stakeholders by delineating the unique digital capabilities necessary in the workplace. These insights can assist industry partners in enhancing staff training, fostering collaboration with higher education institutions and ensuring that graduates fulfill the technology demands of contemporary tourism operations. The study's conclusions will be disseminated via academic papers, seminars, conferences, and industry forums, facilitating stakeholders' adoption of the suggestions and implementation of the model in their respective settings. This study enhances Smart Tourism education and facilitates the sector's transition to a digitally connected tourism economy.

1.5 Scope and Delimitations of the Study

Delimitations are defined by Coker (2022:141) as the limits that the researcher establishes to omit variables from the study. Delimitations help researchers focus their research by limiting its scope. This study confined itself to accommodation establishments based in KZN, as this is the largest sub-sector of the Tourism industry in the province, according to the Tourism KwaZulu-Natal (TKZN) database (TKZN, 2024). Hence, accommodation establishments based globally and in other provinces of South Africa were not included in this study. Moreover, various types of accommodation establishments, including hotels, bed and breakfasts, self-catering units, guesthouses and lodges, are included in the TKZN database. The researcher specifically chose KZN because, apart from the various types of accommodation establishments available in the province, it is also easily accessible and has key market areas for domestic and international tourism (Kohler and Bihari, 2013:3-7). In the context of this study, only staff from accommodation establishments based in KZN who are identified as general staff and managers participated. Moreover, the study used KZN as a research site due to timeframes and the funding that was available.

1.6 Research Output

The research study resulted in the publication of the following Department of Higher Education and Training (DHET) recognised journal publication:

Razack, F., Naicker, N. & Sucheran, R. (2025). Digital Literacy and Employability Skills in Hospitality and Tourism Education. *African Journal of Hospitality, Tourism and Leisure*, 14(2):437-444. DOI: <https://doi.org/10.46222/ajhtl.19770720.624>

This study employs Structural Equation Modelling (SEM) to validate the proposed model, linking Smart Tourism/4IR adoption, skills and training needs and the perceptions of graduate competencies. Detailed SEM results are presented in **Section 5.9**.

1.7 Process Model of the Study

Figure 1.1 provides an outline and serves as a guide for the chapters and the research process in this study.

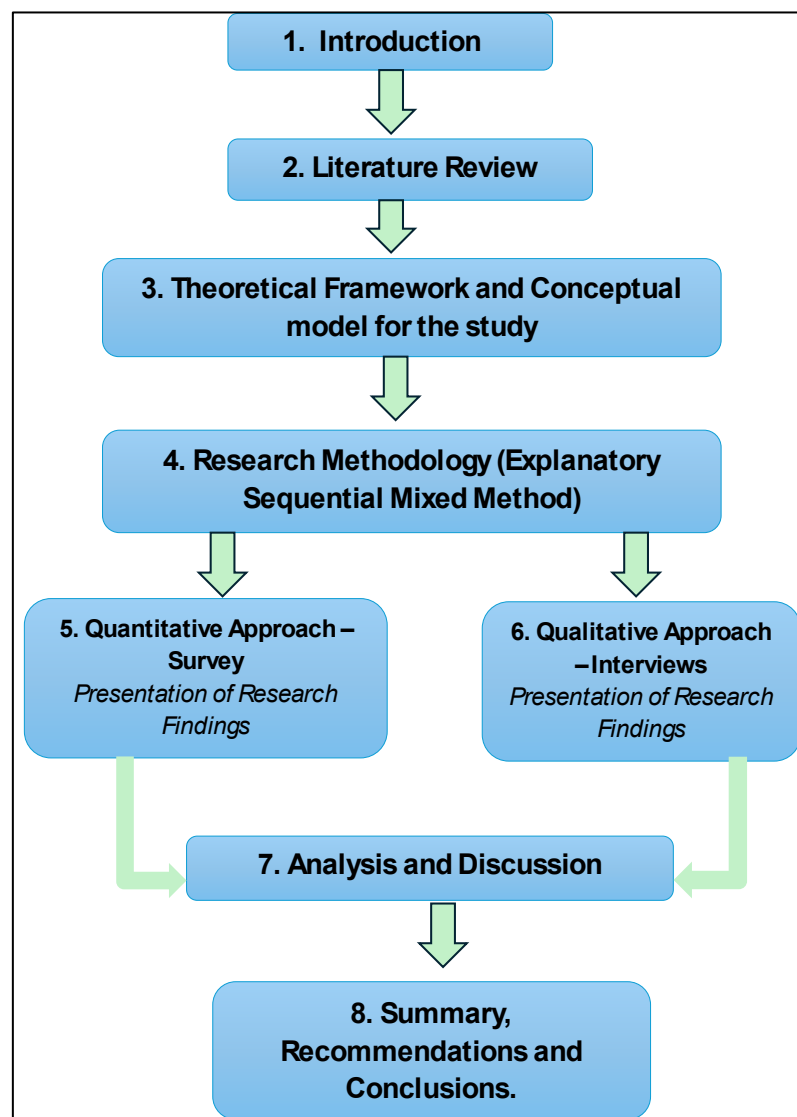


Figure 1.1: Study Process Model

Source: Researcher's Construction

1.8 Structure of the Thesis

This study is presented in eight chapters, arranged in the following manner:

Chapter One: Introduction to the Study

This chapter introduces the research study. The problem statement is elucidated, followed by the objectives, which led the researcher to address the significance of the study. The contextual setting and outline of the methodology are described. A summary of the scope and delimitations of the study is provided, followed by the research output and the structure of the thesis.

Chapter Two: Literature Review

Chapter Two presents a critical and comprehensive analysis of the extant literature on Smart Tourism and 4IR. The chapter provides a comprehensive discussion of the digital ecosystem, thus enhancing an understanding of the digital economy. The chapter presents a robust landscape of literature on the adoption of 4IR technologies in the Tourism industry. Furthermore, it explores the phenomenon of Smart Tourism, 4IR skills and training needs in the Accommodation sector.

Chapter Three: Theoretical Framework

Chapter Three provides the theoretical frameworks of the research. These include the Technology Acceptance Model (TAM) and the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development in relation to technology and the developing technologies in the Tourism industry. Moreover, the various theoretical frameworks are discussed. The chapter also includes the conceptual framework for the study, which encompasses the fundamental dimensions and factors that give rise to the discrepancy between current curricula and industry requirements in the Fourth Industrial Revolution era.

Chapter Four: Research Methodology

This chapter explains the paradigms, research design, approach and methods used in the study. A mixed-method research approach within the pragmatic paradigm was employed to examine the nature and usage of Smart Tourism and 4IR skills used at accommodation establishments within the Tourism industry. The methods and instruments used to collect data, including a brief explanation of the data analysis, are also provided.

Chapter Five: Presentation of the Quantitative Results

This chapter presents the main findings from the analysis of the quantitative data collected using a survey questionnaire. The quantitative results are presented using descriptive and inferential statistics, including correlations supported through regression tables.

Chapter Six: Presentation of the Qualitative Results

The sixth chapter presents the findings derived from the analysis of the qualitative data collected using interviews conducted with managers from the Accommodation sector. The qualitative results are described through narratives and word frequencies from a coding process aligned with this study.

Chapter Seven: Triangulation and Model Development

This chapter provides the triangulation of the quantitative and qualitative results, as well as the Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education and the mobile application that was developed.

Chapter Eight: Summary, Conclusions, Recommendations and Implications of the Study

The final chapter summarises chapters one to seven and discusses the main findings within the context of the theories framing the study. The relevant literature is combined with the analysed results from inferential and descriptive findings to address the study's objectives. Based on these discussions, conclusions are drawn, and recommendations are made, including presenting a curriculum model incorporating Smart Tourism and 4IR for Accommodation establishments in KwaZulu-Natal.

1.9 Chapter Summary

This introductory chapter presented the study and covered the problem statement, followed by the aim and objectives of the study, its significance, scope, delimitations, and research output. It also provided an overview of all eight chapters of the dissertation. Chapter Two follows and proffers a critical examination of literature relevant to the current study, along with terminologies, the theoretical context, and critiques.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The previous chapter provided an overview of this study. This chapter proffers an in-depth review of the literature on Smart Tourism and Fourth Industrial Revolution (4IR) skills in the Tourism industry's higher education curriculum. The literature review is based on the aim and objectives of the study. The research output is a Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education for accommodation establishments within KwaZulu-Natal (KZN). The literature review forms the basis of the design and development of the Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education. The chapter begins by providing information on the digital ecosystem, followed by the digital economy in the Tourism industry. Thereafter, 4IR technologies and the phenomenon of Smart Tourism are discussed, followed by an exploration of 4IR skills and training needs in the accommodation sector. This is followed by an examination of Smart Tourism and 4IR in the existing higher education curriculum. Figure 2.1 presents a visual overview of the structure of the literature review.

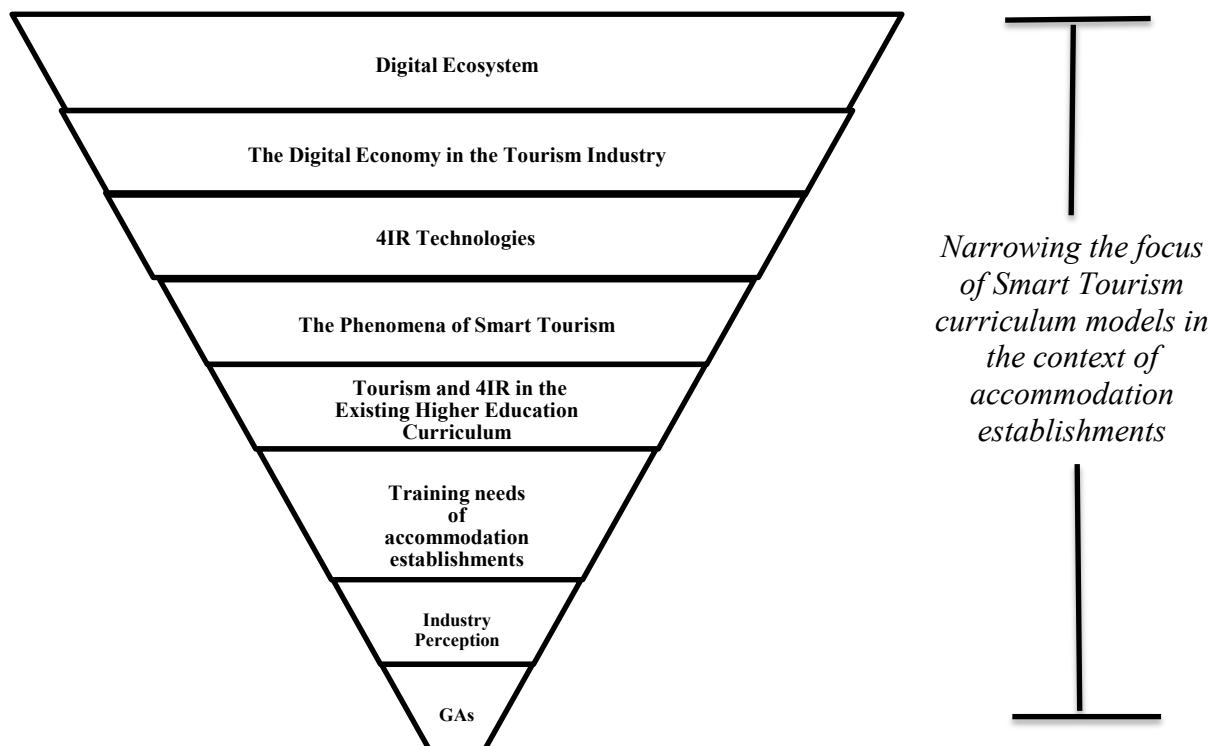


Figure 2.1: Overview of Literature Review
Source: Researcher's Construction

2.2 Digital Ecosystem

The literature reviewed emphasises the need for development agencies, donors and investors to go beyond traditional assistance models to address the global demand for a digital ecosystem. For example, Turpie *et al.* (2022:54) conducted a study in KZN, South Africa, to develop a strategy for ecosystem accounting in the KZN region. The findings of their study inferred that companies must recognise that the digital ecosystem extends beyond the digital economy. On the other hand, Peng (2024:39-40) praised the role of digital technologies in enhancing transparency, inclusivity and innovation whilst fostering economic growth. However, as global connectivity increases, digital ecosystems also face vulnerabilities (Loan, 2022:140). Thus, stakeholders must understand key participants and systems to implement effective policies, digital tools and strategic initiatives (Frick, 2023:63-64). This is further emphasised by the United States Agency for International Development (USAID), which launched its first Digital Strategy in April 2020, aiming to build open, secure and inclusive digital ecosystems that drive measurable development and humanitarian outcomes (Juma and Patel, 2022:94).

Guided by the Principles for Digital Development, USAID introduced the Digital Ecosystem Framework, which helps decision-makers assess opportunities and risks in digital environments (Stewart *et al.* 2019:1). This framework supports digital investments, programming and policy reforms (Turpie *et al.* 2022:55). According to Cai, Neszmelyi and Wei (2023:15-17), understanding digital ecosystems is critical for evaluating their impact on development and identifying infrastructure gaps requiring targeted investment. Each country's digital ecosystem has unique challenges and risks, necessitating specific policies to enhance digital skills, improve legislation and ensure digital inclusion (Loan, 2022:142). The Digital Environment Country Assessment (DECA) is a tool introduced to analyse national digital landscapes, identifying key development opportunities and regulatory factors that shape industries, such as Smart Tourism (USAID, 2024:38).

The Digital Ecosystem Framework as illustrated in Figure 2.2 below serves as a tool for Smart Tourism and 4IR assessments, enabling collaboration and informed decision-making (Penprase, 2018:18). Private sector stakeholders play a crucial role in this system by enhancing digital connectivity and protecting user data (Juma and Patel, 2022:95). Digital assessments, such as DECA reports from Colombia, Kenya and Serbia, provide insights into market conditions and regulatory landscapes that impact tourism operations (Juma and Patel, 2022:97-

100). Thus, digital technologies play a key role in the growth of the Tourism industry, particularly in low and middle-income regions such as KZN, South Africa (Mlambo and Ezeuduji, 2020: 1195). Henriques, de Almeida and Ramos (2024:66) assert that policymakers can create well-integrated digital strategies by evaluating digital rights, economic factors and infrastructure.

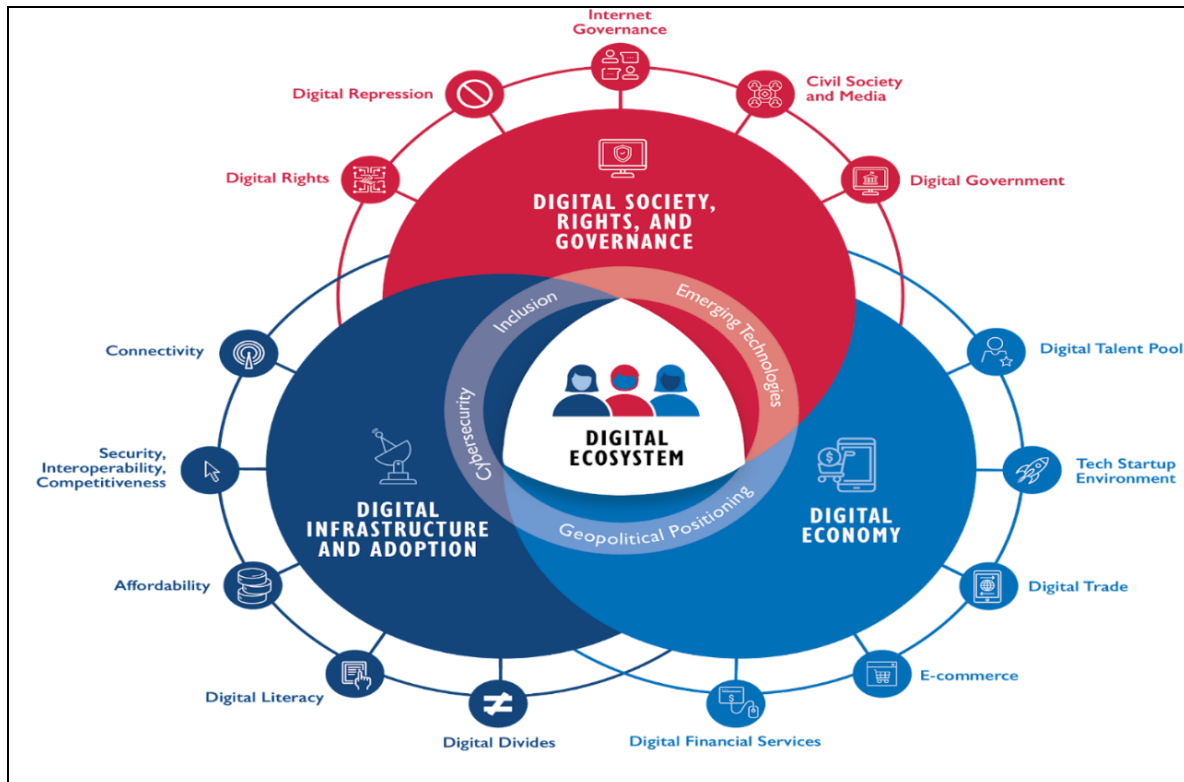


Figure 2.2: The Digital Ecosystem Framework Pillars

Source: Extracted from Alet (2022)

2.3 The Digital Economy in the Tourism Industry

Money from billions of daily online interactions between individuals, organisations, products, services, data and procedures is called the "digital economy" (Alekseeva *et al.* 2024:1, Valdez-De-Leon, 2019:44). This suggests that the Tourism industry can now better connect with customers, streamline processes and make more informed decisions because of the integration of e-commerce, online advertising, social media, big data and the Internet of Things (IoT). Whilst this integration presents various benefits and opportunities, Javadi (2022:140) noted that the dynamic digital economy has created new challenges, such as needing specialist skills and expertise to employ these technologies.

Nevertheless, the proliferation of digital channels makes it seamless for customers to book their stay online and use mobile apps to access services, thereby changing how they interact with businesses. Jevtic *et al.* (2023:1) argued that customers increasingly expect high-quality digital services throughout every transaction in the Tourism industry. As such, emerging technologies such as IoT, cloud computing and big data analytics have transformed businesses' productivity, streamlined processes and personalised products and services, which have significantly impacted the Tourism industry (Verma *et al.* 2021: 1-2; Lan, 2023: 1-5). However, digital technology growth has resulted in disruptions in hospitality and tourism businesses. Due to limited resources and technical competence, many enterprises in this industry struggle to develop and embrace new technologies as rapidly as the market requires (Pribadi *et al.* 2021:254). While the roots of technology utilisation in the Tourism industry could be traced back to the 1970s and 1980s, when computer reservation systems (CRS) and global distribution systems (GDS) were introduced (Provenzano and Baggio, 2020:847), research suggests that the emergence of artificial intelligence (AI) presented a significant paradigm shift in the Tourism industry. For example, Penprase (2018:19) argued that technological advances have the potential to make present abilities outdated quickly. As such, there is a significant need for present and future practitioners to be conversant with their tools and the newest digital advances (Juma and Patel, 2022:96). Thus, the Tourism curriculum in Higher Education Institutions (HEIs) must adequately prepare future practitioners.

Apart from artificial intelligence, Choi and Kim (2024:1891-1892) identified many other disruptive technologies, namely Virtual Reality (VR), Augmented Reality (AR) and chatbots, which could be used in the Tourism industry. Bertacchini *et al.* (2021:1-2) argued that the insufficient incorporation of 4IR Technologies into higher education curricula will result in the lack of 4IR skills and expertise amongst Tourism graduates. Thus, the lack of 4IR skills and expertise will have a negative impact on graduates' ability to use new technologies to improve consumer experiences, streamline corporate processes and encourage industry innovation. On the other hand, Garcez *et al.* (2021:160) posited that the Tourism industry's varied consequences of 4IR are not adequately considered due to the lack of an interdisciplinary approach. The 4IR's technological advances are lauded, but Tourism marketing techniques, sustainability practices and consumer interaction are neglected. However, conventional

Tourism curricula generally prioritise sector-specific knowledge over an interdisciplinary framework that encourages 4IR technology understanding and use (Garcez *et al.* 2021:160).

Moreover, there is a need for tourism organisations to utilise technologies such as data analytics to understand client preferences, predict trends and make Smart strategic decisions. Therefore, the curriculum's lack of data analytics training hinders graduates' ability to use data for strategic planning and operational improvements (Javadi, 2022:141). This concern is also noted by Stewart *et al.* (2019:1), who identified a disconnect between academic and industrial needs. Curricula may not reflect current industry developments, resulting in a gap between graduates' abilities and the needs of Tourism enterprises spurred by 4IR.

South Africa's tourism sector has also been significantly shaped by digital transformation, with emerging technologies increasingly influencing destination management, customer behaviour and service delivery. The National Tourism Sector Strategy (NTSS) 2016–2026 identifies technological innovation as a key driver for competitiveness and sustainability in the tourism economy (Department of Tourism, 2017). However, local studies reveal that many tourism establishments particularly SMEs, face barriers such as limited digital adoption, inadequate ICT infrastructure and shortage of technologically skilled staff (Rogerson and Baum, 2020:727; Ndlovu and Rogerson, 2023:1010). These constraints are especially evident in KwaZulu-Natal, where technology readiness varies across accommodation establishments, underscoring the need for context-specific investigations into Smart Tourism capabilities and workforce digital skills.

2.4 4IR Technologies

People often use the word "Smart" in relation to technology, especially concerning how technology is improving business, society and technology (Ballina, 2020:169). The intelligence that one sees in this situation derives from the growth and integration of different technology systems worldwide (Ajibade and Mutula, 2020:189). Real-time data usage, data sharing, data analysis, data models, data optimisation and data visualisation are some of the tools that have helped get to this point (Siddiqui *et al.* 2022:12). The idea of intelligence can be used in many places, like cities and tourist locations. For example, a Smart city makes good use of technology to improve its resources; management attempts to be environmentally friendly; and improves the general quality of life (Yang *et al.* 2021:3).

Importantly, KZN's tourism industry holds significant potential for growth given its diverse attractions and rich cultural heritage (Mlambo and Ezeuduji, 2020:1195). The integration of 4IR technologies could potentially enhance this industry by improving tourist experiences through personalised services, optimising resource management and fostering economic growth. For example, emerging technologies can provide customised travel recommendations, manage resource use in hospitality, and aid in destination marketing and management (Buhalis and Amaranggana, 2015:379).

2.4.1 Emerging Technologies in the Tourism Industry

Whilst the perusal of literature commends the significant role played by a wide range of emerging technologies in shaping delivery service in the Tourism industry, the implications of these technologies for the curriculum in Tourism education are often overlooked. Therefore, this study provides a comprehensive exploration of emerging technologies as pedagogical tools that significantly transform Tourism education's design and delivery. For example, Figure 2.3 illustrates the wide range of emerging technologies integrated into the Tourism industry, including big data; mobile technology; VR; IoT; fifth generation cellular technology (5G); blockchain; and AR, which is advantageous to the Tourism industry (Marques, 2024:44). Thus, in higher education, these technologies present a potential for a significant shift in Tourism education from passive theory-based instruction that lacks innovation and transformation, to active, transformative and experiential learning. The utilisation of emerging technological tools such as virtual reality stimulates Smart learning environments, allowing students to engage in role-play and scenario planning.

Figure 2.3 demonstrates the importance of emerging technologies in the Tourism industry, highlighting their interrelationship and the various advantages they provide. For example, central to the diagram is the primary focus on the benefits of emerging technologies to the Tourism industry, surrounded by various emerging technological tools contributing to it, as per the thick grey arrows. Furthermore, the network of thin blue arrows connects each of the technologies to real-time information, seamless transactions, personalised travel and enhanced customer experience. This implies that emerging technologies could assist in personalised travel services in the Tourism industry by having seamless and secure transactions taking place and allowing for real-time information to ensure that operations are carried out efficiently, resulting in enhanced customer experience (Marques, 2024:44). In Figure 2.3, the large curved

blue arrows show a cyclical process illustrating that there is continuous innovation and that the impact of the technologies is constantly evolving. As evident in Figure 2.3, technologies do not function in isolation and, when combined, result in many advantages and add value to the Tourism industry.

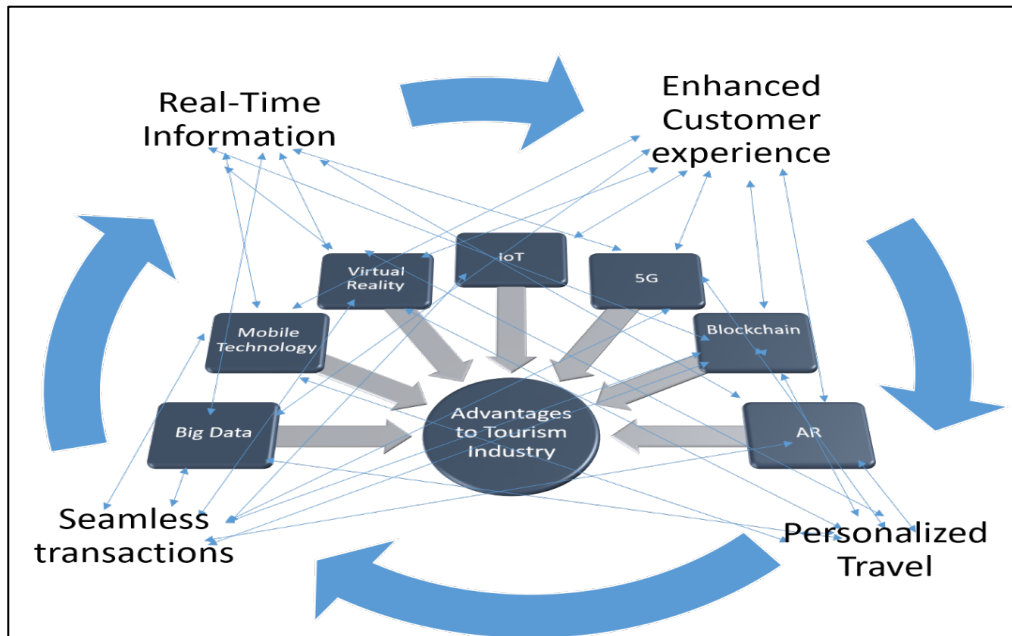


Figure 2.3: Emerging Technologies in the Tourism Industry

Source: Researcher's Construction

Big Data: Big Data is a term used to describe large and complex datasets, as per Ballina (2020:172). Big data technologies play an essential role in facilitating informed decisions amongst organisations. This argument is supported by Wirdarti, Erkamim and Wartono (2024: 720), who similarly argue that big data technology is useful in analysing customer behaviour and preferences to allow for tailor-made services and personalised marketing strategies. Momani, Alsakhnini and Hanaysha (2022:2) noted that in the Tourism industry, big data effectively predicts analytics where tourist demands and travel trends can be identified and resource allocation optimised for smooth operations. In the Tourism education curriculum, the integration of big data technologies implies a fundamental shift toward teaching models of decision-making, data analytics and customer behaviour analysis. Furthermore, the integration of modules related to big data could foster innovative mindsets amongst students, allowing them to harness data and identify trends to facilitate the delivery of innovative services (Momani, Alsakhnini and Hanaysha, 2022:2). Incorporating big data technologies in Tourism education could bridge the gap between higher education and industry by producing adaptive

graduates who are not only critical thinkers but who also possess analytical reasoning, a critical attribute amongst graduates in Tourism management.

Mobile Technology: Mobile technologies have emerged as a critical advancement in various industries. In the Tourism industry, mobile technologies have become a foundation to modern tourism experiences, ranging from mobile navigation to digital bookings and offering real-time location-based services (Fernández Alcantud and García Moreno, 2022:19). The use of mobile technologies allows for electronic payment systems, which are a growing, more popular and efficient method to conduct transactions without the use of physical money exchange. In tourism education, the integration of mobile technologies in the curriculum could prepare students to be innovative in the management of mobile-driven customer experiences.

Virtual Reality: The rise of VR technologies offers tremendous benefits to the Tourism industry, thus creating a unique concept known as the virtual tourist (Polishchuk, 2023:10534). Scholarly literature views the emergence of the concept of virtual tourism as an innovative move towards creating a Smart Tourism environment where customers take virtual tours of numerous destinations from the comfort of their own homes (Siddiqui *et al.* 2022:13; Ballina, 2020:172). Combining videos and still photographs with multimedia features like narration, music and sound effects creates a highly interesting and immersive experience for the user. Another important innovation is using AI-powered chatbots, which work as virtual assistants that can interact with humans and have human-like conversations to deliver real-time information and support. The voice-activated assistants offer hands-free travel guidance, and accommodation establishments use AI-powered chatbots for instant guest support (Ballina, 2020:172). Moreover, Ballina (2020:172) mentioned that in an age where the dependency on digital resources is increasing, it is critical to ensure cybersecurity to guard networks, data and systems from cyber threats. Schott and Marshall (2021:96-97) infer that virtual reality can be integrated in tourism education to enhance teaching and experiential learning, particularly in destination management and heritage tourism.

Internet of Things: IoT technology has been revolutionised and has become a practical tool in the Tourism industry as it is used for “Smart applications, Smart services and Smart management” (Novera *et al.* 2022:327). In addition, this tool allows businesses in the industry to offer personalised services by collecting and analysing data using connected devices (Vinh

et al. 2023:4). This results in services being tailored for clients as they can get travel itineraries that are customised as well as personalised hotel services, resulting in customer satisfaction (Abdel Hamid, 2024:158; Vinh *et al.* 2023:4). Moreover, it allows for real-time decision-making, which assists with a reduction in operational costs (Abdel Hamid, 2024:158). Tourism educators could integrate IoT in the design of the Tourism curriculum to ensure the delivery of innovative content that teaches students the management of Smart infrastructure, IoT-based Tourism planning and Smart techniques for guest personalisation (Vinh *et al.* 2023:5).

Fifth Generation Cellular Technology (5G): 5G is the fifth generation of mobile network technology that allows for tourist experiences to be enhanced by making them more connected in the form of augmented reality tours as well as real-time information sharing (Pradini *et al.* 2024:429; Vignaroli *et al.* 2020:1). This technology also assists with enhancing data transfer and provides higher device connectivity. In addition, it assists with making operational tasks efficient through IoT integrations and enables Smart sensors for maintenance, which is powered by real data analytics (Pradini *et al.* 2024:429). This is important as it completely revolutionises guest services in the industry and assists with back-end operations. Furthermore, this technology improves communication between service providers and tourists, increasing customer satisfaction (Pradini *et al.* 2024:430). Additionally, Vignaroli *et al.* (2020:2) shared an argument that the use of 5G technology in the Tourism industry can revolutionise travel experiences by making them more interactive and immersive, allowing for an innovation boost in digital-based tourism products and services. In higher education, the design of a Tourism education curriculum based on emerging digital infrastructures and connectivity in rural tourism development is critical to the contextualisation of the strategic value of 5G in South Africa and KZN, where infrastructure limitations remain a stumbling block. This argument is further supported by Pradini *et al.* (2024:431), who highlighted that although the integration of 5G in the Tourism industry presents various benefits, this transformative move still faces challenges, especially concerning the availability of infrastructure as well as the devices being compatible with each other.

Blockchain: Blockchain technology is a crucial decentralised system for tourism businesses to utilise as it assists with providing security, ensuring transparency and allowing for transactions to take place that are tamper-proof (Muharam, Tussyadiah and Kimbu, 2024:7; Rashideh, 2020:1). Moreover, blockchain can remove the usage of intermediaries in the Tourism industry

by allowing for direct transactions to take place between the tourism businesses and their customers, resulting in cost reduction as well as increased efficiency (Muharam, Tussyadiah and Kimbu, 2024:1; Rashideh, 2020:1). In other words, when cryptocurrencies are used for making payments, this would save travellers money by making use of intermediary platforms and they will therefore be able to book directly with hotels and purchase their own airline tickets (Rashideh, 2020:1). It is therefore recommended that blockchain be incorporated into more tourism businesses to reduce the usage of intermediaries and make the experience of travellers and tourists a more pleasurable one.

Augmented Reality: Yang *et al.* (2021:5) mention that AR is a digital technology that transforms an individual's perception of their physical surroundings when seen via a specific device. The technology is similar to VR, but unlike VR, AR enriches the actual world by superimposing digital features (Vasista, 2022:1-2). Consequently, AR allows tourists to have immersive interactions, which are done through virtual exploration of historical sites. Virtually exploring historical sites assists with reducing the environmental impact at the tourist site (Zaifri *et al.* 2023:15). There are key AR elements, including mobile devices and visual overlays. When these AR elements integrate with IoT, they provide real-time information and further enhance the tourist experience (Zaifri *et al.* 2023:1). The technologies mentioned above play a crucial role in shaping the Tourism industry by improving customer experiences; ensuring efficient operations; securing transactions; and personalising travel services (Abdel Hamid, 2024:158; Vinh *et al.* 2023:4). Vinh *et al.* (2023:5) state that as technology continues to evolve, the Tourism industry will become increasingly seamless, convenient and immersive, providing travellers with enriched, customised and secure journeys.

Table 2.1 below synthesises the key literature findings on **Fourth Industrial Revolution (4IR) technologies** and their role in **Smart Tourism**.

Table 2.1: Summary of the 4IR Technologies in Smart Tourism

4IR Technology	Description and Role	Source
Big Data and Data Analytics	Collects, analyses and visualises large datasets to enhance decision-making, marketing and customer insights.	Ballina (2020); Momani, Alsakhnini and Hanaysha (2022); Wirdarti, Erkamim and Wartono (2024)

IoT	Connects devices and systems to optimise resource management; improve guest experiences; and support Smart applications, Smart services and Smart management.	Abdel Hamid (2024); Novera <i>et al.</i> (2022); Vinh <i>et al.</i> (2023)
Mobile Technology	Makes travel planning and booking more convenient.	Fernández Alcantud and García Moreno (2022)
AI	Enhances personalisation and automation in Tourism, such as AI-driven chatbots, virtual assistants and tailored travel recommendations.	Buhalis and Amaranggana (2015)
Fifth generation of cellular technology (5G)	Allows for tourist experiences to be enhanced through augmented reality tours and real-time information sharing.	Pradini <i>et al.</i> (2024); Vignaroli <i>et al.</i> (2020)
Smart Tourism Platforms	Enhances tourist decision-making by offering reviews, price comparisons and personalised itineraries.	Alet (2022)
AR/VR	Enhances immersive tourism experiences through virtual site visits and interactive cultural heritage displays.	Abdel Hamid (2024); Ballina (2020); Buhalis and Amaranggana (2015); Siddiqui <i>et al.</i> (2022); Vasista (2022); Vinh <i>et al.</i> (2023); Yang <i>et al.</i> (2021); Zaifri <i>et al.</i> (2023)
Blockchain	Ensures secure transactions and data protection in digital tourism services.	Ajibade and Mutula (2020); Muharam, Tussyadiah and Kimbu (2024); Rashideh (2020)

2.5 The Phenomenon of Smart Tourism

The concept of Smart Tourism is explained by Fernández Alcantud and García Moreno (2022:18) as integrating sophisticated technologies to improve efficiency, sustainability and the overall customer experience in the tourism business. Marques (2024:43) proclaims that the term "Smart" refers to the incorporation of several technology-integrated or augmented aspects. As such, the concept of Smart Tourism emerges from the convergence of tourism and information and communication technologies (ICT). Smart Tourism is a relatively new concept that explains an innovative, lasting and ecologically responsible plan for the strategic

management, growth, operation and marketing of tourism goods and companies (Ballina, 2020:171). Consequently, Gretzel (2021:3) divided the notion of Smart Tourism into two categories, namely management strategies for Smart demand and intelligent marketing methods that target specific client groups to provide relevant information. The United Kingdom's Organisation for Smart Tourism explained the concept of Smart Tourism as using technology to transform the tourism business (Ajibade and Mutula, 2020:187). Moreover, Siddiqui *et al.* (2022:11) asserted that Smart Tourism involves using mobile digital connections to build lasting, intentional relationships between visitors and the area.

The landscape of global tourism, which is largely competitive, continues to foster the broad adoption of innovative technologies as transformative ways of differentiation and expanding markets in tourism management organisations (Santarsiero, Carlucci and Schiuma, 2024:1). Alet (2022:296) argued that improving accessibility standards and the quality of online information is vital in attracting a broader and digitally connected audience. This argument illustrates a fundamental shift founded on the revolution of digital technologies and the broad adoption of ICTs in the Tourism industry, which has transformed the operations and user experience in the industry. The same sentiments are shared by Valdez-De-Leon (2019:43), who asserted that digital transformation and the broad adoption of emerging technologies in the Tourism industry not only enhance operational efficiency but also improve the competitiveness of the Tourism industry and tourist engagement. For example, technologies such as e-commerce are widely used in Smart Tourism strategies to inform personalisation and data-driven experiences (Garcez *et al.* 2021:161). The emergence of Smart Tourism cultivates the provision of online services, including booking services (flight, accommodation and car rentals), which are all embedded in the Smart Tourism data ecosystem, enabling the analysis of customer behaviour and service optimisation.

Table 2.2 below synthesises key literature findings on Smart Tourism, highlighting its core components, technological applications and industry impact. This structured table presents key findings clearly and comparatively, making the complex concepts of Smart Tourism more accessible and engaging.

Table 2.2: Summary of Smart Tourism Phenomenon

Aspect of Smart Tourism	Description and Role	Source
Definition and Concept	Uses advanced technology and data-driven strategies to enhance efficiency, sustainability and the visitor experience.	Fernández Alcantud and García Moreno (2022)
Emergence of Smart Tourism	Originates from the integration of tourism and ICT, focusing on digital transformation in travel experiences.	Marques (2024)
Key Components	Smart Tourism involves demand management (visitor flow regulation) and targeted marketing strategies for personalised travel experiences.	Gretzel (2021)
Technology in Smart Tourism	Incorporates mobile connectivity, e-commerce, VR, AR and AI to enhance destination image and service quality.	Garcez <i>et al.</i> (2021)
Global Adoption	Countries like China categorise Smart Tourism into seven areas, including technological applications in travel.	Yang <i>et al.</i> (2021)
Smart Destinations	The most competitive tourism destinations integrate ICT solutions, digital services and gamification techniques for engagement.	Valdez-De-Leon (2019); Loan (2022)
Data-Driven Tourism	Smart destinations use data analytics and user intelligence to improve travel experiences and decision-making.	Lubinga <i>et al.</i> (2023)
Smart Airport Innovations	Bluetooth sensors, self-check-ins, contactless payment systems (T-mobility) and AI-powered security enhance efficiency.	Juma and Patel (2022:97); Penprase (2018)

2.6 Smart Tourism and 4IR in the existing Higher Education Curriculum

In the South African context, the integration of Fourth Industrial Revolution (4IR) technology into higher education remains unequal and hampered by historical inequities, resource restrictions, and institutional capacity issues. National policy documents such as the Department of Higher Education and Training (DHET) White Paper for Post-School Education and Training (DHET, 2013) and the Ministerial Task Team Report on 4IR (DHET, 2021) emphasise the urgent need for higher education institutions to incorporate digital literacy, data competencies and technology-enhanced pedagogies into academic programmes. Despite these governmental guidelines, research undertaken at South African institutions found sluggish curricular response, poor digital infrastructure, and considerable gaps in lecturers' digital preparedness (Czerniewicz *et al.*, 2020:946; Mhlanga and Moloi, 2020:1). These contextual

challenges highlight the importance of studying Smart Tourism and 4IR integration, particularly in South African higher education, where digital transformation is both necessary and complex.

Digital literacy skills and expertise are significant attributes that define adaptive graduates in the digital information society and are survival skills in the Tourism industry. The broad adoption of emerging technologies and the over-reliance on digital tools in the Tourism industry call for graduates who are not only familiar with industry requirements but also adaptive enough to keep up with the digitally evolving nature of tourism. These arguments are further emphasised by Ferras *et al.* (2020:4-9), who asserted that Smart technical skills and expertise, including the ability to use intelligent systems, data analytics, social media management, and digital fluency, are critical requirements in the modern tourism workspace. Notwithstanding the current landscape of digital transformation in the Tourism industry, the current higher education curriculum demonstrates ineffectiveness in integrating digital competencies as required in the current digital era. The study by Chugh, Grose and Macht (2021:984) points out the significant gaps between academic output and the requirements of the Tourism industry, highlighting that most graduates produced by HEIs lack practical experience with the platforms and tools used in digital tourism. According to Aydin and Sirkeci (2024:49-51), this disconnect emerges from the ranks of a deteriorated curriculum that lacks technology integration, leading to limited access to Smart technological tools and a lack of technological training amongst Tourism educators. Given this context, along with the importance of digital literacy skills and competencies in the digital era, there is a need for HEIs, especially in regions such as KwaZulu-Natal that have many communities suffering from digital disparities, to redesign their curricula to embed digital technologies and foster critical thinking and adaptability (Adeyinka-Ojo *et al.* 2020:120; Chugh, Grose and Macht; 2021:984).

South African tourism education has also faced ongoing criticism regarding its limited responsiveness to technological change. Scholars argue that tourism programmes often remain theoretically oriented and insufficiently aligned with digital industry expectations (Nkwanyana and Pelser, 2022:44; Marumo and Mearns, 2021). Digital literacy training, data-driven decision-making and exposure to smart technologies are inconsistently integrated into tourism curricula, resulting in graduates who are under-prepared for the digital demands of contemporary tourism workplaces (Saayman, 2022:210). These concerns are echoed in the Council on Higher Education's (CHE, 2020) reviews, which highlight the need for curriculum

transformation that incorporates 4IR-aligned competencies. This local literature reinforces the rationale for developing a Transformative Higher Education Curriculum Model tailored to South Africa's Smart Tourism environment.

2.6.1 The Concept of Smart Tourism in Higher Education

The concept of Smart Tourism necessitates the Higher Education sector to rethink its offerings to respond swiftly to the technological advancements and the paradigm shift in the Tourism industry. The emergence of Smart Tourism prompts the integration of technologies in the Tourism education curriculum to reflect the innovative response to the demands of the digital information society for adaptive graduates with transformative technological competencies. The study by Tsiligiris and Bowyer (2021:622) highlighted that various emerging technologies are extensively integrated into the Tourism industry to improve operational efficiency, the quality of service delivery and overall sustainability. Mandalia (2023:513) maintains that HEIs, especially in South Africa, have a mandate to equip students with the necessary and digitally relevant skills and practical competencies in various areas, including data analytics and digital marketing. Significantly, this paradigm shift necessitates an innovative educational curriculum in Smart Tourism that transcends disciplinary boundaries to foster adaptability through the integration of technology.

As the global workforce increasingly demands digital literacy, adaptability and interdisciplinary expertise, universities must radically transform their teaching approaches to ensure that students are equipped with the necessary 4IR competencies. The emphasis on critical thinking, creativity and advanced problem-solving skills is now central to student success in this rapidly evolving landscape (Sitepu *et al.* 2020:2). It is therefore important that the curriculum models developed take into account these aspects to ensure that students are being adequately prepared with a knowledge of Smart Tourism and the necessary 4IR competencies.

2.6.2 The Synergistic Relationship between Smart Tourism and 4IR

The convergence of Smart Tourism and 4IR has become a focal point in Tourism education reform. Thus, 4IR's related technologies play a critical role in Smart Tourism. Gretzel (2021:5) argued that students may acquire a comprehensive grasp of the dynamic link between technology and the Tourism industry through a curriculum incorporating both elements. The

assertions of Fernández Alcantud and García Moreno (2022:22) highlight that the ethical difficulties in 4IR could be addressed by courses that explore the ethical implications of data usage in the context of Smart Tourism. Additionally, Gretzel (2021:5) stated that students are better prepared to navigate the constantly shifting landscape of responsible Smart Tourism if they thoroughly understand the social implications of automation and artificial intelligence within the context of 4IR.

To sufficiently prepare students for the upcoming changes in the Tourism industry, curricula in higher education must include both Smart Tourism and 4IR concepts. The continued impact of technology on tourists' interactions with destinations and services requires HEIs to adapt their curriculum to provide students with the necessary skills and knowledge to succeed in a digitally oriented environment (Huang, de la Mora Velasco and Haney, 2024:116c). The ties between Smart Tourism and 4IR highlight the need for an all-encompassing, multidisciplinary approach to higher education, a strategy that guarantees that graduates possess the critical thinking and problem-solving skills necessary to succeed in the 4IR and technical proficiency.

2.6.3 Global Integration of 4IR into the Curriculum in Higher Education

Globally, HEIs have integrated 4IR concepts into their curriculum in various disciplines. To prepare students for the technology-driven workforce, leading universities worldwide have redesigned their curricula to incorporate 4IR technologies and skills. For example, the Massachusetts Institute of Technology (MIT) in the United States of America is at the forefront of 4IR education, integrating AI, robotics, blockchain and big data analytics into various programmes. MIT's Digital Learning Strategy emphasises experiential learning, problem-solving and cross-disciplinary collaboration. The university's Micro Master's in Data, Economics and Development Policy offers flexible, technology-driven education, equipping students with real-world analytical skills applicable in Smart Tourism and other sectors (Coetzee *et al.* 2021:10). Similarly, the National University of Singapore (NUS), has revolutionised its curriculum through the NUS Smart Nation Initiative, embedding big data analytics, fintech and Smart Tourism technologies into its courses. The university's School of Computing collaborates with industry leaders to provide students with practical exposure to AI-driven tourism applications and contactless service innovations (Liu, Jiang and Chan, 2019:834).

On the other hand, the University of Cambridge, based in the United Kingdom, incorporates AI, machine learning and IoT within its Engineering, Business and Tourism programmes. The university's Institute for Manufacturing (IFM) and Centre for Smart Infrastructure and Construction (CSIC) provide students with hands-on research opportunities, ensuring that graduates understand how 4IR technologies transform industries (Mich, 2020:5). In addition, the Technical University of Munich (TUM), based in Germany, has integrated 4IR concepts into Business, Tourism and Engineering programmes, offering courses in digital transformation, Smart mobility and sustainable tourism. Moreover, its Entrepreneurship Centre fosters innovation in digital tourism, preparing students to apply AI-driven solutions in tourism and hospitality (Bottazzi, 2024:23). The incorporation of 4IR concepts into university courses ensures that students develop technological proficiency while enhancing their cognitive and interpersonal skills (Roque and Ramos, 2019:63). Leading institutions such as MIT, Cambridge, TUM and NUS have already implemented 4IR concepts into their curriculum, prioritising experiential learning, interdisciplinary collaboration and Smart technology applications. Implementing 4IR concepts serves as a benchmark for HEIs in South Africa and other developing regions, guiding their transition toward technology-driven tourism education. Universities can bridge the gap between academic learning and industry demands by integrating AI, IoT, big data and digital platforms into tourism and hospitality curricula. This ensures that graduates are well-equipped for careers in the Tourism industry with Smart Tourism knowledge and skills, positioning HEIs as key drivers of 4IR innovation in the industry.

2.6.4 Local Integration of 4IR into the Curriculum in Higher Education

Despite the significant progress made by national higher education institutions towards developing frameworks for digital transformation, regions such as KZN continue to grapple with unique regional challenges that hinder the seamless integration of emerging 4IR technologies into the tourism education curriculum. According to Msila (2023:93), HEIs have started to spread the influence of 4IR, mainly during the lockdown period due to the COVID-19 pandemic. However, it was further mentioned that teaching and learning were not transformed effectively using 4IR methodologies. Arguably, knowledge of 4IR technologies is beneficial for students, especially when they are expected to be digitally literate when entering the industry (Msila, 2023:93). While the region of KZN boasts diverse offerings in the Tourism industry, digital transformation amongst various accommodation establishments remains

unequal. Similarly, Sincuba (2024:78) noted that HEIs face challenges in integrating the 4IR into their curricula, mainly due to a lack of infrastructure and educators and students not being entirely digitally literate. This is a crucial challenge because when educators are not entirely digitally literate, they would be unable to adequately prepare students for the demands of 4IR in line with industry requirements. Additionally, it has been found that many institutions experience challenges such as having insufficient computers or even electricity issues, which further hampers technology usage in their lectures and curriculum (Sincuba, 2024:78).

Drawing on the literature, three higher-order constructs were operationalised for empirical testing, namely: Section B (Smart Tourism/4IR adoption), Section C (4IR skills and training needs) and Section D (perceptions of graduate competencies). The questionnaire items in Sections B, C and D were designed to measure these constructs and are examined via Structural Equation Modelling (SEM) in Chapter Five.

2.6.5 The Evolution of Curricula in Response to Industry Demands

Tsiligiris and Bowyer (2021:624) assert that 4IR enables rapid changes in many industries, thus requiring universities to adapt their curricula to meet the growing demands of industry. In interdisciplinary studies, Syafruddin *et al.* (2025:293) observe an increasing emphasis on the fusion of technical proficiency with critical thinking, creativity and adaptability. Data science, AI, cybersecurity and digital literacy courses are becoming increasingly popular, which suggests that these skills are becoming important in the context of 4IR. Furthermore, it was emphasised by Roque and Ramos (2019:98) that developing soft skills, including problem-solving techniques, cooperation and effective communication, is becoming progressively important. On the other hand, Buhler *et al.* (2022:3) wrote that the 4IR calls for a workforce adept at working in various settings that significantly depend on technology and navigating circumstances marked by ambiguity and uncertainty. HEIs incorporate project-based learning, internships and practical learning opportunities into the curricula to prepare graduates with the practical skills required for professional success in response to the dynamic job market (Fernández Alcantud and García Moreno, 2022:21).

2.7 Training Needs of Accommodation Establishments

There will be many challenges and opportunities for tourism in protected places in the future. The COVID-19 pandemic has caused numerous problems in the Tourism industry. This could mean the start of a new way of thinking about growth. The outbreak appears to have been a

major force behind the change to a new type of technology called 4IR (Tsiligiris and Bowyer, 2021:621). This has meant that many businesses and parts of the economy, as well as society as a whole, have had to accept and use new technical solutions and applications. The Fourth Industrial Revolution sets new standards for businesses, which implies that they must shift technologically by taking advantage of the various technological advances and using new technology solutions that allow for a considerable change in the industry (Radun and Bartula, 2022:635-636). The above situation is believed to have immense effects on tourist services, the supply of tourist amenities, ecotourism and the general attitude towards customers. Additionally, the experience of using the services offered by tourism businesses will change significantly (Radun and Bartula, 2022:642-643).

One of the most important considerations is the selection of the correct technologies to assist groups that work in tourism in covered areas, which involves making creative technological advances. Xiao (2022:5) stated that when selecting and shaping a portfolio of 4IR technologies for the efficient running of tourism businesses, it is important to consider the natural trade-offs that come with using sustainable tourism practices whilst protecting natural environments. It is essential to analyse the current trends in tourism in general to gain deeper knowledge and predict trends of the coming technological change in the tourism business, as mentioned by Khupase *et al.* (2024:1-2). The 4IR technologies, namely big data, AI, IoT, VR, AR and robots, have the potential to significantly improve the competitiveness of tourism organisations. In modern discourse, the terms "Tourism 4.0" and "Smart Tourism " have emerged to highlight the distinction between revolutionary 4IR technology and traditional tourism. Tourism 4.0 is often regarded as a fresh paradigm in the tourism business as it entails applying the Industry 4.0 4IR framework to tourism, hence promoting technical improvement in the industry consistent with the technological achievements of the 4IR age, as customised expressly for the tourist domain (Javadi, 2022:142).

Stewart *et al.* (2019:68) asserted that the usage of speech-to-text technologies (STT), notably information and communication technologies (ICT), is recognised as a critical component alongside a variety of other technologies and applications. These include social platforms, Smart devices, cloud computing, IoT, big data, AI, VR, AR, mixed reality, near field communication (NFC) and radio-frequency identification (RFID). Smart Tourism is developing as a major trend in the Tourism industry, offering a revolutionary approach with

considerable implications for service delivery, customer relations, overall business operations, management methods and marketing practices (Stewart *et al.* 2019:68). Volchek and Brysch (2023:300-302) stated that the metaverse is a model of transformational virtual interactions. The notion of the metaverse provides clients with a new possibility to participate in a unique universe of travel experiences. Furthermore, it offers the exciting promise of creating and immersing oneself in an interactive virtual world, allowing for customisation based on individual preferences until a suitable result is attained. The term "Metaverse" refers to a broad spectrum of technologies and represents a substantial shift in our technical interactions, rather than being restricted to a certain kind of technology (Volchek and Brysch, 2023:300). The continued evolution of 4IR is causing a significant change in the employment market's skill needs (Tsiligiris and Bowyer, 2021:625). HEIs are responsible for providing students with the required skills and information to complete future professional duties that may not yet exist. In the age of the 4IR, critical thinking abilities, adaptability and a good foundation in digital literacy are widely seen as crucial success requirements (MN K. Khalid *et al.* 2020:313-315). Moreover, lifelong learning is gaining traction as technology advances exponentially, necessitating people's continuous skill enhancement throughout their professional lives. Kukla (2019:54-55) highlighted that HEIs are reacting to the needs of the changing labour market by adopting flexible and modular programmes and encouraging a culture of lifelong learning. These initiatives are intended to give graduates the required skills and knowledge to remain competitive throughout their careers. According to Sitepu *et al.* (2020:2-3), the 4IR has a considerable impact on higher education, prompting a rethink of teaching methodologies, curricula design and the competencies required for professional success. Since technology is increasingly integrated into all aspects of society, HEIs must play a critical role in equipping students with the essential knowledge and skills to properly navigate the challenges and opportunities posed by 4IR. Higher education's dynamic character reflects a commitment to flexibility, inventiveness and a thorough approach to preparing graduates for a future shaped by extraordinary technological advances (Kubitsky *et al.* 2023:124-125).

2.8 Industry Perceptions of the 4IR Competencies and Skills of Tourism Graduates

As emphasised by Tsiligiris and Bowyer (2021:626), the advent of 4IR has triggered significant technological advancements, culminating in a global revolution of various industries. Within the Tourism industry, Misra (2023:99) noted a growing demand for individuals with higher education and the essential proficiencies and aptitudes that meet 4IR standards. It is therefore

vital to investigate the Tourism industry's perspective on the competencies and skills linked to 4IR gained by graduates.

2.8.1 Industry Demand for Digital Literacy

In the context of the 4IR, digital literacy is an essential competency required by the Tourism industry (Misra, 2023:98). The increasing use of technology in all aspects of tourism businesses has resulted in industry stakeholders realising the value of graduates with strong digital abilities. This skillset encompasses social media management, data analytics proficiency and proficiency in using new technologies for marketing and customer engagement. Furthermore, Misra (2023:99) stated that there is increasing recognition in the Tourism industry of the need for digital literacy for those who have completed their studies in the Tourism profession. The study emphasises how critical digital skills are to remaining competitive and efficient in satisfying the evolving needs and preferences of tech-savvy visitors in the modern digital age.

2.8.2 Adaptability and Technological Ability

Research by Fernández Alcantud and García Moreno (2022:23) highlighted the significance of adaptation and technical agility in modern culture. These two notions are inextricably linked and play critical roles in the development and survival of people, organisations and civilisations (Marques, 2024:46). The rapid evolution of technology in the 4IR highlights the need for adaptable and technically agile graduates. However, Ballina (2020:175) stated that industry stakeholders highly value professionals who can quickly acquire and implement new technologies because they contribute to improving operational efficiency and the overall tourist experience. Efficiently adapting to future technologies, such as AR, VR and AI, is increasingly seen as a valuable talent. A World Economic Forum study identified flexibility and a desire to learn as key characteristics sought after by sectors across the 4IR era. Adaptability acquires essential relevance in Tourism, given the continual change in destination marketing, service delivery and customer interactions caused by technological improvements (Tsiligiris and Bowyer, 2021:627).

2.8.3 Interdisciplinary and Collaborative Skills

In academic and professional contexts, developing interdisciplinary and collaborative skills is critical. The capacity to work across multiple disciplines and effectively collaborate with others is essential for tackling complex issues and expanding knowledge across various fields (Roque

and Ramos, 2019:73). The interconnection of 4IR highlights the importance of diverse and collaborative skills amongst graduates in the Tourism industry. Industry stakeholders consider professionals able to successfully traverse several disciplines and collaborate with experts from different professions in high regard (Ferns, Dawson and Howitt, 2019:104). Moreover, Aydin and Sirkeci (2024:49-50) posited that the Tourism industry values interdisciplinary expertise because it recognises that complex problems need various answers. People who can bridge the gap between their technical proficiency and a broad awareness of several sectors are highly esteemed for their ability to effectively manage the complex issues posed by 4IR.

2.8.4 Ethical Considerations and Sustainability

Ethical considerations and sustainability are crucial in various academic disciplines and industries. This involves assessing moral principles, values and the long-term viability and impact of actions (Fernández Alcantud and García Moreno, 2022:24). The rising importance of technology in the Tourism industry has prompted industry leaders to acknowledge the worth of people with a solid ethical basis and a consistent commitment to sustainable practices. According to the United Nations World Tourism Organisation, people working in tourism businesses must be able to successfully utilise technology responsibly (Marques, 2024:47). This includes considering the ethical implications of data use, resolving privacy concerns and recognising the possible environmental effects of technology solutions.

Ballina (2020:176) indicated that the Tourism industry's evaluation of graduates' 4IR competencies and skills demonstrates the complex and various needs of the workforce in the digital age. Industry stakeholders value digital literacy, adaptability, interdisciplinary cooperation and ethical considerations. To ensure that tourism graduates are appropriately prepared to make significant contributions in a landscape driven by 4IR, Gretzel (2021:6) emphasised that HEIs must align their curriculum with the sector's aspirations. The business's constant expansion needs a close relationship between academic training and industrial requirements. This relationship will be crucial in determining the future success of tourism professionals.

2.9 Alignment of Graduate Attributes towards the Tourism Businesses

Small and medium-sized enterprises (SMEs) comprise a significant percentage of the Tourism industry. The International Labour Organisation (Duru *et al.* 2020:9) and Kreismann and

Talaulicar (2020:69) have observed that this presents a significant challenge in creating innovative tourism products and delivering high-quality services, particularly in the Accommodation sector, where service excellence is crucial. Despite the industry's dependence on human interaction, education, training and development are often undervalued, affecting employees' ability to meet the evolving demands of the industry (Kimeto, 2021:21). Hajoš (2019:62) highlights that neglecting structured training limits employees' adaptability to the rapidly changing hospitality environment, preventing them from acquiring the necessary knowledge, skills and employability traits.

Businesses that cater to tourists, especially hotels, lodges and guesthouses, often fail to provide structured training programmes, particularly for first-time hires. Chaka (2020:340) noted that Tourism graduates are expected to possess key skills, industry knowledge and professional attributes. However, it is common for accommodation establishments to recruit graduates from non-tourism disciplines, which raises concerns about skill gaps and workforce readiness (Tani, 2022:25). Tenbergen *et al.* (2023:37) further highlighted that few recognised training providers are offering standardised Tourism and Hospitality curricula, making continuous professional development in the sector a challenge. Workers are also discouraged from participating in existing training programmes due to barriers such as cost, scheduling conflicts and location constraints.

2.9.1 The Relationship between HEIs and Employability

HEIs have recognised the challenge of enhancing graduate employability by adopting two primary strategies: integrating employability skills into curricula through supervised industry placements or embedding professional skills training within academic programmes. The concept of the "Learning Age" or "Learning Society" highlights that HEIs must equip students with a broad set of skills that will enable them to successfully navigate the dynamic Tourism industry (Ochara, 2021:34).

According to Jung (2019:135), HEIs should emphasise the development of key employability skills, such as effective communication and customer service excellence. In addition, independent learning and adaptability are also essential employability skills, followed by information technology proficiency relevant to tourism operations. Numerical literacy and logical reasoning for hospitality management can be further noted as key skills. Moreover, understanding the various tourism and hospitality practices is also considered an important

skill. Jung (2019:135) further mentioned that critical analysis and problem-solving are also skills required in the Tourism industry. It can also be noted that specialised information technology skills relevant to hotel management include property management systems (PMS) and digital booking platforms (Shenkoya and Kim, 2023:26).

The 4IR and disruptive technologies are re-shaping the Accommodation sector. Digital guest experiences, contactless services and AI-driven Hospitality Management are becoming the norm, requiring graduates to adapt quickly to new technological systems (Shenkoya and Kim, 2023:26).

The ability of HEIs to ensure the employability of graduates has become an essential indicator of institutional success. Consequently, academic institutions are embedding career development concepts within Tourism programmes (Tsiligiris and Bowyer, 2021:628). Several key initiatives help facilitate career progression in the Accommodation sector, including an industry-aligned curriculum design that incorporates real-world hospitality challenges; work-integrated learning (WIL); internships and cooperative education placements; project-based learning and simulated industry environments; career mentorship, employer engagement and networking opportunities; and lastly, specialised training in revenue management, hotel operations and customer experience strategies (Tsiligiris and Bowyer, 2021:628).

Despite these efforts, Pervez *et al.* (2024:398) found that graduates often perceive these initiatives as fragmented, resulting in dissonance between academic preparation and real-world applications. This calls for a more structured approach where faculty members actively support students in bridging the gap between academic theory and industry practice (Pervez *et al.* 2024:408). To enhance graduate employability, Fernández Alcantud and García Moreno (2022:25) suggested that HEIs should integrate competency-based learning, ensuring that students develop essential service, digital and managerial skills. Additionally, curricula must be designed to accommodate part-time workers; recognise prior work experience; and provide flexible academic credits to working students (Ballina, 2020:177). In contrast, Gretzel (2021:7) argued that HEIs must work closely with hospitality businesses to provide students with practical work experience, job placements and career support services. The same sentiment is shared by Ballina (2020:178), who highlighted the importance of global opportunities, which can expose graduates to international hospitality standards and best practices.

Given the rising education costs, students expect HEIs to provide clear career pathways and returns on investment. However, Ajibade and Mutula (2020:191) note that employment in the Tourism industry remains unevenly distributed geographically and across different sub-sectors. This creates barriers to career progression, reinforcing concerns about education quality, skill acquisition and long-term employability (Siddiqui *et al.* 2022:14).

2.9.2 Graduate Employability in the Tourism Accommodation Sector

The demand for highly skilled Tourism graduates has increased due to the massification of higher education and the expansion of access to tourism programmes. However, Shenkoya and Kim (2023:27) highlighted that some employers perceive graduates as being over-educated but underprepared for the realities of the hospitality workplace. This issue arises due to a misalignment between academic qualifications and the industry's practical skill requirements. Graduates often prefer employment in well-established hotel chains and multinational corporations, perceiving these as prestigious career opportunities (Yasar, 2022:31) even though the Accommodation sector consists of hotels, bed and breakfasts, motels, hostels and guesthouses (Ionel, 2021:321). Furthermore, Marques (2024:49) stressed the importance of lifelong learning and short learning programmes to help Tourism graduates upskill and stay competitive. However, high tuition fees create financial constraints, particularly for students from lower socio-economic backgrounds (Ballina, 2020:178).

Mature graduates entering the workforce later in life often struggle to secure employment due to employer biases favouring younger candidates. However, mature graduates bring valuable soft skills such as work ethic, time management and adaptability (Ballina, 2020:179). Employers in the Accommodation sector value a mix of technical expertise and soft skills, including customer service excellence and problem-solving; operational efficiency in hotel management; the ability to adapt to changing guest preferences; and flexibility, teamwork and leadership (Stewart *et al.* 2019:69). Finally, Nguyen, Kailasam and Kamble (2023:49) emphasised that higher education must strengthen collaboration with industry stakeholders to enhance graduate employability. This includes increasing mobility opportunities, integrating applied research into Tourism programmes and fostering partnerships between HEIs and accommodation businesses (Nguyen, Kailasam and Kamble, 2023:49-50). In conclusion, ensuring that graduates are equipped for success in the Accommodation sector requires a

strategic alignment of higher education curricula with industry demands. By emphasising workplace readiness, digital competencies and industry partnerships, HEIs can better prepare students for sustainable careers in the dynamic Tourism industry.

Table 2.3 below synthesises key graduate attributes relevant to the tourism business, categorising them into four dimensions, namely Educational, Cultural, Contextual and Dispositional (Turpie *et al.* 2022:64-65).

Table 2.3: Summary of Graduate Attributes for the Tourism Industry

Graduate Attribute Category	Key Attributes and Skills	Source
Educational Attributes	- Subject-specific knowledge in Tourism - Digital literacy and IT proficiency - Critical thinking and problem-solving - Communication skills (verbal and written) - Research and analytical skills - Work-integrated learning and industry exposure	Jung (2019); Siddiqui <i>et al.</i> (2022); Yang <i>et al.</i> (2021)
Cultural Attributes	- Multicultural awareness and global perspective - Language proficiency and communication adaptability - Knowledge of diverse traditions, values and customs - Respect for cultural diversity and inclusivity	Turpie <i>et al.</i> (2022); Ajibade and Mutula (2020)
Contextual Attributes	- Flexibility and adaptability in the workplace - Understanding of workplace ethics and professionalism - Financial literacy and economic awareness - Career development and entrepreneurial skills - Ability to balance part-time work and studies	Ballina (2020); Chaka (2020); Ochara (2021)
Dispositional Attributes	- Self-motivation and confidence - Emotional intelligence and resilience - Leadership and teamwork abilities - Creativity and innovation in Tourism	Roque and Ramos (2019); Gretzel (2021)

	- Customer service orientation - Lifelong learning mindset	
--	---	--

This structured overview ensures a clear understanding of the skills and competencies required for graduates to succeed in the Tourism industry while maintaining the golden thread of employability and industry expectations.

2.10 Chapter Summary

Whilst the reviewed literature presented an optimistic view of integrating Smart Tourism and 4IR skills into higher education, several critical gaps remain. In relation to the literature review, 4IR has the potential to cause graduate unemployment, as with previous industrial revolutions. Furthermore, the continuous digital revolution is dramatically affecting many aspects of human life, including interpersonal relationships, economic sectors, market dynamics and humanity as a whole (O’Lemmon, 2024:1359-1362). According to the evidence presented above, experts in the Tourism industry are now starting to grapple with the complexity of 4IR and its influence on the organisational structure of marketing departments, consumer dynamics and overall business operations. Consequently, this influence will most likely change the dynamics of higher education curricula and training. The research explores Smart Tourism and several techniques to educate students in the digital age. It is critical to provide innovative training and human resource development focusing on 4IR technology and its direct interaction with education. The next chapter describes the theoretical and conceptual framework underpinning the current investigation.

CHAPTER THREE: THEORETICAL FRAMEWORKS AND CONCEPTUAL MODEL

3.1 Introduction

The previous chapter reviewed the literature. The current chapter presents the theoretical frameworks and the conceptual model. This chapter provides a comprehensive discussion of theoretical and conceptual frameworks that underpin the development of a Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education that aligns with the current industry demands. The chapter critically explores the importance of 4IR technologies in Tourism education and discusses the frameworks underpinning the design of a Multi-Dimensional Conceptual Model. In higher education, creative curriculum design is desperately needed at this time, given how rapidly technology is evolving and how much it affects the Tourism industry. Integrating digital, biological and physical technologies such as artificial intelligence (AI), the Internet of Things (IoT) and big data analytics into everyday life is bringing about a fundamental shift. This study aims to bridge current educational gaps by ensuring that the requisite 4IR skills are included in the curriculum. In Chapter Three, the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development, the Technology Acceptance Model (TAM) and an interdisciplinary approach to curriculum building are used to provide the theoretical underpinning for this research undertaking. These models provide a framework for weighing the benefits and drawbacks of 4IR technologies and Smart Tourism in higher education. This chapter uses a newly developed conceptual model to explain how KwaZulu-Natal (KZN) higher education might adjust to technological advancements connected to tourism. Graduates who improve their chances of employability may contribute to intelligent tourism.

3.2 Rationale for the chosen Theoretical Frameworks

Transforming Tourism education curricula in higher education requires a significant shift from traditional education by embedding innovative strategies, fostering critical thinking, promoting socio-technical awareness and cultivating adaptability. The transformative curriculum presents opportunities to foster student autonomy, interdisciplinarity and the ability to solve real-life problems innovatively. Therefore, theories are required to explain Smart Tourism, higher education and the 4IR. These theories will allow Higher Education Institutions (HEIs) to prepare students with the technical skills and cognitive agility to navigate the constantly

changing industry environment. These theoretical frameworks organise complicated linkages and variables whilst also conceptualising the study problem. The Innovative Technologies Framework for Hospitality and Tourism Development and the TAM model were used to create the Multi-Dimensional Conceptual Model. This framework and the TAM model facilitate examining curricular integration, industry requirements and technological acceptability.

The Fourth Industrial Revolution's rapid technological improvements have greatly influenced the Tourism industry, especially businesses in the Accommodation sector. As a result, the application of the theoretical framework and model was critical in this research attempt. According to Formunyam (2020:56), Smart Tourism incorporates various technologies to improve customer service and operational efficiency. However, making higher education courses relevant to industry demands remains a difficulty (Huang *et al.* 2019:340). The TAM model can be used to identify the perceived utility and user-friendliness of novel technologies, as proposed by Davis (1989:322), as well as the need for digital literacy and interdisciplinary competencies, as outlined by Adeyinka-Ojo *et al.* (2020:294). This study adopts the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development and the TAM model to emphasise the challenge of incorporating 4IR technologies into education. In higher education, integrating these theories presents a comprehensive model to explore the relationship between industry requirements, technological advancements and academic preparation, providing graduates with technical capabilities, flexibility, creativity and a global perspective. Sheikh and Kader (2022:56) suggested a proactive curriculum design to prepare students to be technology consumers and tourism leaders.

3.3 Technology Acceptance Model

3.3.1 Foundations of Technology Acceptance Model

The Technology Acceptance Model (TAM), created by Fred Davis in 1989, is a prominent and extensively utilized theory for comprehending technology adoption and usage behavior. Grounded in the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM) posits that an individual's desire to embrace a technology is predominantly influenced by two principal perceptual beliefs: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Davis (1989) characterizes Perceived Usefulness as the level to which an individual feels that utilizing a certain technology would improve their performance, whereas Perceived Ease of Use pertains to the degree to which the technology is regarded as effortless. These

beliefs affect the user's Behavioral Intention (BI) to utilize the technology, which subsequently forecasts Actual Use (AU).

The Technology Acceptance Model (TAM) has been revised and expanded several times, notably with TAM2 (Venkatesh and Davis, 2000) and TAM3 (Venkatesh and Bala, 2008), which integrate supplementary elements including social impact and enabling situations. Venkatesh *et al.* (2003) introduced the Unified Theory of Acceptance and Use of Technology (UTAUT), which synthesizes components from eight notable theories, including TAM, to offer a more thorough explanation of technology adoption. Despite the enhanced prediction capabilities of newer models like UTAUT, the Technology Acceptance Model (TAM) continues to be prevalent owing to its simplicity, strong empirical validation, and relevance across many technological settings.

The Technology Acceptance Model (TAM) is especially pertinent to this research, as it offers a theoretical framework for analyzing the perceptions and adoption of Smart Tourism and Fourth Industrial Revolution (4IR) technologies by personnel and management in hospitality companies. Concepts like PU and PEOU provide significant understanding of the determinants affecting technology utilization, preparedness, and acceptability in tourist operations. This study uses the Technology Acceptance Model (TAM) to analyze technology adoption behaviors, identify obstacles to digital integration, and comprehend the perceptual hurdles that may hinder the incorporation of intelligent technologies in tourism education and practice. The methodology therefore, facilitates the advancement of the Transformative Higher Education Curriculum methodology by correlating technological perceptions with digital competency requirements in the Tourism sector.

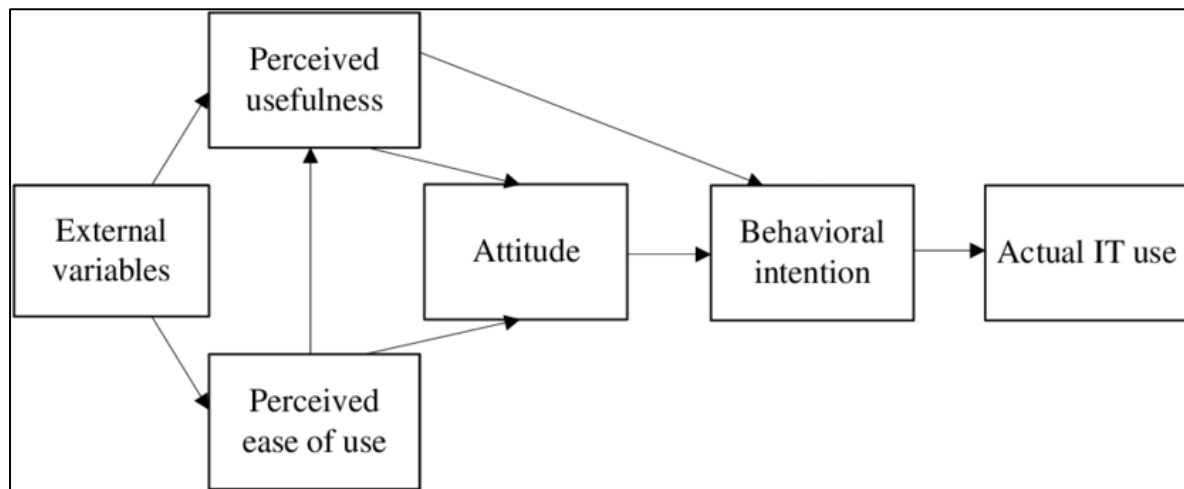


Figure 3.1: Technology Acceptance Model

Source: Extracted from Julianto and Daniawan (2022) as adapted from Davis (1989)

The utilisation of technology is primarily shaped by factors such as the perceived benefits of using technology, its convenience and individual attitudes (Collado-Agudo, Herrero-Crespo and Martín-Gutiérrez, 2023:1-2). This study draws from the core constructs of the TAM to design and frame the set of questions that will be used to collect both quantitative and qualitative data. The TAM was developed by Davis (1989:322) to shed light on various processes that underpin users' acceptance of technological advancements; to predict their behavioural intentions; and further form a theoretical basis for the seamless implementation of technology. Therefore, the TAM is a practical determinant of factors to consider in integrating technologies in organisations. The theory posits that the use of technology is influenced by the perceptions and beliefs of users that using technology is easier and will enhance their performance (PU) (Davis, 1989:333). In higher education and the Tourism industry, the acceptance and use of emerging technologies present various immediate and long-term benefits such as convenience, enhanced performance, time efficiency and enhanced learning.

The potential of emerging technology to deliver various benefits for organisations makes the TAM significant at both the institutional and individual levels, especially in Tourism education. Setiawan and Oktaviani (2021:57) highlighted that the TAM model has been used extensively in studies exploring the acceptance and utilisation of digital technologies and platforms by academics and students in higher education. In comparison, the study by Fuentes-Martínez (2020:61) noted the broad adoption of TAM to investigate Smart Tourism technologies that enhance tourist experiences, such as augmented reality and Smartphone applications. Contrary

to the benefits and applications of TAM in various disciplines, Julianto and Daniawan (2022:78) criticised this model for neglecting many other factors influencing the adoption of technology. Nevertheless, TAM in education looks at digital technology's pedagogical and technological elements. The importance of academics' technology viewpoints on teaching and student results was highlighted by Alam and Saputro (2022:1142). This helps achieve the aims of educational technology adoption, which include integrating new technologies and enhancing accessibility and quality (Zhao, Pinto and Lai, 2019:57).

The TAM sheds light on tourism development and the marketing strategies to be adopted by industries to satisfy the demands of service providers and travellers. The Tourism industry's broad adoption of modern technologies facilitates service delivery and user engagement. For example, a study by Zhang, Sotiriadis and Shen (2022:1-3) found that the behavioural intentions of travellers to adopt modern technology were primarily influenced by their perception of the ease of use and practicality of Smart Tourism technologies. Hence, the extensive use of TAM in various disciplines shows the significance of comprehending technology adoption. The current study sought to illustrate the application of the TAM to create a new curriculum model for Smart Tourism careers based on the perceived ease of use and user-friendliness of 4IR technology.

3.3.2 Core Constructs of the Technology Acceptance Model

3.3.2.1 *Perceived Ease of Use*

In higher education, Prastiawan *et al.* (2021:678) explained Perceived Ease of Use (PE) as a critical component of the TAM that measures the acceptance and adoption of digital technologies by academic staff and students. According to Denaputri and Usman (2019:1-2), the acceptance and adoption of emerging technologies increases if it is intuitive and complexity discourages usage. In the context of this study, the perceived ease of use of 4IR technologies such as augmented reality (AR), virtual reality (VR) and AI in Smart Tourism education is essential for eventual adoption. Apritado and Borbonr (2022:39) emphasised the integration of emerging technologies that are easy to use in the design and implementation of Tourism education curricula to inform adaptive and future-ready graduates. Similarly, Setiawan and Oktaviani (2021:57) also held that simple technology facilitates learning as it diminishes cognitive load. Smart Tourism curricula must remain transformative by integrating the type of technology that is helpful to instructional goals without overwhelming instructors or students.

Ultimately, ease of use decides engagement and how HEIs prepare students for 4IR-driven tourism.

3.3.2.2 Attitude Towards Using Technology

According to the TAM, attitudes toward the use of technology are considered significant influencers of technology adoption and use in higher education (Nithyanantham, 2020:2585). This implies that the perceptions of academic staff and students determine the learning outcome and whether the curriculum is effective and amicable in higher education, especially in Smart Tourism and 4IR technologies. Prastiawan *et al.* (2021:75) argued that the attitudes of academics towards technology also correlate with their digital tool adoption in their teaching. Contrarily, Denaputri and Usman (2019:1-4) highlighted that a negative attitude towards emerging technologies makes it impossible for adoption and use despite its effectiveness in teaching and learning. Additionally, students' perceptions of digital tools are also strongly related to their motivation, engagement and academic success (Scherer, Siddiq and Tondeur, 2019:13-15). TAM plays a central role in the relationship between ease of use, perceived usefulness and attitude toward technology adoption as technologies that are simpler, relevant and aligned with pedagogical practices tend to foster positive attitudes and higher adoption rates (Almaiah *et al.* 2022:1). Consequently, Smart Tourism education should integrate user-friendly technologies; provide adequate support; and select participants based on educators' and students' preferences. Moreover, HEIs should enhance curriculum effectiveness and graduate readiness to address the challenges of digital transformation in the Tourism industry by cultivating and shaping positive attitudes toward technology (Setiawan and Oktaviani, 2021:789).

3.3.3 Usefulness of the Technology Acceptance Model in this Study

The TAM is essential to this study because it facilitates structure for this study since it offers a structured framework to understand how a new technology gets adopted in Smart Tourism education. Since the integration of 4IR technologies like AI, AR and digital platforms is increasing, Nithyanantham (2020: 2585) analysed how perceived usefulness (PU) and ease of use (PEOU) can influence the acceptance of these tools by the students and academic staff.

One aspect of this study focuses on the level of readiness of HEIs to embrace Smart Tourism technology and whether the technology was easy to use and valuable for learning. In such cases,

academic staff are more likely to integrate technology (Prastiawan *et al.* 2021:75). Young people's motivation, engagement and development of 4IR-related skills are also preconditioned by youth's perceptions of digital tools (Scherer, Sidiq and Tondeur, 2019:13-16). Through TAM, this study identified the barriers to adopting technology in Smart Tourism curricula, which would make technology available and congruent with the pedagogical objectives (Setiawan and Oktaviani, 2021:789). Such an understanding forms a Transformative Curriculum Model that allows HEIs to educate graduates who are capable of addressing digital transformation needs in the Tourism industry.

3.4 Innovative Technologies Framework for Hospitality and Tourism Curriculum Development

The Innovative Technologies Framework for Hospitality and Tourism Curriculum Development covers a broad spectrum of technological breakthroughs and innovations. The study of the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development focuses on the influence of developing technologies on the Tourism industry. This framework investigates the use of AI, VR, blockchain, IoT and big data analytics in tourism. The various aspects are listed in Figure 3.2.

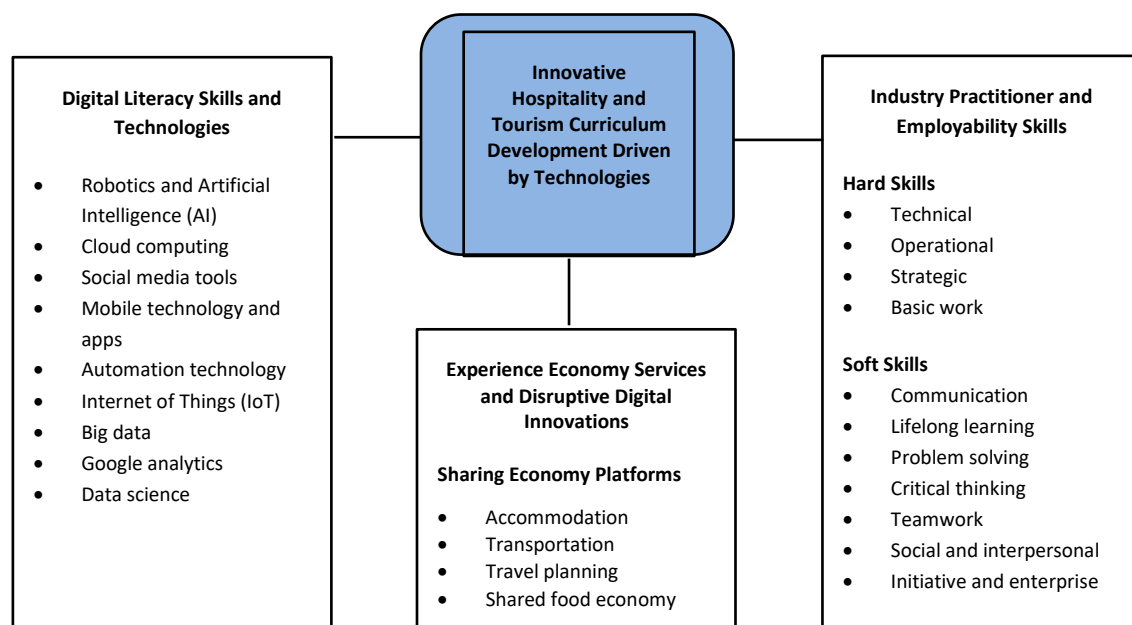


Figure 3.2: Innovative Technologies Framework for Hospitality and Tourism Curriculum Development

Source: Extracted from Adeyinka-Ojo, Lee, Abdullah and Teo (2020:293)

This framework encompasses digital literacy, technical proficiency, experience economy services, disruptive developments in the digital space, industry practitioner skills and employability skills. To ensure that graduates are employable in the industry, the framework demonstrates employability skills and industry practitioners who drive graduate attribute development in courses.

3.4.1 Framework Components

3.4.1.1 Digital Literacy Skills and Technologies

The 4IR era, known by its broad adoption of emerging technologies, necessitates a transformative higher education curriculum that emphasises the acquisition of digital literacy skills amongst students. Therefore, integrating emerging technologies such as artificial intelligence, the internet of things, big data analytics, virtual reality and blockchain technologies is all part of the 4IR technologies that could significantly impact the Tourism industry. In the context of this study, digital literacy is the use of diverse digital technologies in an ethical, efficient and creative manner to facilitate teaching and learning, thereby informing digitally ready graduates. Digital literacy extends beyond basic software or device functionality. For tourism students, it means assessing and applying digital data; understanding online consumer behaviour; using digital marketing tools; and embracing new technologies that enhance the visitor experience (Reddy *et al.* 2023:789). Therefore, incorporating digital literacy into the curriculum cannot be overemphasised. According to Treglia and Tomasson (2019:89), digital transformation presents various benefits for the Tourism industry. Thus, graduates must be acquainted with emerging technologies to be adaptable in the future.

Therefore, incorporating 4IR technology into the curriculum requires careful preparation and consideration to ensure that students are not just digital consumers but also critical thinkers capable of assessing the impact of technology on the environment, the economy and society. This necessitates a multifaceted approach that integrates technical training in AI, VR and IoT with courses on data security, cyber ethics and sustainability (Egger and Neuburger, 2022:318). Soft skills such as creativity, critical thinking and problem-solving should be highlighted in the curriculum since they are essential for creating and implementing new technologies in the Tourism industry. However, bridging the gap between HEIs' slower curriculum development and the rapidly changing technological ecosystem is problematic. Huang *et al.* (2019:340) highlighted the importance of collaborative efforts between industry partners and HEIs to

support ongoing professional development and the development of flexible modular curricula, thereby promoting the integration of emerging technologies and digital literacy skills into Tourism education.

3.4.1.2 Experience Economy Services

The advent of an experience economy that emphasises the greater value of distinctive and memorable visitor experiences continues to make a significant contribution towards the transformation of the Tourism industry (Ahtamova 2021:39). Therefore, the integration of 4IR technologies in Tourism education is essential to ensure that the Tourism industry continues to create value for visitors by offering memorable engaging user experiences, rather than just the provision of ordinary goods and services. Emerging technologies such as AI, AR, VR and IoT are examples of 4IR technologies that could be integrated into Tourism education and the sector to provide personalised services and enhance customer experiences. The study by Okhota (2021:87) emphasised the need for students to better understand 4IR technologies to develop unique tourist experiences through integrating digital literacy and technology skills in the curriculum. Consequently, it takes technical, creative and critical thinking skills to develop novel visitor engagement strategies.

The experience economy also requires a thorough understanding of memorable interactions and consumer psychology. As active participants, visitors teach students co-creation, narrative, emotional involvement and sensory design (Reddy *et al.* 2023:897). Courses on destination management, product creation and marketing must include these concepts. Similarly, emphasising the importance of aligning tourist experiences with ethical standards and sustainability principles is essential. This is supported in a critical argument by Treglia and Tomassoni (2019:55), who highlighted the need for higher education curricula to address sustainable practices and ethical issues related to the use of tourism technology as tourists grow more socially and ecologically concerned. Thus, it is vital for academic staff teaching Tourism education to adjust to the rapidly evolving technology and changing needs of the Tourism industry, which constantly requires a thorough understanding of how to strike a balance between technological advancement and cultural and environmental preservation.

3.4.1.3 Disruptive Digital Innovations

The emergence of modern technologies presents various opportunities and benefits that seek to foster digital transformation in the Tourism industry, especially the Accommodation sector. For example, Almansour (2022:370) noted the transformative potential of digital services such as Airbnb's platform-based business models that have emerged to transform the Accommodation sector's competitive dynamics, thereby highlighting the need for strategic management and digital literacy in the classroom. While such a transformative platform enhances guest lodging alternatives, it also raises concerns about the sustainability, legality and economic effects on local communities. Customising client experiences using AI and machine learning is another aspect of digital disruption. According to Imam (2022:733), chatbots for customer support, AI-driven travel recommendation customisation and dynamic pricing algorithms have increased consumer engagement and operational efficiency. This emphasises the need to integrate 4IR technologies into Tourism curricula to better educate students for the Accommodation sector. According to Ahtamova (2021:38), technologies like Smart locks, voice-controlled rooms and real-time feedback systems need new technology management and customer experience design abilities. Addressing disruptive curricular changes requires interdisciplinary approaches that combine technological expertise, critical thinking and strategic planning. Therefore, the curriculum of Tourism education should encompass elements such as digital strategy, data privacy and security, technological ethics and the socio-economic implications of digital disruption. This is further emphasised by Janchai *et al.* (2019), who argued that practical experience gained via industry collaborations and case studies of successful and unsuccessful digital disruption responses may help develop strategic agility and creativity.

3.4.1.4 Industry Practitioner and Employability Skills

Considering the disruptive 4IR technologies and the dynamic and ever-changing Tourism industry, higher education curricula are responsible for responding to the digital skills gap to foster adaptive graduates and promote employability. Industry-specific skills are essential for equipping students with the abilities required to satisfy the changing demands of the Tourism industry, notably in KZN's Accommodation sector. The proficiency difference in the Tourism industry is sometimes caused by a mismatch between educational competencies and industry expectations, notably in digital literacy, analytical thinking and interpersonal skills such as flexibility, effective communication and leadership. The emergence of Smart Tourism

technologies such as AI, IoT and big data analytics has exacerbated this disparity rather than creating bridges. To address these gaps and misalignments, Tourism education must be updated to incorporate practical learning consistent with industry practices and future improvements. According to Singh and Tilak (2020:601-602), internships, collaborative projects with industry partners and real-world case studies may all help students learn new skills. Furthermore, including certifications and courses on new technology and processes in the curriculum may guarantee that students are ready for the workplace. This partnership may involve industry practitioner guest lectures, advisory boards to aid curriculum development and research collaborations on current industry issues (Imam, 2022:733).

3.5 Usefulness of the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development towards the Study

The Innovative Technologies Framework for Hospitality and Tourism Curriculum Development (Adeyinka-Ojo, Lee, Abdullah and Teo, 2020:293) is relevant to the current study as it advocates for developing a transformative curriculum that meets the needs of 4IR. Furthermore, the framework emerges as a multidisciplinary approach that combines technology, innovation and critical thinking to promote the production of adaptive graduates who are employable and sustainable. This framework further identifies the necessary digital tools and platforms that Tourism graduates should be knowledgeable about and guides academics on developing a curriculum in line with industry standards. The Innovative Technologies Framework for Hospitality and Tourism Curriculum Development presents a comprehensive framework to explore the current state of digital literacy skills amongst graduate students and their employability in the Tourism industry. Additionally, this framework is useful in shedding light on whether the current curriculum falls short in terms of including essential 4IR technology and ideas. This, in turn, has a direct bearing on developing a Transformative Higher Education Curriculum Model in Smart Tourism within the 4IR that introduces noteworthy modifications.

3.6 Application of Theoretical Frameworks

3.6.1 Mapping Theoretical Insights to the Research Aim

A solid theoretical foundation can be established to effectively address the research goal and objectives of developing a Transformative Higher Education Curriculum Model in Smart Tourism within the framework of 4IR by combining the Innovative Technologies Framework

for Hospitality and Tourism Curriculum Development and TAM with an interdisciplinary approach. Understanding the acceptance of 4IR technologies and Smart Tourism amongst KwaZulu-Natal lodging establishments mainly depends on the TAM, which is based on the subjective evaluation of PU and PEOU (Objective i). This research assesses how people's views of the usability and convenience of the use of technology affect their adoption and utilisation of these technologies by using the TAM. The observation indicated above is crucial in determining the specific competencies and training needs required to achieve employability in these companies (Objective ii).

Furthermore, the current higher education curriculum may be evaluated using the TAM constructs of PU and PEOU (Objective iii). This research aims to determine how effectively the programme uses resources that business stakeholders believe are practical and user-friendly. Hence, its objective is to ascertain the probability of graduates using these technologies in their next professional pursuits. Examining the incorporation of 4IR applications into the curriculum for higher education may be done using the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development. The experience economy, disruptive digital technologies and digital literacy are highlighted in this framework (Objective iii). This approach makes it easier to identify areas where the current curriculum falls short in including essential 4IR technologies and ideas, directly impacting the development of a curriculum model that introduces noteworthy modifications.

With a focus on the experience economy services and disruptive digital innovations, the study intends to determine how the current curriculum provides students with the abilities and knowledge needed to actively engage in and drive innovation within the Tourism industry (Objective iv). The latter includes the ability to create memorable experiences via digital innovations and the ability to navigate and take advantage of disruptive technologies. The curriculum model must take an interdisciplinary approach to address the requisite 4IR knowledge and abilities. By incorporating information technology, business management, sustainable development and design thinking into the curriculum, this approach tackles the complexity of Smart Tourism (Objective iii). The assessment of industry stakeholders' perceptions of KZN University Tourism graduates' abilities and competencies is improved by an interdisciplinary approach (Objective iv). It guarantees that technical proficiency, essential soft skills, sustainable practices and ethical considerations, all of which become increasingly

important in the 4IR era, are included in the curriculum. An interdisciplinary approach, TAM and the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development provide a strong theoretical basis for the research objectives. This combination identifies the demands of the Tourism industry both now and in the future, resulting in a curriculum model consistent with 4IR and boosting graduates' employability in Smart Tourism.

3.6.2 Analysis of Frameworks Guiding the Investigation into Usage, Perception and Curriculum Integration

The adoption of TAM and the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development offers a more nuanced lens to investigate the acceptance and integration of technologies into higher education to significantly transform the Tourism education curriculum. The use of TAM is essential to explore the usage of Smart Tourism and 4IR applications at accommodation establishments based in KwaZulu-Natal (KZN). Essentially, two components of the TAM (PE and PEOU) are effectively applied to understand the factors that influence the Tourism industry's acceptance and embracing of technologies. These components present a clear framework for illustrating how emerging technologies are used to enhance everyday operations. Consequently, adopting the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development in the current study was significant to explore the landscape of digital advances impacting the Tourism industry. The integration of these two robust frameworks provides a strong foundation to determine the 4IR skills and training necessary for adaptive graduates in Tourism education to be employable, critical thinkers and sustainable.

The Innovative Technologies Framework for Hospitality and Tourism Curriculum Development emphasises the importance of establishing an innovative curriculum in higher education. Furthermore, it drives the determination of competencies that are in demand in the Tourism industry. In the same way, the components of the TAM could be used to investigate the behavioural intentions of users to accept and adopt technological advancements, including their perceptions of the usability ease of these technologies. Thus, an interdisciplinary approach is needed in KwaZulu-Natal to assess how KZN institutions integrate Smart Tourism and 4IR applications into their curricula. This multifaceted approach will ensure that the curriculum covers 4IR technologies' technical elements, socio-economic impact, ethical considerations and sustainability practices. The integration of the TAM and the Innovative Technologies

Framework for Hospitality and Tourism Curriculum Development will guide the inquiry of how well-presented curricula equip students to meet the technical and inventive demands of the Tourism industry, emphasising the necessity for a curriculum that quickly adapts to technology.

3.7 Emergent Multi-Dimensional Conceptual Model

The primary objective of this conceptual model is to identify the fundamental dimensions and factors contributing to the discrepancy between current curricula and industry requirements in the 4IR era. The model encompasses seven dimensions informed by the comprehensive literature review and underpinned by the two theoretical frameworks adopted. The seven dimensions present a robust model and clear lenses to investigate the current state of the Tourism education curriculum and technology integration.

The conceptual model is depicted in Figure 3.3.



Figure 3.3: Multi-Dimensional Conceptual Model for Integrating 4IR Skills into Tourism Curricula

Source: Researcher's Construction

Figure 3.3 illustrates the components of the Multi-Dimensional Conceptual Model for integrating 4IR skills into Tourism curricula and their significance in transforming Tourism

education curricula. For example, the first component of **curriculum analysis** clearly explains higher education Tourism programmes. The component of **industry needs assessment** emerges as a comprehensive guide for tourism businesses, destination management organisations and technology vendors to identify the 4IR technologies necessary to grow and compete in the Tourism industry (Buhalis and Amaranggana, 2015:379). **Skills gap identification** fosters a critical review of course syllabi, learning goals and teaching methods to identify how 4IR technologies such as AI, big data analytics, VR, blockchain and IoT should be incorporated into the curriculum. Skills Gap Identification is a significant component that informs the identification of disparities between the skills and knowledge presently imparted in Tourism curricula and the skills demanded by the industry to successfully adopt and implement 4IR technologies (Kana and Letaba, 2024:157). The potential components of this skillset encompass a range of attributes, namely interpersonal abilities, specialised knowledge, proficiency in analysing data, expertise in digital marketing and the capacity to devise innovative solutions to complex problems. The **integration of new technologies** is presented as the fourth component of the conceptual framework that illustrates the importance of integrating emerging technologies into Tourism curriculum programmes (Costantino and Rodzinka, 2022:44). Essentially, this component prioritises the redesign or the creation of Tourism education curricula to address the influx of emerging technologies and 4IR tools such as Smart route management, data-driven decision-making and Smart environments.

Furthermore, the Multi-Dimensional Conceptual Model for integrating 4IR skills into Tourism curricula is also underpinned by the component of faculty development, which puts greater emphasis on the need for academics to be trained and capacitated with the relevant skills and expertise to be able to deliver the innovative content in Tourism education (Apritado and Borbonr, 2022:39). **Faculty development** plans might involve a variety of activities such as lectures, presentations and collaboration with subject matter experts or industry experts. These activities aim to keep academics up to speed on the most recent technological advancements. Thus, **industry-academic collaboration** is the sixth component of the Multi-Dimensional Conceptual Model for integrating 4IR skills into Tourism curricula. This critical component highlights the need for collaborative efforts between the Tourism industry and HEIs to foster significant linkages between Tourism education and the industry (Apritado and Borbonr, 2022:39). Participating in collaborative research projects, internships, guest lectures and industry advisory boards can augment the applicability of educational programmes and afford

students valuable exposure to real-world contexts and provide them with practical experience. Lastly, the final component of the model, as illustrated in Figure 3.3, is **lifelong learning and flexibility**, which acknowledges the dynamic nature of 4IR technologies and the imperative for ongoing education (Kana and Letaba, 2024:159). Integrating a culture of continuous learning into Tourism curricula is crucial to equipping graduates with the necessary skills to effectively navigate and stay current with emerging technologies throughout their professional journeys. This culture will require ongoing curriculum analysis for future enhancements as new technologies are developed. The conceptual model delineates the fundamental dimensions and factors that give rise to the discrepancy between extant Tourism curricula and the industry's requisites in embracing 4IR technologies.

3.7.1 Challenges and Usefulness of the Emergent Multi-Dimensional Conceptual Model

A critical assessment of the new Multi-Dimensional Conceptual Model presents challenges and opportunities, as described below.

3.7.1.1 Challenges

Due to the rapid pace of technological change, HEIs may find it challenging to adjust curricula and teaching techniques. According to David *et al.* (2022:363), this may result in a skills gap, making graduates unsuitable for the demands of the Tourism industry. The absence of technology skills and digital literacy amongst educators may also impede teaching and curricular integration. A key challenge is institutional and personal resistance to change amongst educators and students who are used to conventional teaching and learning techniques. TAM's concepts of perceived utility and ease of use are critical to adoption since technology is often seen as intimidating or sophisticated (Avelino and Ismail, 2022:415). However, Costantino and Rodzinka (2022:44) caution that many educational institutions may find new software, technology and training costly, especially in low-resource regions.

3.7.1.2 Usefulness of the Emergent Multi-Dimensional Conceptual Model

The usefulness and advantages of the Emergent Multi-Dimensional Conceptual Model are presented below:

Enhancing Digital Literacy and Skills: According to Singh and Tilak (2020:601-603), educational institutions can improve student engagement and the applicability of the learning process by prioritising the perceived utility and ease of application of 4IR technologies in

curriculum design. This entails adding practical and immersive learning opportunities, utilising technologies like AI, IoT and big data analytics to improve students' digital literacy and technical abilities.

Fostering an Adaptive and Flexible Curriculum: An interdisciplinary approach promotes the integration of technology, social problems, sustainable practices and Tourism management to provide students with a well-rounded education that prepares them for the complexities of the contemporary Tourism industry (Hendrawan and Daryanto, 2019:1742). One must be able to adapt to keep up with rapidly developing technology.

Building Partnerships with Industry: Tourism education programmes on present and upcoming technological advancements may benefit from input from industry stakeholders, increasing their relevance to the actual world (Almansour, 2022:370). Partnerships may also result in project-based learning, guest lectures, internships and other opportunities that link theory and practice.

Investing in Educator Training: Academics must learn how to utilise technology effectively. Programmes that use technology in the classroom should concentrate on instructional approaches and professional skills (Imam, 2022:733).

Rapid technical innovation, change resistance and financing limits make using 4IR technology in Tourism education challenging. The Innovative Technologies Framework for Hospitality and Tourism Curriculum Development, TAM and multidisciplinary techniques may help universities address these difficulties. To create a revolutionary higher education curriculum model for Smart Tourism that emphasises perceived utility and ease of use, there is a need to develop a flexible curriculum, establish strong industry ties and train instructors. This strategy provides graduates with the knowledge, skills and competencies to flourish in the 4IR-shaped Tourism industry.

3.7.2 Strategies for Curriculum Transformation offered by the Emergent Multi-Dimensional Conceptual Model

3.7.2.1 Proposals for Curriculum Development

Digital literacy is required to integrate Tourism education with 4IR. In Tourism, students understand, evaluate and use technology. Courses on Smart Tourism need to include AI, VR, AR, IoT and blockchain.

Employers favour soft skills and 4IR technology. Therefore, employment skills must include both. Critical thinking, problem-solving, communication, flexibility and digital ethics are all part of it. Business, technology and social sciences students are more equipped to work in the complicated Tourism industry.

Industry stakeholders should be involved in curriculum development. Case studies, project-based learning, guest lectures and internships may all highlight the benefits and drawbacks of Smart Tourism. Through these partnerships, the curriculum is kept up-to-date and relevant to business, which helps graduates find employment.

Since technology changes often, 4IR curricula need to be updated. To assess the curriculum's relevance to the Tourism industry, ongoing communication with industry stakeholders, alumni and students is necessary. Changing and integrating the classroom might improve curriculum adaptability. To include 4IR technology in Tourism education, faculty members must possess digital literacy and pedagogy skills. Educators need to attend seminars, conferences and online courses to keep up with the latest technology and teaching techniques.

Incorporating digital literacy, employability and Smart technology into a creative higher education curriculum is essential for Smart Tourism in the 4IR. Educational institutions may create a technology and tourism adaptive curriculum using an interdisciplinary approach and insights from the TAM and Innovative Technologies Framework for Hospitality and Tourism Curriculum Development. Graduates of this proactive, team-oriented curriculum will be prepared for the rapid changes in Smart Tourism.

3.7.2.2 Continuous Learning and Faculty Development

In higher education, continuous learning implies that students always learn new topics, improve their existing knowledge and develop new teaching methods. This is particularly true in industries where new technologies, such as Smart Tourism, rapidly transform the landscape (Saneinia *et al.* 2024:1287). Furthermore, it ensures that courses are kept current with the latest business trends and technological developments. This increases students' employability in today's challenging employment market (Saneinia *et al.* 2024:1297).

Faculty members must continue to study to stay updated with the 4IR technologies that are transforming the Tourism industry. These include artificial intelligence, blockchain, the IoT, VR and AR. The integration of these technologies into the educational system necessitates that teachers understand not only the operational mechanisms of these technologies but also their strategic implications for Tourism management and marketing (Billiot, 2023:28).

The adoption of critical faculty development courses enables educators to acquire the knowledge and skills required to navigate the challenges of teaching 4IR technologies and ideas. Such courses should concentrate on technology proficiency, pedagogical innovation, industry engagement, research and scholarship. Technology proficiency focuses on training academics in developing technologies so that they can confidently employ them in their teaching. On the other hand, pedagogical innovation promotes creative teaching methods that promote active learning, critical thinking and problem-solving. A few examples of pedagogical innovation include flipped classes, collaborative projects and real-world problem-solving (Parry Thompson, 2023:56). Industry Engagement involves developing ties with tourism companies and technology suppliers to educate academics about industry trends and practices. This interaction makes the curriculum more relevant and helpful to students by reflecting the Tourism industry reality (Lewing, 2020:78). With research and scholarship, this supports faculty research on tourism, technology and education. Such a project helps academics incorporate 4IR technology into Tourism education and educates students for the digital economy.

The execution of these initiatives requires institutional finance, resources and policy frameworks that prioritise professional development and innovative curricula. Leadership must show that they are committed to both academic success and continuous improvement to inspire

academics to pursue ongoing learning and development. Furthermore, it is crucial to implement feedback mechanisms for evaluating faculty development initiatives and their effects on instruction and student outcomes. These details may be used to adjust professional development programmes to better suit the changing needs of educators and learners.

Faculty members must further their studies and expand their abilities to create a paradigm for higher education curricula that is 4IR-Smart Tourism and transformative. This is dependent on HEIs investing in the professional development of their faculty and ensuring that the curriculum is updated with the most recent technological and pedagogical advancements, which will better prepare graduates for successful positions in the increasingly technologically driven Tourism industry. Moreover, this approach increases graduate employability and the competitiveness and sustainability of businesses in the Tourism industry.

3.8 Validating the Emergent Multi-Dimensional Conceptual Model

To ensure the validity and applicability of the Multi-Dimensional Conceptual Model, this study employed a Mini-Delphi method, a structured expert consultation process widely used for refining theoretical models (Skulmoski, Hartman and Krahn, 2007:21). The Mini-Delphi method gathered insights from a panel of experts through iterative rounds of feedback to evaluate the model's feasibility in integrating 4IR skills into Tourism curricula. Three experts were asked to comment on the questions posed by the researcher on the validity of the Emergent Multi-Dimensional Conceptual Model (See Annexure H for the Mini-Delphi Questionnaire). After the second round of the Mini-Delphi questionnaire, the experts reached consensus on the Multi-Dimensional Conceptual Model. Initially, utilising this approach proved to be a more effective means of acquiring expert perspectives compared to conventional methodologies like surveys or interviews (Barrett and Heale, 2020:68-69). The utilisation of the Mini-Delphi method enabled experts to contribute their opinions anonymously and gain insights into the alignment or divergence of their perspectives with those of other experts. Barrett and Heale (2020:68-69) state that this approach has the potential to facilitate a more transparent and sincere dialogue, thereby expediting the process of reaching a collective agreement.

3.9 Chapter Summary

Theoretical research into 4IR technology's educational applications and Smart Tourism is necessary. The discussion in Chapter Three illustrated the importance of understanding

technical and pedagogical factors in preparing students for the ever-changing Tourism business. Therefore, this chapter critically discussed theoretical underpinnings for a transformative curriculum in Smart Tourism education, encompassing emerging technologies and 4IR. The chapter provided a comprehensive exploration of relevant frameworks, thus justifying the choice of both the TAM and the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development and further introduced a Multi-Dimensional Conceptual Model tailored for higher education. Following this chapter, theoretical notions may be used to develop practical curricular reform alternatives. Theoretical frameworks can guide the development of curricula that produce technologically adept, adaptable and innovative graduates capable of leading Smart Tourism. HEIs in KZN confront several challenges in implementing a new higher education curriculum model for Smart Tourism in the 4IR. From this theoretical analysis, the route ahead will become evident and a significant and lasting shift in Tourism education is possible. These insights inform the methodological approach detailed in the next chapter.

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1 Introduction

Chapter Four clearly describes how this research was carried out and how data and information were collected, presented and analysed in response to the research aim and objectives. Research methodology refers to the principles and procedures of applying logical thought processes in a scientific investigation (Patel and Patel, 2019:48). Moreover, the methodology is used to collect information and data for decision-making. It may include publication research, interviews, surveys and other research techniques, including both present and historical information. This study's methodology section details the research philosophy, research approach, research design, data collection methods, sampling techniques and data analysis procedures used to investigate these technologies' current usage, benefits and challenges in accommodation establishments. The research aimed to inform the development of a curriculum that will equip students with the requisite technological competencies for the evolving demands of the Tourism industry.

The research methodology adopted provides the overall strategy to achieve the study's objectives (Du Plooy-Cilliers, 2023:329-330). The research objectives, as outlined in Section 1.3 of this study, are:

- [RO1]:** Investigate the nature and extent of the usage of Smart Tourism and 4IR applications at accommodation establishments based in KwaZulu-Natal (KZN);
- [RO2]:** Determine the 4IR skills and training needed to be employable at accommodation establishments based in KZN;
- [RO3]:** Ascertain the extent to which Smart Tourism and 4IR applications are included in the existing higher education curriculum at universities in KZN;
- [RO4]:** Explore the perceptions of industry stakeholders from accommodation establishments towards the 4IR competencies and skills of Tourism graduates from universities in KZN; and
- [RO5]:** Formulate a model for a Transformative Higher Education Framework for the inclusion of 4IR into the Tourism curriculum.

Figure 4.1 provides a roadmap for this chapter and highlights the process of applying the explanatory sequential mixed-method design in research.

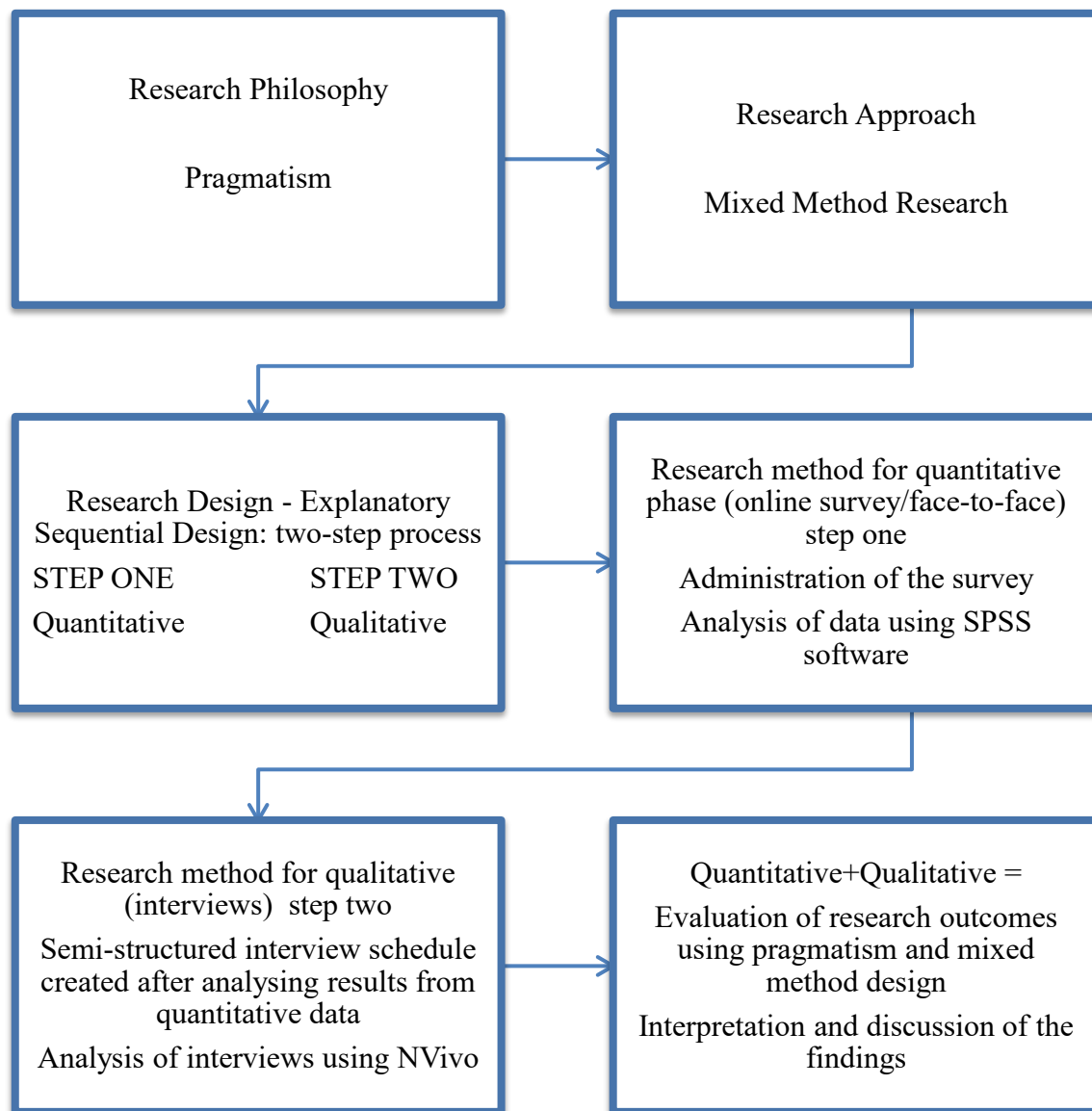


Figure 4.1: Research Methodology Roadmap for the Study

Source: Researcher's Construction

The next section provides information on the philosophical worldview for this study.

4.2 Philosophical Worldview

The research philosophy is foundational to understanding how knowledge is constructed and interpreted. It is divided into two key branches, namely ontology and epistemology. Ontology is the branch that deals with claims and assumptions about the nature of reality, including what exists and how it interacts (Du Plooy-Cilliers, 2021:30). The current study was situated within the parameters of the pragmatist philosophy. The pragmatic approach was necessary for the study to answer the research question and present actionable recommendations practically. Consequently, pragmatism is a research paradigm that prioritises practical outcomes and real-world problem-solving over rigid methodological traditions (Kelly and Cordeiro, 2020: 1-2). The researcher's decisions regarding the nature of knowledge gained via action and what would be effective in resolving an issue will determine the epistemological nature of pragmatism (Maarouf, 2019:1-3). As a result, in a pragmatic setting, the researcher concentrates on the *what* and *how* of the research problem (Kelly and Cordeiro, 2020: 1-2).

4.2.1 Pragmatism

Elgeddawy and Abouraia (2024:71-72) describe pragmatism as a widely used philosophical approach that is flexible and open to various methods, perspectives and different forms of data collection and analysis. In the context of the current study, the adoption of the pragmatist philosophy allowed for the seamless use of the explanatory sequential mixed-method design. Anguera *et al.* (2020:1-3) advocate for a mixed-methods approach that integrates both qualitative and quantitative techniques for data collection and analysis. In this study, data were collected from representatives of accommodation establishments in KZN using in-depth interviews and standardised questionnaires. Rooted in pragmatism, this approach embraces multiple ways of understanding and viewing the world, thereby enriching insights into the subject matter through diverse thinking methods.

The pragmatic philosophical approach explores the multifaceted issues surrounding 4IR and its implications for the Tourism industry and higher education curricula, especially the Tourism education curriculum. The study was driven by the need to present practical outcomes and real-world applications that could effectively inform and enhance practices in the Accommodation sector, hence the adoption of pragmatism, which advocates for the use of the mixed methods research design. Integrating both positivist and interpretivist methodologies within a pragmatic framework allowed for a comprehensive exploration of the challenges and opportunities

presented by 4IR technologies. Heinonen and Strandvik (2022:467-468) argued that the pragmatic approach is particularly relevant in dynamic fields such as Tourism, where the goal is to understand and improve operational practices in real-world settings. By prioritising issues that resonate with practitioners and stakeholders, pragmatic methodologies produce findings that can be directly applied to enhance decision-making and operational efficiency.

The integration of both qualitative and quantitative data in research allows researchers to leverage the strengths of different approaches to gain a more nuanced understanding of complex problems (Clarke and Visser, 2019: 455-469). Thus, in the current study, the mixed-methods design allowed the researcher to quantitatively assess the current usage and benefits of Smart Tourism technologies whilst simultaneously exploring the subjective experiences and perceptions of managers through qualitative interviews. The positivist paradigm lends itself to quantifiable measurements of technological impact, enabling the researcher to establish objective correlations between 4IR applications and performance metrics such as customer satisfaction and operational efficiency. Conversely, the interpretivist paradigm provides insights into the subjective experiences of stakeholders, allowing the researcher to explore how these technologies are perceived, adopted and utilised in practice. Such duality ensures that this research captures the empirical data necessary for robust analysis and the rich narratives reflecting individual experiences.

Pragmatism allowed the researcher to adapt the methods based on the specific needs of this study. For example, the researcher utilised quantitative surveys to gather broad data on technology usage across various accommodation establishments, whilst also conducting in-depth qualitative interviews to understand the contextual factors influencing these practices. This flexibility enhanced the researcher's ability to respond to the complexities of the Tourism industry and the varied needs of its stakeholders (Heinonen and Strandvik, 2022: 467-468). By employing a pragmatic approach, the researcher aimed to produce findings that were directly relevant to practitioners in the Tourism industry. This is crucial for informing human resource development, training programmes and educational curricula related to 4IR competencies. Pragmatism emphasises actionable insights that can lead to practical improvements in industrial practices, making it particularly suitable for research focused on the intersection of technology and tourism.

Addressing Diverse Perspectives: By engaging with both quantitative data and qualitative insights, the researcher created a holistic view that recognises the complexity of these issues and the varying experiences of different stakeholders. Adopting a pragmatic research approach to explore the implications of 4IR for the Tourism industry is not only justified but imperative. By integrating the strengths of positivist and interpretivist methodologies, the researcher developed a comprehensive understanding of the nature and extent of Smart Tourism applications; the skills and training needs within the Accommodation sector; and the perceptions of industry stakeholders. This approach enabled the researcher to produce relevant, actionable insights that could enhance practices in the Tourism industry, ultimately contributing to the successful integration of 4IR technologies.

4.3 Strategy of Inquiry

The selected strategy of inquiry employed is Explanatory Sequential Mixed Methods Research. The strategy of inquiry outlines the procedures to be followed, as well as the tools needed to gather and analyse data and identify answers to the research topic (Alharahsheh and Pius, 2020:40). Mixed methods research enhances the robustness of conclusions by using multiple data sources or methods to cross-verify results (Subedi, 2023:99), thereby mitigating the weaknesses of a single method by leveraging the strengths of both quantitative and qualitative approaches (Bans-Akutey and Tiimub, 2021:3). According to Subedi (2023:100), this method offers a comprehensive understanding of intricate social phenomena by examining diverse human experiences, behaviours and interactions that single-method approaches may overlook.

4.3.1 Qualitative and Quantitative Methods

Qualitative research is valued for its focus on understanding social phenomena from the perspectives of participants, emphasising subjective experiences and insights. Quantitative research, on the other hand, seeks to establish causal relationships and generalise findings (Alharahsheh and Pius, 2020:41). Qualitative research aims for illumination and a deeper understanding of a phenomenon, whereas quantitative research aims to prove a phenomenon by testing or proving that it exists and qualitative research goes deeper to understand why a phenomenon exists. This distinction is evident in various aspects of their methodologies and applications (Alharahsheh and Pius, 2020:41). Alharahsheh and Pius (2020:41) state that the data collected from qualitative studies is subjective as it gathers the opinions, experiences and feelings of participants, thereby producing rich, descriptive data. It uses flexible research

questions that can evolve during the study, allowing for a deeper exploration of emerging themes (Bouncken *et al.* 2021:251-255). Qualitative methods are diverse and include semi-structured interviews, focus groups and participant observation, which prioritise participant perspectives (Bryman, 2017: 57-78; Bezuidenhout and Strydom, 2021:204).

In qualitative research, participants are usually selected using purposive sampling methods rather than random sampling and usually, participants with shared experiences are considered (Devers and Frankel, 2000: 263-264). On the other hand, quantitative research relies on measured data, unlike qualitative research, which uses observed data. For data analysis, qualitative analysis is often thematic and interpretative, contrasting with the statistical analysis typical in quantitative studies. In terms of sample size, qualitative studies usually have a smaller sample size, while quantitative studies involve larger sample sizes. Qualitative studies focus on depth rather than breadth (Bouncken *et al.* 2022: 252-255). Therefore, integrating qualitative and quantitative research is crucial for comprehensively understanding social phenomena. Bryman (2017:57-58) states that qualitative research offers valuable insights, but many lack generalisability and predictive power. This is why the researcher chose to use a mixed-methods approach. The next section discusses the explanatory sequential mixed-methods design applied to this study.

4.3.2 Explanatory Sequential Mixed Method Design

Figure 4.2 presents the explanatory sequential mixed method design used for this study, which involves two phases in the data collection process. These phases include the quantitative phase being carried out first, whereby the results are analysed and then used to plan for the second phase, which is qualitative in nature (James, DeJonckheere and Guetterman, 2024:15). Hence, this study was conducted in two phases, with the first phase being quantitative and the second phase being qualitative.

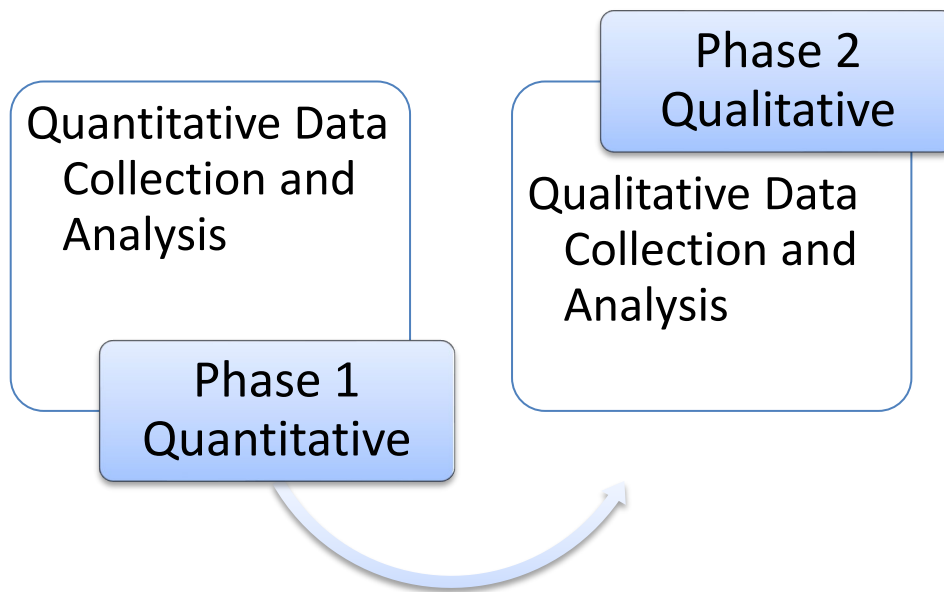


Figure 4.2: Explanatory Sequential Mixed Method Design

Source: Researcher's Construction

During the quantitative phase, an online survey was administered to stakeholders employed at accommodation establishments in KZN between April and July 2024. These establishments were listed in the Tourism KZN database. Upon the researcher noticing that the response rates were low, she attended the Travel Indaba, which was held between the 13th and 16th of May 2024 at the Durban Exhibition Centre and approached the stand-holders who were employees in the Accommodation sector in KZN to complete hard copies of the questionnaires. This assisted the researcher in obtaining more completed responses, with a completion rate of 90% of the surveys, where 295 surveys were completed out of the 327 distributed. Upon reviewing the completed surveys, the issues that needed further introspection from the survey results were used to design the qualitative second phase and were cross-analysed with relevant literature for benchmarking purposes.

During the qualitative phase of this study, semi-structured interviews were conducted with 11 managers from accommodation establishments based in KZN who were willing to be interviewed. These interviews took place between September 2024 and December 2024. The findings from the semi-structured interviews were analysed, validated, and related to the emerging themes from the quantitative first phase of this study. The cross-sectional survey and

the semi-structured interviews were used to meet research objectives RO1, RO2 and RO4 of this study. Within a mixed-method study, content validity is related to a type of validity in which different elements, skills and behaviours are effectively measured. Regarding reliability, the purpose is not to attain the same results but rather to agree that, based on the data collection processes, the findings and results are consistent and dependable (Vivek and Nanthagopan, 2021:203). Therefore, a mixed-methods design applied through a sequential explanatory design could provide greater insight, validity and reliability to this study.

To meet research objective RO3, the study included a document analysis that reviewed the handbooks on the Tourism offerings at universities based in KZN that offer Tourism-related qualifications. These documents are publicly available on the university websites. To meet the research objective (RO5), the researcher aimed to develop a model for a Transformative Higher Education Framework for the inclusion of 4IR into the Tourism curriculum.

4.3.3 Data Collection Phases

The study adopted a mixed-methods research approach to thoroughly investigate the impact of 4IR on the Tourism industry, specifically within accommodation establishments in KZN. This methodology consisted of two distinct data collection phases: a quantitative first phase using a cross-sectional online survey and a qualitative second phase involving semi-structured interviews.

4.3.3.1 Phase 1: Quantitative Research (Breadth of Study)

Cross-Sectional Online Survey

In the first phase, a cross-sectional online survey was administered to stakeholders employed at accommodation establishments listed on the Tourism KZN database. This survey aimed to gather quantitative data on various aspects of the adoption and impact of 4IR technologies in the Tourism industry. Key features of the survey include:

- **Target Population:** The survey targeted a diverse group of stakeholders, including managers, staff and technology specialists within accommodation establishments. By engaging a wide array of participants, the survey aimed to capture different perspectives on technology usage, training needs and challenges faced in the industry.

- **Survey Design:** The survey was designed to include closed-ended questions, allowing for a quantitative analysis of the responses. Key areas of focus included the current usage of smart technologies, perceived benefits, challenges in implementation, skills assessment and training needs related to 4IR applications.
- **Data Collection:** The survey was initially emailed to participants across KZN from the Tourism KZN database. Upon noticing the low response rate, the researcher then administered hard copies of the survey to stand-holders from accommodation establishments based in KwaZulu–Natal who had stands at the Travel Indaba. This allowed for the response rate to improve as the researcher physically handed out the surveys to these stand-holders and collected them upon completing the survey.

The quantitative data obtained from the survey were analysed using statistical methods to identify patterns, correlations and trends. This analysis provided a foundational understanding of how 4IR technologies are currently utilised in the Accommodation sector and highlighted areas for further exploration in the qualitative phase.

4.3.3.2 Phase 2: Qualitative Research (Depth of Study)

4.3.3.2.1 Semi-Structured Interviews

Following the quantitative phase, semi-structured interviews were conducted with selected stakeholders from the accommodation establishments. This qualitative approach aimed to delve deeper into the insights gained from the survey and explore participants' subjective experiences regarding the nature and extent of the usage of Smart Tourism and 4IR applications at accommodation establishments based in KZN. Key features of this phase include:

- **Interview Structure:** The semi-structured format allowed for guided yet flexible conversations with participants. This approach enabled the researcher to ask specific questions whilst also allowing participants to elaborate on their thoughts and experiences. Topics of discussion included perceptions of 4IR technologies, barriers to implementation and the perceived impacts on service delivery and customer satisfaction.

- **Data Collection Tools:** The qualitative data was gathered using online resources such as Microsoft Teams. This platform facilitated remote interviews, accommodating participants' schedules and geographic constraints whilst ensuring a comfortable environment for discussion.
- **Participant Selection:** The interview participants were managers at the accommodation establishments, who were purposively selected as individuals with relevant experiences and insights. The researcher e-mailed managers of accommodation establishments in KwaZulu-Natal and the managers who agreed to be interviewed were interviewed for the study. This purposeful sampling strategy enriched the qualitative data, providing a more nuanced understanding of the issues. The qualitative data obtained from these interviews were coded and analysed thematically, allowing the researcher to identify key themes and patterns related to stakeholders' experiences and perceptions of the 4IR in the Tourism industry.

4.3.4 Data Collection Tools

4.3.4.1 Questionnaire

The primary data collection tool was a comprehensive survey questionnaire distributed to industry stakeholders based at accommodation establishments in KZN (see Annexure I). The focus of this study was on Smart Tourism and 4IR applications. The survey investigated the current usage, benefits and challenges of these technologies in accommodation establishments to inform the development of a curriculum that equips students with the requisite competencies for the evolving demands of the Tourism industry. The survey also assessed the perceptions of general staff regarding the 4IR competencies and skills of recent graduates, providing a comprehensive understanding of the current landscape and future needs in Smart Tourism education and practice. The survey instrument consisted of 76 items measured using both nominal and ordinal scales, depending on the nature of each construct. Nominal items were used to capture categorical information such as demographic variables, while ordinal items utilised a Likert-type scale. Likert scales are widely used in social science research to measure attitudes, perceptions and behavioural tendencies because they allow respondents to indicate the extent of their agreement or frequency of behaviour along an ordered continuum (Likert, 1932; Joshi *et al.*, 2015).

The questionnaire was divided into 4 sections that measured various themes as follows: Biographical data, Usage of Smart Tourism and 4IR applications in accommodation establishments, Types of Smart Tourism and 4IR applications, Assessing 4IR skills and training needs for employability in accommodation establishments in KZN, 4IR skills assessment, Exploring the perceptions of general staff of the 4IR competencies and skills of Tourism graduates and the Perceptions of graduates of Smart Tourism and 4IR skills.

In this study, the ordinal items were measured using a five-point Likert scale, with assigned numeric values as follows:

1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree.

This weighting approach is consistent with established practice in hospitality, tourism, and educational research, where Likert-type scales enable meaningful quantification of subjective responses for statistical analysis (Boone and Boone, 2012). The assigned weights were used during the coding process in SPSS to calculate descriptive and inferential statistics, ensuring that the measurement aligned with standard methodological conventions and allowed for replicability of the study.

4.3.4.2 Key Informant Interviews

The researcher conducted key informant interviews to validate and buttress the points from the questionnaires (see Annexure J for Interview Schedule). Punzi (2024:162) mentioned that an interview offers a far greater opportunity to delve into issues in more detail and discover things that might not have become apparent through more superficial research. The interviewees in the study were managers from selected accommodation establishments in KZN. The researcher made appointments with the interviewees through an online meeting platform such as MS Teams. The in-depth interviews evaluated their perspectives on 4IR and the contributions, changes and future of the technology in the Accommodation sector.

4.3.4.3 Document analysis

A document analysis was conducted to review the handbooks of universities offering Tourism qualifications at universities based in KZN, which were retrieved from university websites. The document analysis was used to develop a curriculum model for Tourism programmes in higher education that includes 4IR.

4.3.4.4 Pre-test of the questionnaire

On the 28th of February 2024, the researcher emailed the manager of an accommodation establishment based in KZN seeking permission for him and his staff to participate in the pre-test of the online survey questionnaire. The manager agreed to participate in the pre-test of the survey instrument. Google Forms were used to design and distribute the questionnaires. In this part of the study, the respondents were asked to:

- Pinpoint questions and instructions that need more clarity;
- Identify irrelevant questions, omissions and duplications of questions;
- Record the time spent completing the questionnaire;
- Identify unsettling or offensive questions;
- Detect ambiguous questions; and
- Review the language and grammar used.

Table 4.1 reflects the distribution and response rate for the questionnaire pre-testing.

Table 4.1: The Distribution and Response Rate for Pre-Testing the Questionnaire

Desktop/Laptop Device			
Respondent	Number of questionnaires distributed	Number of questionnaires returned	Time taken to complete questionnaire (minutes)
Participant 1	1	100%	10
Participant 2	1	100%	9
Participant 3	1	100%	10
Participant 4	1	100%	15
Participant 5	1	100%	15

Respondents agreed that the instructions of the questionnaire were clear and concise without ambiguity. Respondents felt that all questions were relevant and that there was no omission of questions. They also thought that the questions were not unsettling or offensive. The respondents did, however, indicate that the grammar used in the questionnaire was high-level and needed to be simplified. Based on the feedback provided, the researcher made a few grammatical changes to streamline the questionnaire's content where necessary. The

time taken was mainly within the 10 to 15 minutes allocated for the online research survey questionnaire. Reflecting upon this matter, there was no need to change the time allocated for respondents to answer the online survey questionnaire. All the questionnaires were completed and returned on 4 March 2024.

4.4 Data Analysis

SPSS 29.0 (IBM Corp., 2021) was used to analyse the quantitative data and provided both descriptive and inferential statistical insights. Descriptive statistics, including graphs, cross-tabulations and other visual representations, are employed to elucidate the quantitative data gathered from the respondents.

- **Use of Mean Values in Data Analysis**

In this study, mean values were calculated and reported for the items in Tables 5.11 to 5.20 to summarise respondents' perceptions on various constructs. The mean was selected as it provides a single representative value that reflects the central tendency of the responses on the Likert scale used in the questionnaire. This approach allowed for easier comparison across items and constructs and is a common descriptive statistical technique in survey-based research (Yaska and Nuhu, 2024:33-34). The use of mean values, rather than chi-square statistics, was considered appropriate for the interpretation of attitudinal and perceptual data as it provides a clearer understanding of the average level of agreement or disagreement amongst respondents (Chen and Liu, 2020:39-40).

- **Inferential Statistics**

Techniques such as correlations and chi-square tests were utilised for the inferential analysis, with p-values as the benchmark for determining statistical significance. Traditionally, a result is deemed statistically significant if the p-value is less than 0.05, indicating a high level of confidence in the findings.

- **Factor Analysis**

This study also applied factor analysis to the questionnaire responses collected from industry stakeholders at accommodation establishments in KZN. The primary objective was to uncover the underlying dimensions influencing the usage, awareness and perceptions of Smart Tourism and 4IR applications in the Tourism industry. By identifying these latent factors, the study

provides deeper insights into the critical areas that must be addressed in developing a Transformative Higher Education Curriculum Model in Smart Tourism within the 4IR. Factor analysis is a statistical method to identify underlying relationships between observed variables. It aims to reduce the dimensionality of data by grouping correlated variables into factors, which represent latent constructs that explain the observed variability in the data (Lawley and Maxwell, 1962:209). Lawley and Maxwell (1962:209) state that this technique is particularly useful in fields where data complexity is high and there is a need to simplify the structure without a significant loss of information.

- **Pearson chi-square**

As suggested by Franke, Ho and Christie (2012:448-449), the Pearson chi-square (χ^2) test was utilised to analyse the relationships between categorical predictors and outcomes. A p-value of less than 0.05 was deemed to have statistical significance.

- **Spearman's Correlation**

Spearman's correlation is a statistical technique employed to evaluate the association between two variables, specifically in cases where the data does not conform to a normal distribution or when the relationship between the variables is not linear (Hauke and Kossowski, 2011:87). The measure of correlation being referred to is non-parametric, indicating that it does not make any assumptions regarding the distribution of the data or the presence of a linear relationship between the variables. Spearman's correlation coefficient is derived from the ranks of variables rather than their actual values, making it particularly suitable for analysing both ordinal or ranked data and continuous data (Warner, 2010:83). The utilisation of alternative statistical methods becomes particularly advantageous when analysing data that could not be evaluated using Pearson's correlation due to the underlying assumptions of normality and linearity (Bishara and Hittner, 2017:294).

- **Structural Equation Modelling (SEM)**

Structural Equation Modelling was used to validate the measurement model (CFA) and structural model. Model fit was evaluated using standard indices, including the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA) and Chi-Square statistics. Standardised loadings ≥ 0.60 were considered acceptable. Details and results appear in Section 5.9. In addition, SEM is an advanced multivariate statistical technique that enables the assessment of both measurement relationships (how

observed variables load onto latent constructs) and structural relationships (how latent constructs relate to each other) (Sarstedt and Ringle, 2020:841). This method was chosen because it is well-suited to examining complex models involving multiple latent variables and observed indicators. AMOS version 29.0 was used to conduct the analysis. The process included Confirmatory Factor Analysis (CFA) to validate the measurement model and assess the reliability and validity of the constructs.

- **Content Analysis**

Using NVivo, content analysis was utilised to examine the semi-structured interviews. When analysing data from a qualitative standpoint in a specific investigation, NVivo is used to code emerging themes. Researchers can translate and code textual data in multiple categories at different levels, such as words, phrases, paragraphs and sentences, using the methodological tool known as content analysis (Mohdar and Pawar, 2022:552-555). Many academics place content analysis at the nexus of qualitative and quantitative traditions because they understand how valuable it is for drawing reliable inferences from a body of text that can be replicated (Mohdar and Pawar, 2022: 563-564). Triangulation was used to compare and contrast the findings, their strengths, flaws and opportunities.

The process of document analysis involved several steps to extract meaningful insights from university yearbooks, course codes and curricula related to Tourism and Hospitality qualifications. These steps included selecting handbooks from universities based in KZN and familiarising oneself with the content. The researcher analysed the documents to identify broader themes and patterns within the curricula related to the Information and Communication Technology (ICT) modules taught; modules focusing on the use of the 4IR in the Tourism industry; and digital tourism management trends in course offerings or specific areas of focus. Thereafter, the researcher critically interpreted the findings in relation to the research objectives, considering the implications for 4IR-based programme development, industry relevance and student preparedness. The findings were then presented in a comprehensive report, highlighting key insights, methodologies and recommendations for stakeholders in the field of Tourism and Hospitality education on the inclusion of the 4IR in their curriculum.

4.5 Reliability and Validity

Koonin (2021:290) asserts that the validity of a measurement tool refers to the extent to which it accurately measures the intended construct. Validity refers to how well a research study is designed and conducted to effectively address the study objectives and provide accurate responses to the research questions (Koonin, 2021:291). The types of validity encompassed in the field of research include convergent validity, face and content validity, concurrent and predictive validity, construct validity and discriminant validity (Koonin, 2021:293). This study evaluated the instruments' pertinence and representativeness to the target population using content validity testing in both the quantitative and qualitative phases.

Reliability pertains to the degree of consistency a measuring instrument exhibits in producing a particular outcome, under the condition that the object of measurement remains unchanged (Koonin, 2021:289). The reliability of a study is determined by evaluating the accuracy, consistency, transparency and reproducibility of its results. Observer error, also known as observer bias, as well as participant or subject bias and participant or subject error, are factors that can significantly influence the reliability of data (Keaney, Jones and Mulder, 2024:175). According to Koonin (2021:291), three distinct forms of dependability exist, namely test-retest reliability, parallel-form reliability and inter-rater reliability.

The other method used to test the reliability of data is the Cronbach's alpha coefficient, which is used as a measure of internal consistency, indicating the closeness of a set of items as a group and the internal consistency of a scale (Jugessur, 2022:9). It is calculated by comparing the scores of individual items within a measure with the total score for each observation. The formula is: $\alpha = k * m[r] / (1 + (k-1) * m[r])$, where k is the number of items and $m[r]$ is the mean correlation between items. The alpha value ranges from 0 to 1, with a higher value indicating better internal consistency and reliability. General guidelines for alpha are 0.70 or higher, with 0.80 or higher considered good and 0.90 or higher considered excellent (Bonett and Wright, 2024). Factors affecting alpha include the number of items, item homogeneity and sample size. Alpha increases with the number of items, even if the correlations between items do not change. A larger sample size generally provides a more stable estimate of the alpha.

Moreover, it is common practice to conduct pilot research to assess the feasibility of various techniques, such as surveys, interviews and focus groups, as well as to evaluate their compatibility within a specific context (Koonin, 2021:294). Before administering the instruments to industry stakeholders at the accommodation establishments, a pre-test study was undertaken to evaluate the validity and reliability of the instruments. This enabled the adjustment of the instruments to achieve a more precise and controlled operation. The objective of this study was to gain an understanding of the characteristics and utilisation of Smart Tourism and 4IR applications and competencies within accommodation establishments located in KZN. Furthermore, the literature was carefully selected from relevant academic databases and rigorously reviewed by peers. The industry experts were chosen from the Tourism KZN database.

4.6 Population and Sampling

4.6.1 Population

A population is described as the group of people who would be the research subject in an ideal world (Babbie, 2021:199; Pascoe, 2021:146). The situations that people are exposed to are what set any population apart from another, regardless of grouping. This enables the researcher to make precise judgments regarding a study. The target population for this study included stakeholders from the accommodation establishments as per the Tourism KZN (TKZN) database. The total number of accommodation establishments was 2154. The sampling method is discussed in the next sub-section.

4.6.2 Sampling method

Sampling is the process of selecting a sample from a population to serve as the foundation for estimating or predicting a fact, circumstance, or outcome about the population (Pascoe, 2021:145). Sampling techniques fall into two main categories: probability and non-probability techniques. In contrast to non-probability methods, probability methods are founded on the concepts of randomness and probability theory (Pascoe, 2021:152). The systematic sampling method under probability sampling was used for the quantitative phase. This technique involves methodically moving across the sample frame to obtain a systematic sample (Pascoe, 2021:155). This study used the list of accommodation establishments obtained from TKZN for the sampling process. The beginning point is selected randomly to add some randomness to the process (Pascoe, 2021:155). Hence, in this process, the fifth name on the list was selected at

intervals until the exact number of the stated sample size was achieved, as indicated in Table 4.2. This was carried out to avoid bias in the sampling process. In addition, selecting every fifth name on the list enhanced efficiency and simplicity in the sampling process, especially when dealing with large datasets (Hossan, Mansor and Jaharuddin, 2023: 211-212). According to Sekaran and Bougie (2016:266), the sample size for the population of 2154 is 327 participants, as shown in Table 4.2. Hence, the survey was administered to all 327 participants.

Table 4.2: Establishing a Sample Size from a Given Population

N	S	N	S	N	S	N	S	N	S	N	S
10	10	85	70	220	140	440	205	1 200	291	4 000	351
15	14	90	73	230	144	460	210	1 300	297	4 500	354
20	19	95	76	240	148	480	214	1 400	302	5 000	357
25	24	100	80	250	152	500	217	1 500	306	6 000	361
30	28	110	86	260	155	550	226	1 600	310	7 000	364
35	32	120	92	270	159	600	234	1 700	313	8 000	367
40	36	130	97	280	162	650	242	1 800	317	9 000	368
45	40	140	103	290	165	700	248	1 900	320	10 000	370
50	44	150	108	300	169	750	254	2 000	322	15 000	375
55	48	160	113	320	175	800	260	2 200	327	20 000	377
60	52	170	118	340	181	850	265	2 400	331	30 000	379
65	56	180	123	360	186	900	269	2 600	335	40 000	380
70	59	190	127	380	191	950	274	2 800	338	50 000	381
75	63	200	132	400	196	1 000	278	3 000	341	75 000	382
80	66	210	136	420	201	1 100	285	3 500	346	1 000 000	384

N is the population size; *S* is the sample size.

Source: Sekaran and Bougie (2016: 266)

In the qualitative phase, the non-probability purposive sampling method was applied. A purposive sampling strategy was used to identify the target population. Purposive sampling allows researchers to purposefully choose elements for the sample based on a set list of characteristics (Pascoe, 2021:161-162). In addition, purposive sampling allows researchers to intentionally select participants with a ‘lived experience’ related to the study (Pascoe,

2021:162). Mocanasu (2020:182) reported that there are no set guidelines for the sample size in qualitative research since it depends on the questions the researcher wants to ask, the goal of the investigation, what will be helpful, what is believable and what can be completed within the allotted time frame with the available resources. Furthermore, researchers can feel confident in their results when there are several replications and data saturation. On the other hand, Thorne (2022:1) indicated that data saturation occurs when no new themes or insights emerge from additional interviews, limiting the depth of understanding gained from qualitative research. Further research stated that saturation is generally achieved within a narrow range of interviews and that most datasets reached saturation at between 9 and 17 interviews (Hennink and Kaiser, 2020:3). By the time 11 respondents were interviewed in this study, responses began to repeat and no significant new data was generated. Therefore, the sample of 11 was the minimum number that the researcher determined could provide a rich diversity of perspectives, ensuring that the data captured a range of experiences, thereby contributing to a deeper understanding of the phenomenon being studied. It can therefore be concluded that non-probability sampling is virtually always employed in qualitative research (Wang, 2024:142).

4.6.3 Inclusion and exclusion criteria

The research confined itself to accommodation establishments based in KZN as this is the largest sub-sector of the Tourism industry in the province, according to the TKZN database. There are various types of accommodation establishments, including hotels, bed and breakfasts, self-catering units, guesthouses and lodges, as contained in the TKZN database. Furthermore, the researcher had specifically chosen KZN because it has many different types of accommodation establishments, is accessible and has key market areas for domestic and international tourism (Tifflin and Balkaran, 2014:432-437). In addition, KZN was chosen due to the timeframes and limitations.

This study aimed to explore the development and promotion of a Transformative Higher Education Curriculum Model in Smart Tourism within the 4IR. Enslin (2021:315) explains delimitations as boundaries that the researcher sets to exclude factors from the research. Delimitations assist researchers in narrowing the scope of research. In the case of this study, the researcher opted to include only stakeholders from accommodation establishments who are based in KZN to investigate the nature and extent of the usage of Smart Tourism and 4IR

skills applications used, as well as to determine the 4IR skills and training needed to be employable at the accommodation establishments.

The universities that fall into the scope of the study include a University of Technology (UoT), an Urban Comprehensive University and a Rural Comprehensive University, as they offer tourism-related programmes. One UoT, although situated in KwaZulu-Natal, was not considered because they do not offer any tourism-related programmes.

4.7 Ethical Considerations

Sekaran and Bougie (2013:313) stated that the researcher must follow many ethical guidelines when conducting the study procedure. The researcher is responsible for ensuring that participants face no harm, that their informed consent was obtained, that ethical and organisational approval was obtained and that their identities and confidentiality are maintained (Sekaran and Bougie, 2013:313). An informed consent letter (Refer to Annexure C) was given to participants for their involvement in the study, which they had signed upon being interviewed in the qualitative phase. For the quantitative phase, the respondents had to tick in the online questionnaire that they were granting consent to participate in the study and that the establishment's identities were to be kept secret for the duration of the investigation. In addition, for those questionnaires that were administered face-to-face, the researcher only handed out the questionnaires to the accommodation establishment holders at the Travel Indaba if they agreed to complete them. Respondents suffered no harm and their identities were kept private. The Durban University of Technology's (DUT) Ethics Committee attested to the ethical approval (Refer to Annexure D). The researcher received an Ethics Training Certificate after finishing the Introduction to Ethics programme satisfactorily (Refer to Annexure G).

4.7.1 Recruitment of Participants

The participants for the qualitative phase were emailed the link with the indemnity and consent form to go through and decide whether they were keen to be interviewed. Once they had replied to the researcher indicating their agreement to participate in the study, the interviews were set up and conducted. Each participant was required to sign the indemnity and consent form for this study.

4.7.2 Informed Consent

The researcher received written confirmation from the Federated Hospitality Association of South Africa (FEDHASA) to conduct the study with the accommodation establishments in KZN as per the list of establishments provided by TKZN (Refer to Annexure F).

4.7.3 Anonymity and Confidentiality

The study involved the anonymisation of participant identities, with each participant being assigned a unique code to prevent tracing back to individual participants. Data was stored securely in encrypted digital formats, with access restricted to the researcher. Strong passwords were used and protected electronic files, whilst physical documents were kept in locked cabinets. No references were made to organisations or institutions associated with the participants in published materials or reports, enhancing confidentiality. Participants were informed about confidentiality measures during the informed consent process, which helped build trust and encourage honest responses during data collection. Data retention policies were followed upon the study's completion, with electronic data being deleted and physical documents shredded in accordance with ethical guidelines. This approach ensured the data's confidentiality and the research's integrity.

4.8 Chapter Summary

This chapter outlined the methodology used in this research. It described the research approach employed in the study, as well as the research design, sampling procedures, research instruments, research participants, data collection tools and data analysis. The tools used to gather data were key informant interviews and a survey questionnaire. The sampling choice and target population used were also explained in this chapter. The following chapter focuses on the quantitative data analysis and presentation of the findings.

CHAPTER FIVE: PRESENTATION OF THE QUANTITATIVE RESULTS

5.1 Introduction

This chapter presents the quantitative results and discusses the findings obtained from the questionnaires used in this study. The overarching aim of the research was to explore the development and promotion of a Transformative Higher Education Curriculum Model in Smart Tourism within the Fourth Industrial Revolution (4IR) context. The quantitative study results deal with Phase 1, namely the quantitative study. Figure 5.1 depicts the data collection, analysis and interpretation of the study.

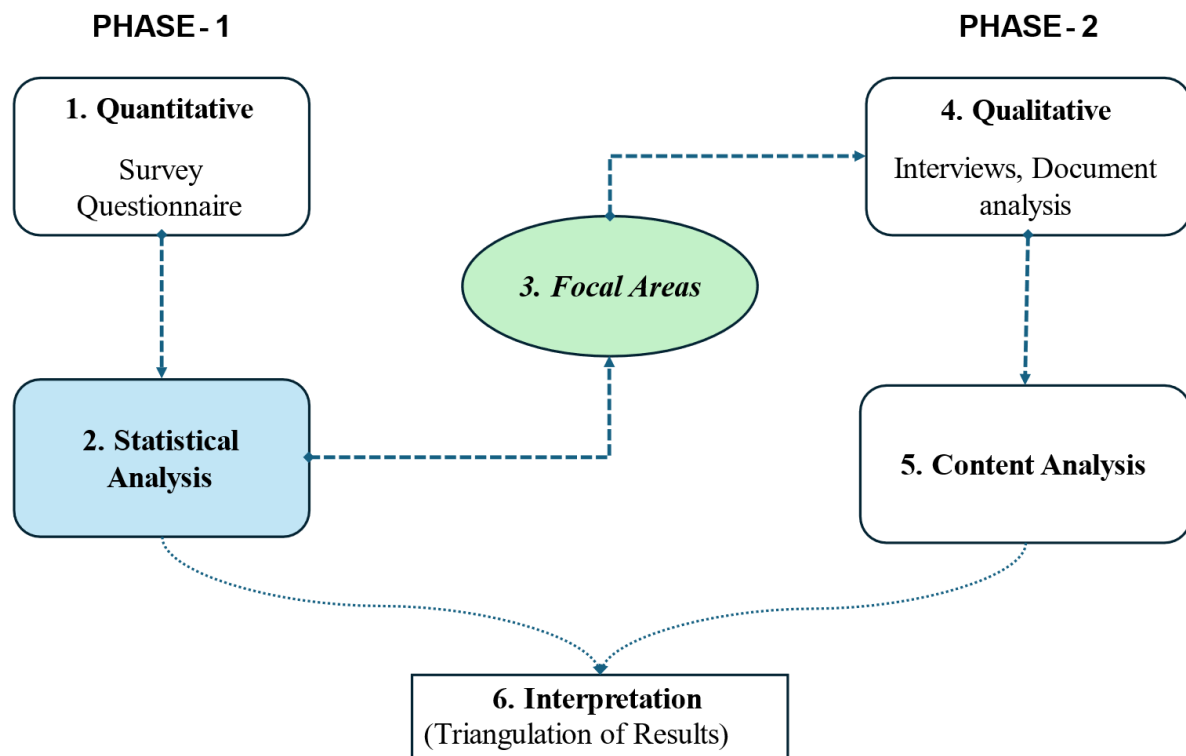


Figure 5.1: Explanatory Sequential Representation of Study

Source: Researcher's Construction

The results are focused on understanding the digital economy, the nature and extent of the usage of Smart Tourism and 4IR applications, 4IR skills and training needs in the Accommodation sector, Smart Tourism and 4IR in the existing higher education curriculum,

the perception of industry towards the 4IR competencies and skills of tourism graduates and human resource development as it pertains to the Tourism business.

Data analysed in this study were collected using an online questionnaire and face-to-face completion of the questionnaire (Refer to Annexure I). The data was collected from staff working in different departments within the accommodation establishments for the quantitative phase (Phase 1) of several established accommodation service providers across KwaZulu-Natal (KZN). The findings are presented based on descriptive statistics, inferential statistics, themes and relationships between constructs, all framed within the context of instruments and theoretical frameworks.

5.2 The Sample

In total, 327 questionnaires were administered and 295 were returned, which gave a 90.2% response rate. According to Mellahi and Harris (2016:3), there is no consensus on an acceptable response rate for quantitative research in business and management. However, it has been reported by Baruch and Holtom (2008:1140) that the response rate could be between 50% and 80%, with an overall average being 55.6%. Similarly, Luo (2020:2) stated that the acceptable range could be 50%, whilst Richardson (2005:406) mentioned that a response rate of 60% would be more desirable. Since the response rate for this study is 90.2%, it can be noted that it is an acceptable response rate for quantitative research.

5.3 The Research Instrument

The survey questionnaire was divided into four sections (Refer to Annexure I for a copy of the Survey Questionnaire), which measured various themes as illustrated below:

- A Biographical data
- B Usage of Smart Tourism and 4IR applications in accommodation establishments:
types of Smart Tourism and 4IR applications
- C Assessing 4IR skills and training needs for employability in accommodation establishments in KZN: 4IR skills assessment

- D Exploring the perception of general staff on the 4IR competencies and skills of tourism graduates: perception of graduates' Smart Tourism and 4IR skills

5.4 Reliability Statistics

The two most important aspects of precision are reliability and validity. Reliability is computed by taking several measurements on the same subjects. A reliability coefficient of 0.60 or higher is considered “acceptable” for a newly developed construct (Kamper, 2019:286).

Table 5.1 reflects the Cronbach’s alpha score for all the questionnaire items.

Table 5.1: Reliability Statistics

Section	Section and Question Number	Statement	Items	Cronbach's Alpha
Usage of Smart Tourism and 4IR applications in accommodation establishments: Awareness and Adoption of Smart Tourism and 4IR Applications	B1	Smart Tourism in the Era of the Fourth Industrial Revolution	3	0.873
Usage of Smart Tourism and 4IR applications in accommodation establishments: Types of Smart Tourism and 4IR Applications	B2.1	Mobile applications (apps) for destination information and navigation	4	0.742
	B.2.2	Personalised recommendations based on user preferences and behaviour	9	0.927
	B2.3	Smart rooms (IoT-enabled) for enhanced guest experience	4	0.877
	B2.4	Facial recognition, security and personalised services	3	0.830
	B2.5	AI-driven chatbots for customer support and questions	5	0.821
	B2.6	Big data analytics to analyse and make decisions on tourism trends	2	0.825

	B2.7	Secure transactions or identity verification using Blockchain-based solutions	2	0.778
Usage of Smart Tourism and 4IR applications in accommodation establishments: Benefits and challenges of Smart Tourism and 4IR applications	B3	Benefits and challenges of Smart Tourism and 4IR applications	6	0.929
Assessing 4IR skills and training needs for employability in accommodation establishments in KwaZulu-Natal: 4IR Skills assessment	C1	Digital Literacy and Technology Skills	4	0.914
	C1.5-C1.6	Data Analysis and Interpretation	2	0.853
	C1.7-C1.8	Artificial Intelligence (AI) and Automation	2	0.889
Assessing 4IR skills and training needs for employability in accommodation establishments in KwaZulu-Natal: Training needs	C2.1	4IR Skills are important to your current position	6	0.950
	C2.2	4IR Skills are most essential for the tourism industry	6	0.948
Exploring the perception of general staff on the 4IR competencies and skills of tourism graduates: Perception of Graduates Smart Tourism and 4IR Skills	D1	Smart Tourism Skills	5	0.948
	D2	4IR Skills	4	0.950

The reliability scores for all sections exceed the recommended Cronbach's alpha value of 0.6. This indicates a degree of acceptable, consistent scoring for these sections of the research instrument.

5.5 Factor Analysis

This study applied factor analysis to the questionnaire responses collected from industry stakeholders at accommodation establishments in KZN. The primary objective was to uncover the underlying dimensions that influence the usage, awareness and perceptions of Smart Tourism and 4IR applications in the Tourism industry. By identifying these latent factors, the study seeks to provide deeper insights into the critical areas that need to be addressed in developing a Transformative Higher Education Curriculum Model in Smart Tourism within the 4IR.

The factor analysis process involves several key steps, including the assessment of data suitability, extraction of initial factors, rotation to achieve a more interpretable structure and

interpretation of the resulting factor solution (Shrestha, 2021:4). The suitability of the data for factor analysis is determined through measures such as the Kaiser-Meyer-Olkin (KMO) test for sampling adequacy and Bartlett's test of sphericity. Once the data are deemed appropriate, the extraction method, typically Principal Component Analysis (PCA) or Principal Axis Factoring (PAF), is used to identify the initial factor structure (Shrestha, 2021:4-5).

Rotation methods such as Varimax (orthogonal rotation) or Promax (oblique rotation) are applied to enhance interpretability. These rotations aim to achieve a simpler and more meaningful factor solution by maximising the loading of variables on a single factor whilst minimising the loading on others (Finch, 2006:39). The final step involves interpreting the factors based on the pattern of loadings, which represents the correlation of each variable with the underlying factor (Finch, 2006:42).

In summary, factor analysis in this study served as a robust tool to extract complex data into comprehensible and actionable insights. It helped identify the key dimensions that influenced the implementation and perception of Smart Tourism and 4IR technologies in the Accommodation sector. These insights are crucial for informing the development of an education curriculum that aligns with the technological advancements and industry requirements of 4IR.

Table 5.2: KMO and Bartlett's Test

	Section	Kaiser-Meyer-Olkin Measure of Sampling Adequacy	Bartlett's Test of Sphericity		
			Approx. Chi-Square	df	Sig.
B	Usage of Smart Tourism and 4IR applications in accommodation establishments: Awareness and Adoption of Smart Tourism and 4IR Applications	0.772	607.679	6	< 0.001
C	Usage of Smart Tourism and 4IR applications in accommodation establishments: Types of Smart Tourism and 4IR Applications	0.913	5647.753	406	< 0.001
D	Usage of Smart Tourism and 4IR applications in accommodation establishments: Benefits and challenges of Smart Tourism and 4IR applications	0.903	1355.283	15	< 0.001

E	Assessing 4IR skills and training needs for employability in accommodation establishments in KwaZulu-Natal: 4IR Skills assessment	0.885	2458.570	45	< 0.001
F	Assessing 4IR skills and training needs for employability in accommodation establishments in KwaZulu-Natal: Training needs	0.901	4216.574	66	< 0.001
G	Exploring the perception of general staff on the 4IR competencies and skills of tourism graduates: Perception of Graduates Smart Tourism and 4IR Skills	0.930	2895.342	36	< 0.001

Table 5.2 shows that all the conditions for factor analysis are satisfied. That is, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy value should be greater than 0.500 and in Bartlett's Test of Sphericity, sig. the value should be less than 0.05.

Factor analysis is done only for the Likert scale items, namely Sections B to D, analysed in the survey questionnaire. The results show that the variables constituting these sections were loaded on 1 to 7 components. Sections B1 and B3.1 loaded perfectly along a single component. This implies that the statements constituting these sections (construct) perfectly measure what they set out to measure. Certain sections were divided into finer components (sub-themes). This is explained by the tables below, which show the results of the rotated component matrix.

Table 5.3: Rotated Component Matrix Section B1

B1	Component 1
I am familiar with the concept of Smart Tourism.	0.819
I am aware of the Fourth Industrial Revolution (4IR).	0.892
I know how 4IR impacts the tourism industry.	0.904
I have personally used 4IR technologies or Smart Tourism applications.	0.730

Table 5.3 shows the statements that constituted section B1, which loaded perfectly along a single component. This implies that the statements that constituted these sections perfectly measured what it set out to measure, namely **‘Awareness and adoption of Smart Tourism and 4IR application’**. It is noted that the variables that constituted the remaining sections loaded along multiple components (sub-themes). This implies that respondents identified

different trends within the section. Within the section, the splits are colour-coded. The names for the suggested components are shown below the tables.

Table 5.4: Rotated Component Matrix Section B2.1 to 2.7

B2.1 - B2.7	Component						
	1	2	3	4	5	6	7
Google Maps	0.749	0.200	-0.091	0.200	0.155	0.085	0.059
Apple Maps	0.543	0.257	0.278	0.209	-0.001	0.146	-0.025
TripAdvisor	0.570	0.376	0.100	0.101	-0.150	0.241	-0.260
Roadtrippers	0.288	0.515	-0.044	0.018	0.114	0.400	0.248
Social media adverts.	0.758	0.115	0.063	0.116	0.275	0.166	0.196
Facebook	0.757	0.226	0.059	0.109	0.255	0.196	0.094
Pinterest	0.396	0.643	0.173	0.112	0.099	0.180	0.134
Airbnb	0.517	0.591	0.075	-0.023	0.068	0.268	-0.204
LinkedIn	0.656	0.373	0.220	0.118	0.284	0.039	0.082
YouTube	0.636	0.429	0.098	0.264	0.229	0.027	0.047
Spotify	0.248	0.751	0.199	0.213	0.242	0.053	-0.001
Netflix	0.373	0.669	0.180	0.380	0.179	0.050	-0.070
Amazon	0.203	0.775	0.107	0.102	0.186	0.166	0.183
Keyless entry	0.080	0.135	0.007	0.830	0.244	0.232	0.030
Automated Climate Control	0.252	0.246	0.041	0.728	0.384	0.190	-0.018
Personalised Lighting	0.337	0.067	0.244	0.751	0.170	0.186	0.182
Virtual Concierge	0.262	0.266	0.232	0.438	0.438	0.105	-0.008
Customer identification	0.158	0.183	0.192	0.350	0.711	0.145	0.062
Employee authentication	0.282	0.140	0.087	0.268	0.598	0.184	0.013
Keyless entry	0.125	0.151	0.147	0.499	0.634	0.137	0.098
Hotels.com Virtual Assistant	0.275	0.021	0.534	0.241	0.394	0.205	-0.196
Marriott's Chatbot	0.131	0.034	0.826	0.132	0.052	0.143	-0.081
Whistle Messaging	0.032	0.174	0.810	-0.031	0.259	0.118	0.233
Accor's All-Around Chatbot	-0.010	0.219	0.861	0.077	0.074	0.061	0.236

Any other AI-driven chatbot	0.206	0.197	0.410	0.185	0.065	0.140	0.739
AI based analytics	0.133	0.162	0.167	0.204	0.145	0.825	0.058
Real time analytics dashboards	0.189	0.164	0.143	0.304	0.192	0.743	0.034
Digital identity for travel documents	0.243	0.138	0.241	0.182	0.456	0.583	-0.007
Smart contracts for automating bookings	0.211	0.301	0.179	0.049	0.597	0.472	0.064

Table 5.4 shows that seven components (sub-themes) can be identified from Sections B2.1 to B2.7. The sub-themes can be described as follows: ‘Navigation and Social Media Platforms’ includes high loadings on Google Maps, Apple Maps, TripAdvisor and social media adverts, focusing on navigation tools and social media usage. ‘Personal and Business Social Media Platforms’ has high loadings on Pinterest, Airbnb, LinkedIn, YouTube, Spotify, Netflix and Amazon, representing a mixture of personal and business social media platforms. ‘Artificial Intelligence (AI)-Driven Chatbots’ shows high loadings on Marriott's Chatbot, Whistle Messaging, Accor's All-Around Chatbot and Hotels.com Virtual Assistant, reflecting the adoption of AI-driven chatbots in customer service. ‘Smart Room Technologies’ indicates high loadings on keyless entry, automated climate control and personalised lighting, focusing on Smart room technologies to enhance guest experiences. ‘Security and Authentication Technologies’ includes customer identification, employee authentication and keyless entry, representing technologies used for security and authentication purposes. ‘AI and Analytics Tools’ indicates high loadings on AI-based analytics and real-time analytics dashboards, indicating a focus on advanced analytics tools for decision-making. ‘Blockchain and Digital Identity Solutions’ includes digital identity for travel documents and Smart contracts for automating bookings, highlighting the use of blockchain technology for secure transactions.

Table 5.5: Rotated Component Matrix Section B3.1

B3.1	Component
	1
Smart Tourism and applications of the Fourth Industrial Revolution (4IR) raise the overall quality of the tourist experience.	0.850
These technologies boost the accommodation establishment's operational effectiveness.	0.897
These technologies improve strategic efficiency in the Accommodation sector.	0.906
Concerns about data security and privacy prevent these technologies from being widely adopted.	0.856
The cost associated with using these technologies and keeping them up to date is a challenge.	0.817
Learning to use Smart Tourism and 4IR applications can be quite challenging.	0.834

Table 5.5 shows that the statements constituting Section B3.1 loaded perfectly along a single component. This implies that the statements that constituted this section perfectly measured what it set out to measure, namely, 'Benefits and challenges of Smart Tourism and 4IR applications'.

Table 5.6: Rotated Component Matrix Section C1

C1	Component			
	1	2	3	4
Using basic computer applications (word processing, spreadsheets, etc.).	0.813	0.029	0.302	0.195
Using mobile apps. for tourism-related activities.	0.811	0.285	0.269	0.220
Using social media for marketing and communication purposes.	0.863	0.321	0.231	0.178
Mastery of virtual reality (VR) and augmented reality (AR) technologies for enhancing tourism experiences.	0.665	0.577	0.020	0.234
Examining and interpreting data related to tourism to gain business insights.	0.277	0.154	0.546	0.696
Using data visualisation tools (e.g., Tableau, Infogram, Google Data Studio, Power BI) to represent tourism trends and patterns.	0.307	0.353	0.237	0.808
Familiarity with chatbots and AI-powered customer services in tourism.	0.210	0.841	0.246	0.220
Comprehension of how AI can improve tourism offerings by being tailor-made	0.225	0.819	0.341	0.172

Knowledge of cybersecurity risks and best practices for data protection in the tourism industry.	0.265	0.256	0.827	0.274
Experience with remote collaboration tools (e.g., video conferencing, project management software).	0.308	0.361	0.724	0.221

Table 5.6 shows that four components (sub-themes) can be identified from Section C1. The sub-themes can be described as follows: ‘Basic Digital Literacy and Social Media Usage’ includes high loadings on basic computer applications, mobile apps for tourism and social media for marketing, indicating a focus on fundamental digital skills and social media proficiency. ‘AI and Chatbot Familiarity’ shows high loadings on familiarity with chatbots and AI-powered customer service and comprehension of how AI can improve tourism offerings. ‘Data Interpretation and Cybersecurity’ includes high loadings on knowledge of cybersecurity risks, experience with remote collaboration tools and examining and interpreting Tourism data, highlighting skills related to data interpretation and cybersecurity awareness. ‘Advanced Data Visualisation’ shows high loadings on using data visualisation tools to represent Tourism trends and patterns, indicating a focus on advanced data visualisation skills.

Table 5.7: Rotated Component Matrix Section C2

C2	Component	
	1	2
Digital Literacy	0.461	0.700
Data Analysis	0.781	0.403
Artificial Intelligence Integration	0.857	0.374
Virtual Reality and Augmented Reality	0.896	0.298
Cybersecurity Awareness	0.656	0.572
Remote collaboration	0.815	0.417
Digital Literacy	0.299	0.858
Data Analysis	0.348	0.866
Artificial Intelligence Integration	0.606	0.657
Virtual Reality and Augmented Reality	0.660	0.512
Cybersecurity Awareness	0.413	0.819
Remote collaboration	0.590	0.659

Table 5.7 shows that two components (sub-themes) can be identified from Section C2. The sub-themes can be described as follows: ‘Advanced Technical Skills and Collaboration’ includes high loadings on data analysis, artificial intelligence integration, virtual reality and augmented reality, cybersecurity awareness and remote collaboration, focusing on advanced

technical skills and collaborative capabilities. ‘Digital Literacy and AI Proficiency’ indicates high loadings on digital literacy, data analysis, artificial intelligence (AI) integration, virtual reality (VR) and augmented reality (AR) and cybersecurity awareness, representing proficiency in digital literacy and AI technologies.

Table 5.8: Rotated Component Matrix Section D

D	Component	
	1	2
Digital Marketing and Social Media Management	0.783	0.366
Data Analytics and Insights	0.789	0.460
Customer Relationship Management (CRM) Systems	0.842	0.370
Mobile App Management	0.836	0.406
Use of Internet of Things in Guest Services	0.834	0.403
Artificial Intelligence	0.420	0.826
Augmented Reality and Virtual Reality	0.447	0.828
Cybersecurity	0.447	0.830
Blockchain Technology	0.338	0.857

Table 5.8 shows that two components (sub-themes) can be identified from Section D. ‘Digital Marketing, Analytics and Internet of Things (IoT) Management’ includes high loadings on digital marketing and social media management, data analytics and insights, customer relationship management (CRM) systems, mobile app management and the use of IoT in guest services, indicating a focus on digital marketing, analytics and IoT management skills. ‘Advanced Technology Proficiency’ includes high loadings on artificial intelligence, AR and VR, cybersecurity and blockchain technology, representing proficiency in advanced and emerging technologies.

5.6 Section Analysis Results

5.6.1 Section A Analysis

5.6.1.1 Demographic data

Table 5.9 below describes the overall gender distribution by age.

Table 5.9: Gender Distribution by Age

Age (years)		Gender		Total
		Male	Female	
18 - 24	Count	17	14	31
	% within Age (years)	54.8%	45.2%	100.0%
	% within Gender	13.9%	8.1%	10.5%
	% of Total	5.8%	4.7%	10.5%
25 - 34	Count	28	48	76
	% within Age (years)	36.8%	63.2%	100.0%
	% within Gender	23.0%	27.7%	25.8%
	% of Total	9.5%	16.3%	25.8%
35 - 44	Count	46	64	110
	% within Age (years)	41.8%	58.2%	100.0%
	% within Gender	37.7%	37.0%	37.3%
	% of Total	15.6%	21.7%	37.3%
45 - 54	Count	17	33	50
	% within Age (years)	34.0%	66.0%	100.0%
	% within Gender	13.9%	19.1%	16.9%
	% of Total	5.8%	11.2%	16.9%
≥ 55	Count	14	14	28
	% within Age (years)	50.0%	50.0%	100.0%
	% within Gender	11.5%	8.1%	9.5%
	% of Total	4.7%	4.7%	9.5%
Total	Count	122	173	295
	% within Age (years)	41.4%	58.6%	100.0%
	% within Gender	100.0%	100.0%	100.0%
	% of Total	41.4%	58.6%	100.0%

5.6.1.2 Gender

The gender study results highlighted that the overall ratio of males to females was approximately 2:3 (41.4%: 58.6%), with females forming a larger portion of the sample. The results show that the respondents were moderately balanced in terms of gender. Therefore, the results of the study exhibited both male and female voices.

5.6.1.3 Age Distribution

Study findings revealed that most respondents were aged between 25-34 years and 35-44 years, with the females outnumbering males in both the categories. The youngest (18-24) and oldest (≥ 55) age groups show a more balanced gender distribution. The 45-54 age group also shows a higher proportion of females compared to males. These trends indicate that females are more

represented in the middle age categories 25-34 and 35-44 years, which are crucial for workforce participation and career development stages. The balanced gender distribution in the youngest and oldest age groups suggests equal interest or participation among younger and older respondents. These insights are important for understanding demographic patterns and can inform strategies for targeted engagement and resource allocation in the tourism industry. Moreover, the results demonstrate that in terms of age distribution, most respondents in the study were younger people who are generally considered more economically active and productive. According to Sumitha *et al.* (2021:857), employee age has the power to impact the willingness of an individual to adopt new technology, as younger employees are technologically savvy. There is hope that the adoption and usage of 4IR technology in the KZN industry will increase and grow in the future.

5.6.1.4 Length of Service

Figure 5.2 shows the length of service of the respondents.

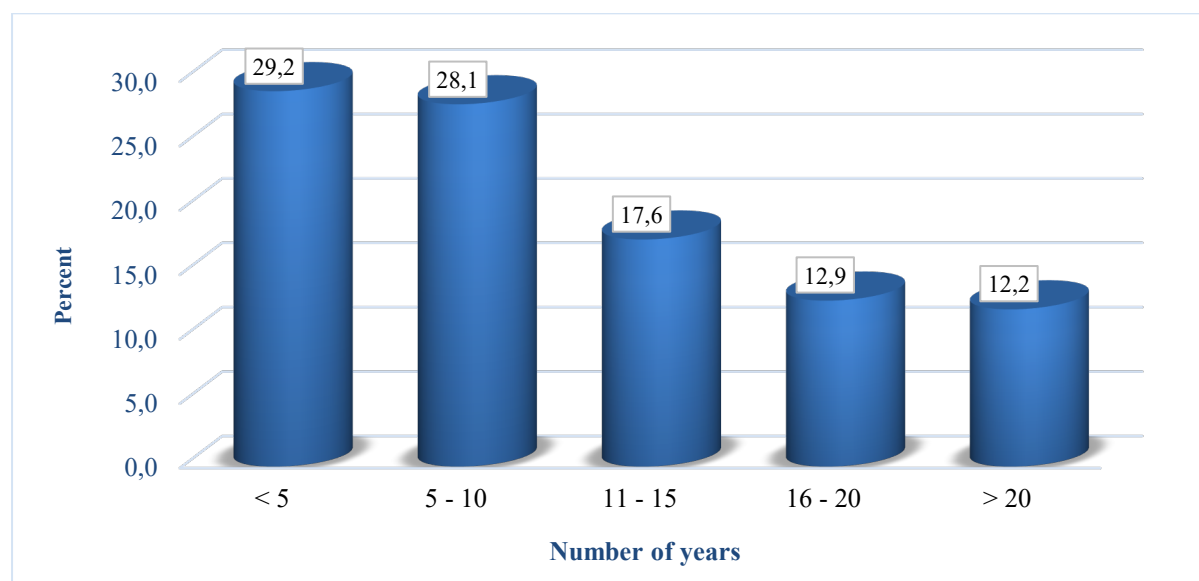


Figure 5.2: Length of Service of Respondents

As per Figure 5.2, the study findings on the respondents' length of service showed that the majority (57.3%) had less than 10 years of experience working in accommodation establishments. Specifically, 29.2% of the respondents had less than 5 years of experience and 28.1% had between 5 and 10 years of experience. Thus, study findings indicate that a significant portion of the workforce was relatively new to the industry ($p < 0.001$). However,

a smaller proportion of respondents, 17.6%, had between 11 and 15 years of experience, suggesting that a moderate retention level still existed within the industry.

The results highlight that while there is a considerable number of relatively new employees, there was also a stable core of experienced personnel who had remained in the industry for a longer period. Overall, the data indicate a rich mixture of young and older members, producing a wealth of experiences that positively contributed to high performance and productivity. The results show a great deal of young talent in the Tourism industry and the future of 4IR technology is bright in the industry.

The implication of 57.3% of the respondents having less than 10 years of experience working in the accommodation establishments could mean that they may lack the insight into how the operations would have evolved in their sector from a digital perspective. In addition, they could have less knowledge and limited insight into the 4IR technologies used in the Tourism industry, as well as their potential and limitations. Therefore, it becomes necessary for this industry to continuously train and develop its employees with knowledge and skills on digital literacy and new technologies to address the digital skills gap, especially with new graduates and staff who are less experienced, as posited by Stylianou and Pericleous (2025:11-13).

5.6.1.5 Academic Qualifications

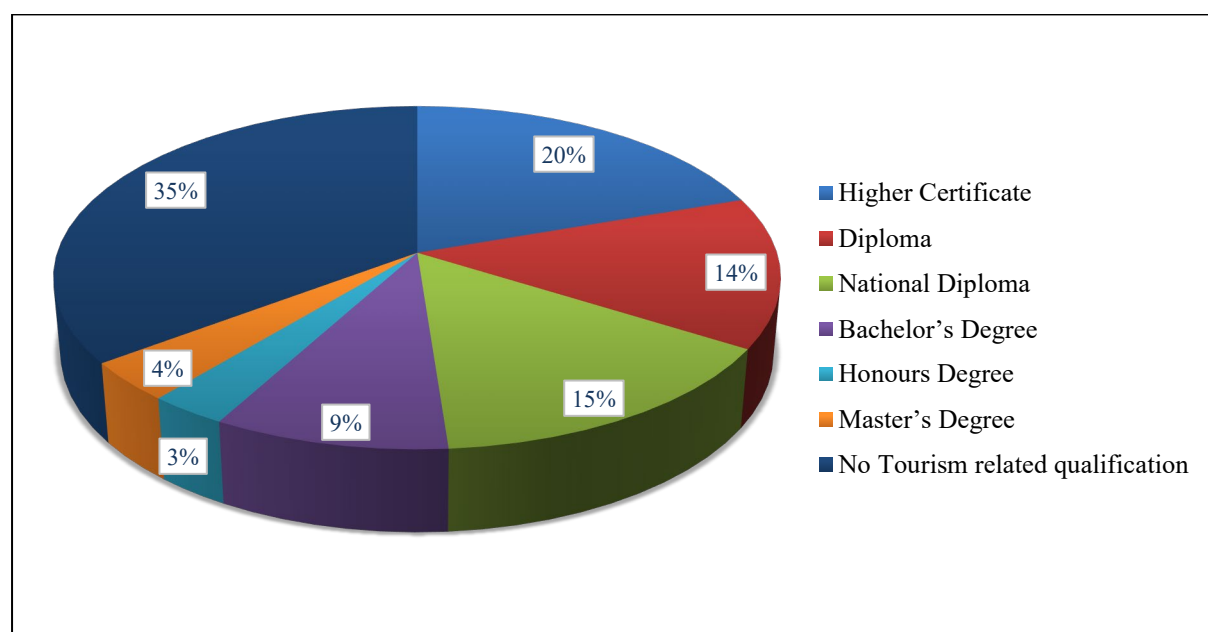


Figure 5.3: Respondents' Highest Qualification in Tourism

As indicated in Figure 5.3, a notable 35% of respondents did not possess any Tourism-related qualifications, suggesting that a substantial portion of the workforce may benefit from targeted professional development and training programmes within the Accommodation sector. Amongst those with Tourism-related qualifications, 20% possessed a Higher Certificate, 14% had a Diploma and 15% possessed a National Diploma. Mid-level qualifications were relatively common, collectively representing nearly half of the sample (49%) ($p < 0.001$). This indicates that most respondents possessed mid-level qualifications. However, higher education qualifications were less prevalent but still significant, with 9% of respondents indicating that they possessed a Bachelor's degree, 3% an Honours Degree and 4% a Master's degree. Together, these advanced qualifications account for 16% of the respondents, highlighting a smaller but noteworthy segment of highly educated individuals within the Tourism industry. Fewer respondents with advanced qualifications, such as Master's degrees, indicate a need to attract people with advanced skills to the sector, capable of meeting the rigorous technological needs driving the industry.

This study's results indicate that most respondents had mid-level qualifications in the form of diplomas and certificates in Tourism. According to Tushabe and Murimi (2024:202), accommodation establishments complained of the extremely low supply of skilled employees with relevant academic qualifications. As noted by Tushabe and Murimi (2024:202), accommodation establishments are becoming more suspicious of Tourism graduates' skills due to the inadequate skill preparation that Higher Education Institutions (HEIs) offer students. Syafruddin *et al.* (2025:291) stated that the main reason Tourism graduates were unskilled to meet industry needs was that their skills were not aligned with industry requirements. Furthermore, Ben Youssef and Zeqiri (2022:1046) noted that the employment problem has worsened due to the emergence of the new industrial revolution, characterised by technological developments such as IoT, AR, VR, robotics, big data, blockchain and 3D printing. Tushabe and Murimi (2024:203) revealed that the Accommodation sector faced significant challenges concerning employment because fresh graduates lacked the necessary skills for the industry. Dimanche and Lo (2022:34) also noted that Tourism graduates experienced a shortage of the necessary skills, which made them less relevant to the industry and less attractive for hotel recruitment. Furthermore, these trends underscore the importance of supporting continuous professional development and enhancing educational pathways to facilitate career advancement in the Tourism industry. This approach could address the educational gaps and

help build a more qualified and skilled workforce that is better equipped to meet the evolving technological demands of the industry.

5.6.1.6 Roles and Responsibilities of Respondents

Table 5.10: Current Role of Respondents

Role	Frequency	Percent
Management	57	19.3
Front Office or Reception	50	16.9
Food and Beverage	50	16.9
Marketing	34	11.5
Event Planning	19	6.4
Maintenance	18	6.1
Information Technology	15	5.1
Housekeeping	14	4.7
Accounts and Finance	13	4.4
Human Resources	7	2.4
Purchasing	7	2.4
Other	11	3.7

As indicated in Table 5.10, the study results on the roles played by the respondents in their organisations highlighted that many were performing traditional jobs. Management roles were the most common, with 19.3% of the respondents indicating that they held managerial positions. This was followed closely by roles in the Front Office or Reception and Food and Beverage, each representing 16.9% of the respondents ($p < 0.001$). Marketing roles were also significantly represented, accounting for 11.5% of the respondents. However, Event Planning and Maintenance roles were less common but still notable, with 6.4% and 6.1%, respectively. The study findings indicated that most respondents held management positions, front office, reception and food and beverage roles, as these were dominant. However, housekeeping, human resources and purchasing were minor common roles. These findings suggest a well-distributed representation across different functional areas within accommodation establishments, emphasising management, front office and food and beverage roles.

Studies by Ahmadi, Kheslat and Akintomide (2024:1) exhibited that new job profiles have emerged due to evolving trends and these include positions in digital marketing, social media management, data analytics, experiential tourism design and technological innovations that led to changes in employment needs and required skill sets. Carlisle, Ivanov and Dijkmans

(2020:241-255) noted that professionals with expertise in digital marketing, data analysis, website development and online customer service are now in high demand by employers. The current study illustrates that most organisations under study were mainly focused on carrying out their traditional duties, with fewer new job profiles related to technology, data analytics and experiential tourism designs. Thus, it can be reasoned, based on the study results, that most of the organisations have not yet reached the level of employing professionals with new job profiles, particularly those related to specialised or complex skills in 4IR.

5.6.2 Section B Analysis: Usage of Smart Tourism and 4IR Applications in Accommodation Establishments

5.6.2.1 Awareness of the Fourth Industrial Revolution

Figure 5.4 summarises the scoring patterns on familiarity with an awareness of Smart Tourism and 4IR applications. As indicated in Figure 5.4, B1.1a represents the familiarity of Smart Tourism; B1.2a shows the awareness of 4IR; and B1.3a indicates how 4IR impacts the Tourism industry.

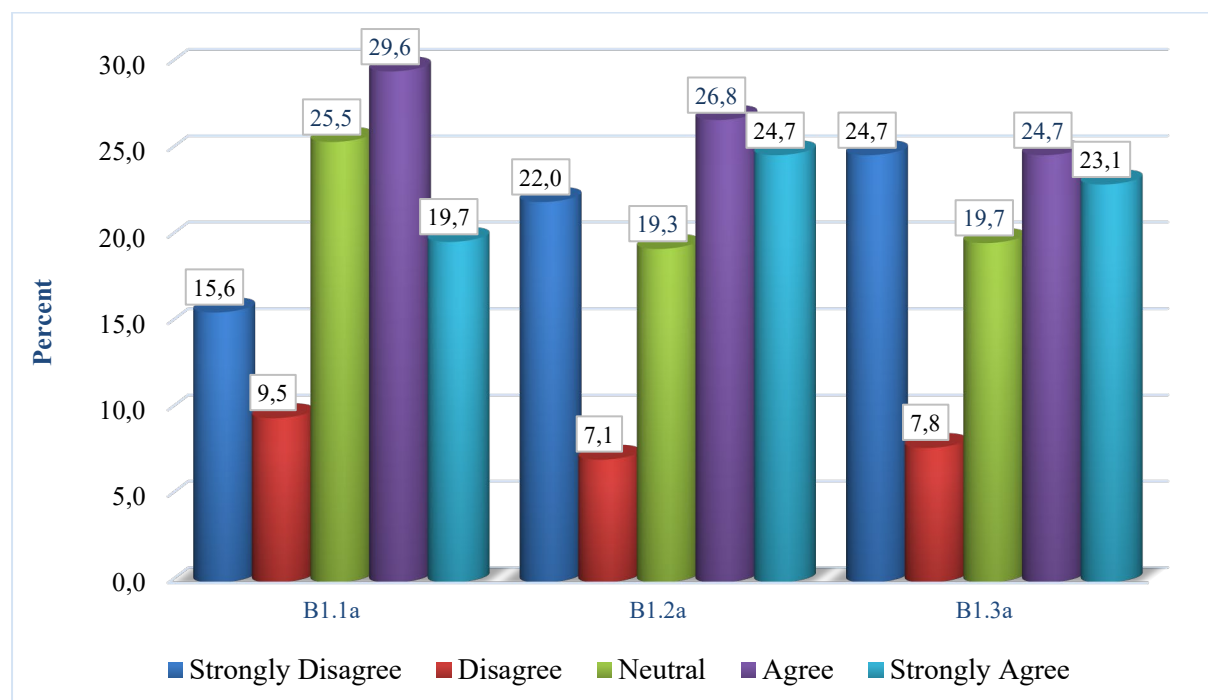


Figure 5.4: Familiarity with and Awareness of Smart Tourism and 4IR Applications

The analysis of respondents' awareness and adoption of Smart Tourism and 4IR applications revealed several key insights: 26. 8% agreed and 24. 7% strongly agreed to having knowledge

and awareness of 4IR. In total, 51.5% of the respondents attested that they were aware of 4IR; 19.3% remained neutral; and 29.1% disagreed or strongly disagreed. The results demonstrate that half the respondents were aware of 4IR, whilst the other half were not. These findings suggest that while many respondents are familiar with these technologies, many are still uncertain or moderately familiar. The findings underscore the need for further education and training to enhance the understanding and adoption of 4IR technology. Additionally, the findings reinforce the idea that much training and education are needed on 4IR technologies within the Accommodation sector.

Furthermore, the results highlight that more than half of the respondents knew about 4IR technology and its implications. Their awareness, therefore, forms the basis for the successful transformation of the sector into 4IR technology. The World Economic Forum (2016:1) reveals that understanding the value and possibilities of new technologies to ensure success in 4IR is the first step towards re-imagining an organisation's future. The results of this study seem to contradict those obtained by CATHSSETA (2021:1), which reported that South Africa lacked awareness of emerging 4IR skills and skills gaps in the workforce, along with the low demand for 4IR courses. Research conducted by CATHSSETA (2021:1) revealed the following information: 33% of employers who were interviewed lacked awareness on how and where 4IR technologies can be adopted; 50% of the employees within the Arts, Culture and Heritage sectors lacked awareness; and 33% from the Tourism industry lacked general knowledge on implementation methods relating to 4IR technologies that would improve workplace processes. Therefore, interventions are needed to advertise and market the importance and demand for 4IR skillsets.

Regarding the impact of 4IR on the Tourism industry, 47.8% of the respondents strongly agreed that they understood how 4IR affected the industry, while 19.7% remained neutral and 32.5% either disagreed or strongly disagreed. These patterns indicate a general positive reception and recognition of Smart Tourism and 4IR concepts amongst respondents, with higher levels of agreement than disagreement ($p < 0.001$). Additionally, the significant proportion of neutral responses, ranging from 19.3% to 25.5%, suggests that while many respondents are familiar with these technologies, a considerable number are still uncertain or moderately familiar. The results underscore the need for further education and training to enhance the understanding and adoption of 4IR technology and its consequences. In South Africa, there are several

interventions by CATHSSETA (2021:1) to disseminate knowledge on the importance of 4IR skills amongst Tourism stakeholders, namely engaging in discussions with key informants covering all six sub-sectors, including other SETAs, industry associations and innovation agencies; collaborating with MICTSETA and MERSETA for joint research projects, innovation labs and partnerships with tech companies to gain insights into emerging technologies and the skills needed to work with them; sharing the identified 4IR skills gaps and 4IR emerging skills per sub-sector documented in the Annual Sector Skills Plan with key stakeholders such as the employers and the training providers, as well as developing and disseminating brochures, pamphlets, infographics and other informational materials that highlights the importance of 4IR skills, the benefits of acquiring these skills and the potential career opportunities they offer.

5.6.2.2 Use of Smart Tourism Technology by Employees

Figure 5.5 shows a scoring pattern of responses to B1.4 – “I have personally used 4IR technologies or Smart Tourism applications”.

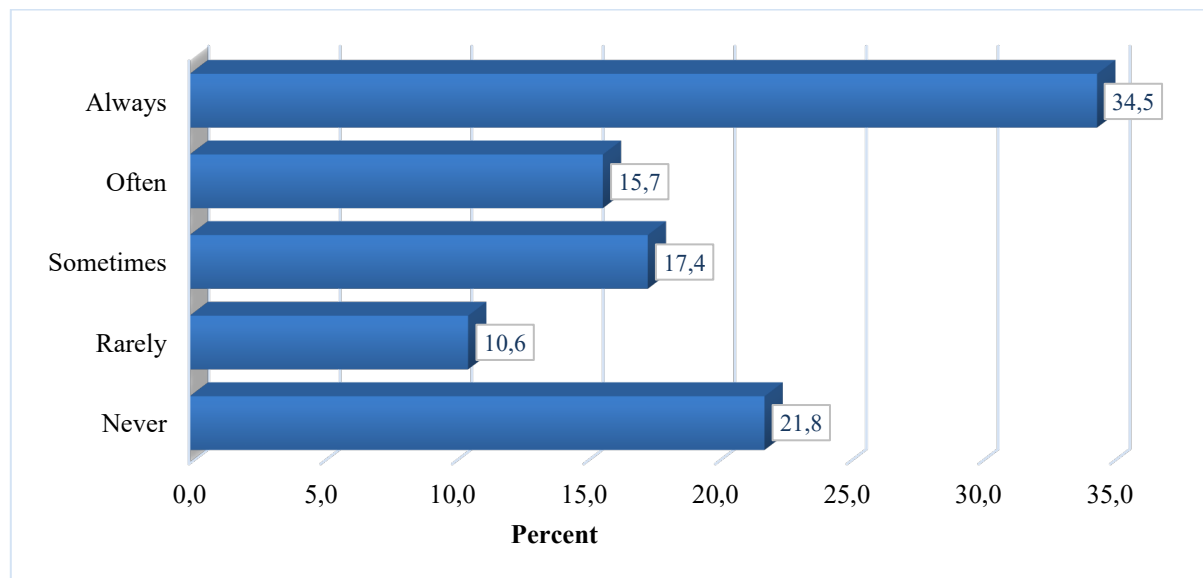


Figure 5.5: Usage of 4IR Technologies or Smart Tourism Applications

As shown in Figure 5.5, the study's overall findings indicated varying levels of engagement with these technologies among the respondents. A significant portion of respondents, 34.5%, reported that they "Always" use 4IR technologies or Smart Tourism applications. This trend highlights a high level of Smart adoption of Smart Tourism technology amongst a notable

segment of the sample. Additionally, 15.7% of the respondents indicated that they "Often" used these technologies, while 17.4% used them "Sometimes". Together, the categories suggest that over two-thirds of respondents (67.6%) had some level of engagement with 4IR technologies and Smart Tourism applications. Conversely, 21.8% of respondents reported that they "Never" used these technologies and 10.6% stated that they used them "Rarely" ($p < 0.001$). This suggests that a significant minority of respondents had limited or no interaction with these advanced technologies despite their importance in the sector.

The results show that the uptake of Tourism technology is increasing in some sections of the industry. Overall, the results indicate that the adoption of 4IR technology is positive and continues to grow. Dahmani (2024:98) observed that by leveraging 4IR technologies, businesses can improve productivity and reduce costs. Moreover, Kadir (2020:157) noted that 4IR technology gives businesses a deeper understanding of their operational environment. The implication of these findings for this study suggests that 4IR technologies are widely used in industry. However, this finding will be triangulated when managers are interviewed as part of the qualitative phase of the research study.

5.6.2.3 Types of Smart Tourism and 4IR Applications

Figure 5.6 illustrates the usage of mobile applications that provide destination information and assist with navigation, highlighting the prevalence and frequency of their use among respondents. As illustrated in Figure 5.6, B2.1.1 signifies Google Maps; B2.1.2 denotes Apple Maps; B2.1.3 indicates TripAdvisor; and B2.1.4 designates Road Trippers.

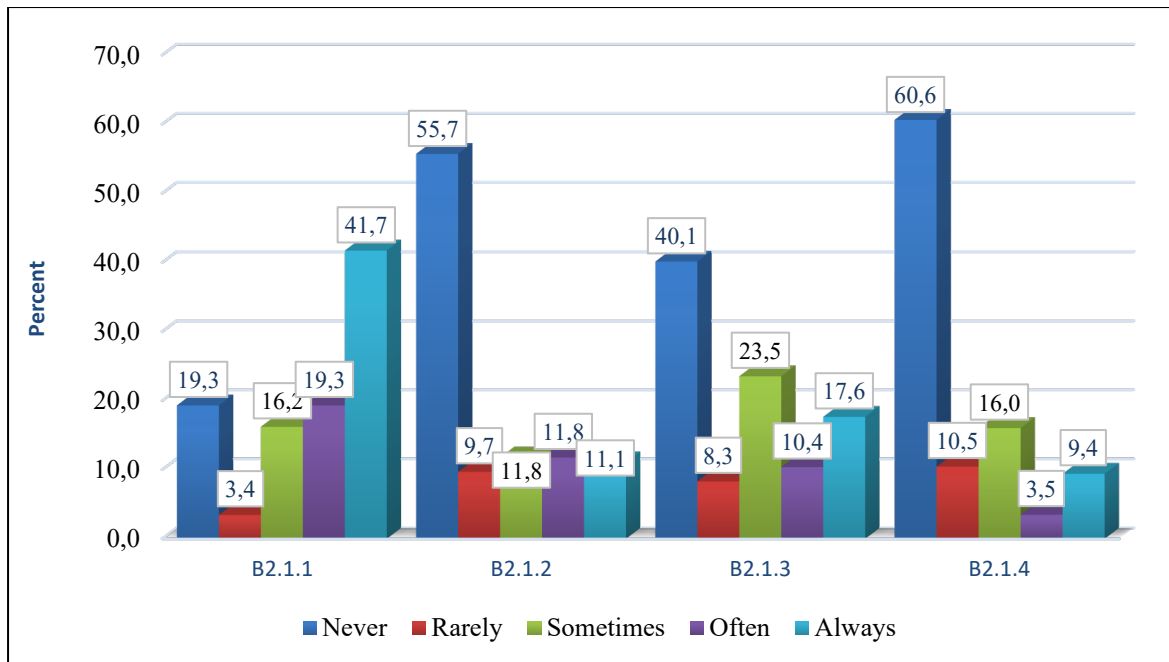


Figure 5.6: Usage of Mobile Applications Providing Destination Information

In Figure 5.6, the study results on the usage patterns of mobile applications for destination information and navigation revealed varying levels of adoption amongst respondents. Google Maps was the most widely used application, with 41.7% of respondents indicating that they "Always" use it and an additional 19.3% testifying to using Google Maps "Often". The high adoption rate signified the importance and reliability of Google Maps as a navigation tool in the Tourism industry. In contrast, results also indicated that on Apple Maps, there was a lower adoption rate, as 55.7% of the respondents stated that they "Never" used the application. Moreover, Road Trippers had the lowest adoption rate amongst the respondents, as 60.6% indicated "Never" using it, showing limited engagement by respondents with this application. These findings highlight that respondents had varying degrees of reliance on different mobile applications for navigation and destination information, with Google Maps being the most dominant tool in this category.

The data suggests that opportunities for increasing the adoption of other potentially practical applications, like Apple Maps and TripAdvisor, could enhance the overall Smart Tourism experience. Organisations should try as much as possible to develop a culture of using various social media tools instead of one. There is a danger in relying on a single tool to attract or retain customers. Myers and Scarinci (2022:169) observed that travel applications are the most popular category of the most downloaded applications and travellers choose to use mobile

technologies such as Smartphones, including tablets, to access travel information. Furthermore, Noone (2020:1) also revealed that Google Maps is one of the most popular applications on mobile devices, with over 1 billion people using it every month. In addition, studies conducted by Hariyanti *et al.* (2024:57) in Indonesia supported the view that Google Maps was one of the most popular travel applications. On the other hand, Myers and Scarinci (2022:169) observed that the strength of travel applications is that destination information is accessible and food can be purchased online without physical contact. Furthermore, Grepon *et al.* (2023:2253) mentioned that travel applications such as Google Maps provide instant access to information on different variables affecting their trips, such as transport, road conditions and construction projects, enhancing the travel experience.

5.6.2.4 Personalised Recommendations Based on User Preferences and Behaviour

Note: Mean values are reported in the following tables (5.11 to 5.20) to summarise the central tendency of responses, as this provides a clearer and more intuitive interpretation of the Likert-scale data than chi-square statistics.

Table 5.11: Usage of Personalised Recommendation Systems Based on User Preferences and Behaviour

		Never		Rarely		Sometimes		Often		Always		Mean
		N	%	N	%	N	%	N	%	N	%	
Social media	B2.2.1	56	19.0	17	5.8	49	16.7	78	26.5	94	32.0	3.47
Facebook	B2.2.2	57	19.5	33	11.3	29	9.9	66	22.5	108	36.9	3.46
Pinterest	B2.2.3	125	43.1	36	12.4	38	13.1	37	12.8	54	18.6	2.51
Airbnb	B2.2.4	128	44.3	26	9.0	56	19.4	28	9.7	51	17.6	2.47
LinkedIn	B2.2.5	102	35.1	29	10.0	53	18.2	40	13.7	67	23.0	2.80
YouTube	B2.2.6	72	24.7	24	8.2	62	21.3	55	18.9	78	26.8	3.14
Spotify	B2.2.7	122	41.9	33	11.3	50	17.2	27	9.3	59	20.3	2.55
Netflix	B2.2.8	103	35.5	36	12.4	42	14.5	40	13.8	69	23.8	2.78
Amazon	B2.2.9	137	48.1	32	11.2	45	15.8	27	9.5	44	15.4	2.33

The usage patterns for personalised recommendation systems based on user preferences and behaviour indicated significant variations amongst different platforms. In this regard, 32.0% of the respondents indicated that they had a high level of engagement with social media advertisements as they "Always" interacted with them and 26.5% of the respondents revealed that they "Often" engaged with social media adverts. The findings show that social media

advertising was most prevalent in the Tourism industry (mean=3.46). Facebook (mean=3.46) also demonstrated considerable usage, with 36.9% of respondents indicating that they were "Always" using it for personalised recommendations and 22.5% confirmed to using it "Often." This highlighted that Facebook was also another commonly used platform for personalised content. Other platforms like LinkedIn (mean=2.80), Spotify (mean=2.55) and Netflix (mean=2.78) had a medium pattern of usage.

In contrast, Pinterest (mean=2.51), Airbnb (mean=2.47) and Amazon (2.33) exhibited lower levels of consistent usage. For instance, 43.1% of the respondents stated that they "Never" used Pinterest for personalised recommendations and 44.3% expressed that they never used Airbnb for this purpose. Similarly, 48.1% of the respondents reported that they "Never" used Amazon for personalised recommendations. These figures suggest that the respondents in this study used Pinterest, Airbnb and Amazon platforms less frequently. These findings underscore the variability in how personalised recommendation systems are utilised within the Tourism industry, suggesting that while some platforms, like social media adverts and Facebook, are widely adopted, others, like Pinterest, Airbnb and Amazon, are less consistently used. This highlights opportunities for increasing awareness and the adoption of a wide range of personalised technologies to enhance diverse user experiences and preferences in the Tourism industry.

Overall, the research findings indicate that the uptake of social media advertisements and Facebook had high levels of consistent use, whilst other platforms, such as Pinterest and Amazon, had low levels of consistent use. The findings show that the respondents were more attached to Facebook and social media advertisements, an indication that their organisations were losing customers using platforms such as Amazon, Airbnb and Pinterest. Therefore, respondents need to be trained in using various social media platforms to ensure a broad customer reach and business viability. Social media marketing is defined by Keke (2022:2580) as an integrative process aimed at promoting goods and services over social media platforms, which have the potential to target a broad customer base. According to Zhang and Jung (2022:1), social media platforms such as Facebook and Twitter (X) are consumed by both younger and older people, indicating that these platforms have large numbers of people visiting them. According to Gupta and Sandhane (2022:351), social media platforms help capture consumer feelings associated with a brand or product, which is the key element for monitoring

social media. On the other hand, Facebook is considered to be the most popular social media platform and has over 3 billion monthly users, as noted by Mwithi (2023:268).

5.6.2.5 Smart Rooms (IoT-enabled) for Enhanced Guest Experience

Table 5.12 shows the usage of IoT-enabled Smart room technologies that enhance the guest experience.

Table 5.12: Usage of IoT-Enabled Smart Room Technologies

	Never		Rarely		Sometimes		Often		Always		Mean
	N	%	N	%	N	%	N	%	N	%	
Keyless entry	103	35.4	14	4.8	34	11.7	38	13.1	102	35.1	3.08
Automated Climate Control	95	32.4	26	8.9	38	13.0	52	17.7	82	28.0	3.00
Personalised Lighting	108	37.0	29	9.9	53	18.2	46	15.8	56	19.2	2.70
Virtual Concierge	134	46.0	30	10.3	34	11.7	46	15.8	47	16.2	2.46

The results of using the IoT-enabled Smart room technologies that enhance guest experience showed variations. The analysis focused on keyless entry, automated climate control, personalised lighting and virtual concierge services. The results indicate that 35.1% of the respondents reported "Always" using these systems, whilst 35.4% reported "Never" using them. The responses indicate that keyless entry (mean=3.08) is either fully integrated into some accommodation establishments or is the most widely used IoT-enabled Smart room technology. Automated climate control systems exhibited moderate adoption, with 28.0% of respondents "Always" using them and 17.7% using them "Often". However, 32.4% of respondents "Never" use these systems, suggesting that while automated climate control system technologies are gaining traction (mean=3.00), they are not yet universally adopted by the respondents. Finally, Virtual concierge services (mean=2.46) had the lowest adoption rate amongst the technologies surveyed, with 46% of respondents not using them at all.

The findings highlight variability in the adoption of IoT-enabled technologies to enhance the guest experience. Most respondents indicated that they preferred keyless entry and automated climate control technology. Other Smart room technologies, such as virtual concierge services and personalised lighting, were less frequently adopted. The findings demonstrate that the accommodation establishments under study have not yet adopted Smart room technology that

enhances guest satisfaction. The results indicate that usage of IoT is either fully integrated into some accommodation establishments or not used at all. Alet (2022:297) defines the IoT as a technical framework that allows communication between computers, mobile phones, machines and gadgets. According to Ordóñez (no date), IoT plays a vital role in the personalisation of experiences and has a direct effect on the competitiveness of various tourism destinations. The moderate level of adoption and engagement of the IoT by respondents shows that most organisations under study had not yet reached the level of enhancing or personalising guest experiences. The results also suggest opportunities for further integration and promotion of IoT-enabled features to improve guest satisfaction and operational efficiency in accommodation establishments.

5.6.2.6 Facial Recognition, Security and Personalised Services

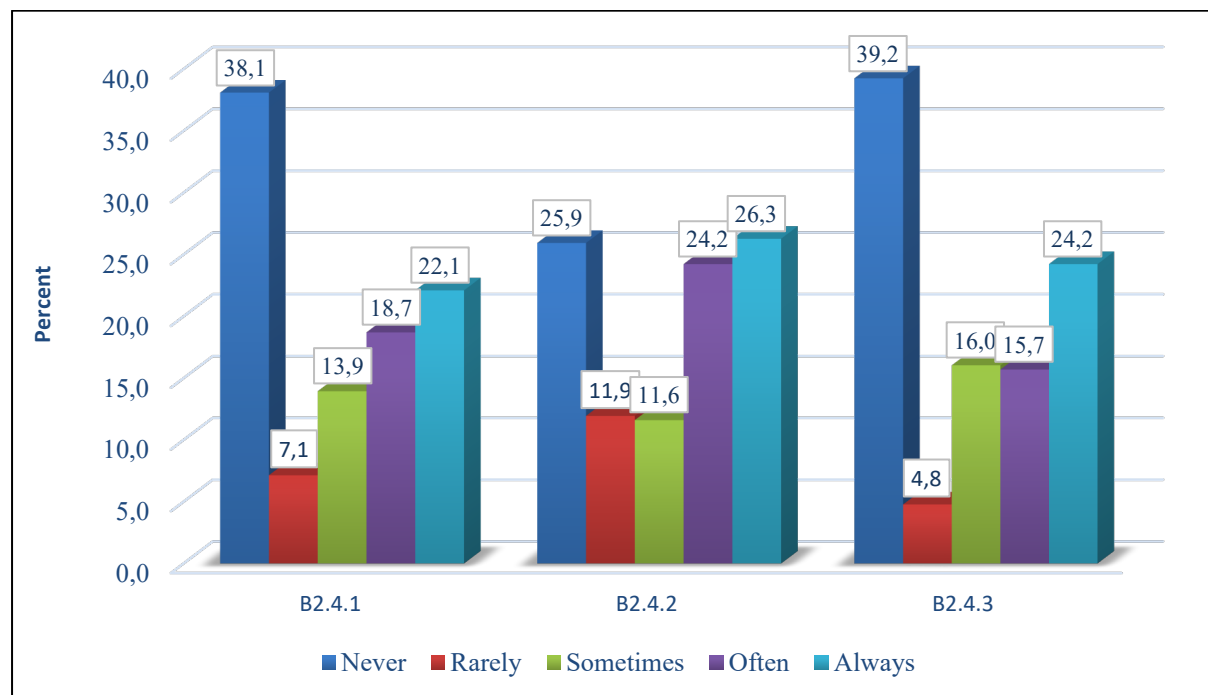


Figure 5.7: Usage of Facial Recognition, Security and Personalised Services within Accommodation Establishments

As illustrated in Figure 5.7, B2.4.1 represents Customer Identification Technologies; B2.4.2 denotes Employee Authentication Systems; and B2.4.3 designates Keyless Entry. The study results on the authentication systems highlighted a more balanced distribution, with 26.3% of the respondents "Always" using them and 24.2% using them "Often". Overall, 50.5 % of the respondents indicated that they frequently used employee authentication. On customer identification technologies, 38.1% of respondents reported "Never" using them, while 22.1%

indicated they "Always" use these systems. This suggests a split in adoption, with some establishments fully integrating these technologies and others not using them at all. Furthermore, these results demonstrate that the respondents have not yet reached a level where they are fully accustomed to and engaged with customer identification technologies. This highlights the need for respondents to be trained on the effectiveness of customer identification technologies in driving Smart Tourism and avoiding losses.

The study's results on keyless entry systems revealed that 39.2% of respondents "Never" use them, while 24.2% "Always" use these technologies. An additional 15.7% attested to using them "Often", indicating a varied but notable level of implementation across establishments. In terms of facial recognition, security and personalised services, the majority of respondents attested that they frequently used employee authentication systems.

These results indicate that employee authentication systems were widely adopted, followed by facial recognition systems, which were moderately adopted. However, the keyless entry system was less adopted. The results suggest that while facial authentication, security and personalised services are valued, their implementation varies widely. This points to further integration and standardisation opportunities to enhance security and guest experiences in accommodation establishments. Fernández Alcantud and García Moreno (2022:19) stated that major technology trends are currently shaping the Tourism industry and recognition technology, encompassing various techniques such as facial recognition and biometric authentication, has gained prominence. The moderate adoption of authentication technology in the study exhibited that most of the businesses studied have not fully embraced most major technological advancements, such as customer identification and keyless entry systems.

5.6.2.7 AI-driven Chatbots for Customer Support and Questions

Table 5.13 shows the outcomes from examining the usage of AI-driven chatbots for customer support and addressing customer questions within accommodation establishments.

Table 5.13: Usage of AI-driven Chatbots for Customer Support

	Never		Rarely		Sometimes		Often		Always		Mean
	N	%	N	%	N	%	N	%	N	%	
Hotels.com Virtual Assistant	139	47.4	27	9.2	41	14.0	44	15.0	42	14.3	2.40

Marriott's Chatbot	177	61.2	23	8.0	36	12.5	22	7.6	31	10.7	1.97
Whistle Messaging	200	68.7	29	10.0	37	12.7	17	5.8	8	2.7	1.64
Accor's All-Around Chatbot	204	70.3	34	11.7	28	9.7	13	4.5	11	3.8	1.60
Any other AI-driven chatbot	174	59.8	25	8.6	33	11.3	28	9.6	31	10.7	2.03

The results on the usage of AI-driven chatbots for customer support and addressing customer questions within accommodation establishments revealed low levels of adoption amongst respondents. Just over 47% (47.4%) of respondents noted that they “Never” used the Hotels.com Virtual Assistant Chatbot (mean=2.40). Only 14.3% indicated "Always" using this Chatbot. An additional 15.0% used it "Often", showing a generally low adoption of this technology. Moreover, 61.2% of the respondents reported "Never" using Marriott’s Chatbot. This suggests that while some establishments have moderately integrated AI Chatbots, they have not been widely adopted across the sample.

Furthermore, Whistle Messaging (mean=1.64) and Accor's All-Around Chatbot (mean=1.60) showed even lower levels of adoption, with 68.7% and 70.3% of respondents, respectively, reporting "Never" using these chatbots. The results show minimal engagement between the respondents and the specific customer AI-driven chatbots. These findings highlight low adoption of AI-driven chatbots for customer support within the Tourism industry. While some chatbots, like the Hotels.com Virtual Assistant, show moderate use, others, such as Whistle Messaging and Accor's All-Around Chatbot, have very low adoption rates.

The results suggest opportunities for the further integration and promotion of AI-driven customer support technologies to enhance guest interactions and operational efficiency in accommodation establishments. The respondents' low adoption rates of AI-driven chatbots also show that the establishments studied had not yet reached a level where they could conduct large-scale surveys and analyse trends to make long-term tourism decisions using AI-driven chatbots. According to Imam (2022:733), AI chatbots powered by AI algorithms have become prevalent in various applications, serving as virtual conversational agents capable of engaging in human-like interactions and providing assistance or information. According to Imam (2022:733), chatbots for customer support, AI-driven travel recommendation customisation and dynamic pricing algorithms have increased consumer engagement and operational efficiency. Low adoption rates of AI-driven chatbots for customer support in the organisations

studied mean that most of the establishments have not yet reached the level of operational efficiency. Thus, AI chatbot adoption is still in its infancy in the KZN Tourism industry.

5.6.2.8 Big Data Analytics to Analyse and Make Decisions on Tourism Trends

Table 5.14 presents the outcomes from examining the use of big data analytics and how they are applied to analyse and inform decisions on tourism trends within accommodation establishments.

Table 5.14: Big Data Analytics to Analyse and Make Decisions on Tourism Trends

	Never		Rarely		Sometimes		Often		Always		Mean
	N	%	N	%	N	%	N	%	N	%	
AI-based analytics	119	40.9	29	10.0	63	21.6	36	12.4	44	15.1	2.51
Real-time analytics dashboards	110	37.8	30	10.3	71	24.4	36	12.4	44	15.1	2.57

Table 5.14 illustrates the usage patterns of big data analytics in analysing and making decisions about tourism trends in accommodation establishments. Real-time analytics dashboards (mean =2.57) show higher usage patterns than AI-based analytics (mean=2.51). For AI-based analytics, the results reveal low levels of usage amongst respondents, whereby 40.9% of the respondents indicated that they “Never” use AI-based analytics, whilst 15.1% indicated that they always use it. An additional 12.4% used it “Often”, showing a generally low adoption of this technology. Real-time analytics dashboards also show low usage, where 37.8% of the respondents reported “Never” using it, whilst 15.1% indicated that they always use it. It can also be noted that 10.3% indicated that they “Rarely” use real-time analytics dashboards. The results suggest opportunities for the further integration and promotion of big data analytics to analyse and make informed decisions in accommodation establishments. Low adoption rates of big data analytics by the respondents also show that the establishments could have hardware and software limitations, resulting in them using basic booking systems or even carrying out their record-keeping manually. Another possible reason for the low usage of big data analytics could be respondents' low data literacy levels, as they may not understand what big data analytics is or its potential applications. The results suggest opportunities for accommodation establishments to carry out training on big data analytics so that their staff can become familiar with it, resulting in increased usage to enhance decision-making in accommodation establishments in the KZN province.

5.6.2.9 Secure Transactions or Identity Verification using Blockchain-based Solutions

Figure 5.8 examines the usage of Blockchain-based solutions for secure transactions and identity verification within accommodation establishments. The analysis focuses on technologies such as digital identity for travel documents and Smart contracts for automating bookings, highlighting their adoption and frequency of use amongst respondents. As illustrated in Figure 5.8, B2.7.1 denotes Digital identity for travel documents, whilst B2.7.2 represents Smart contracts for automated bookings.

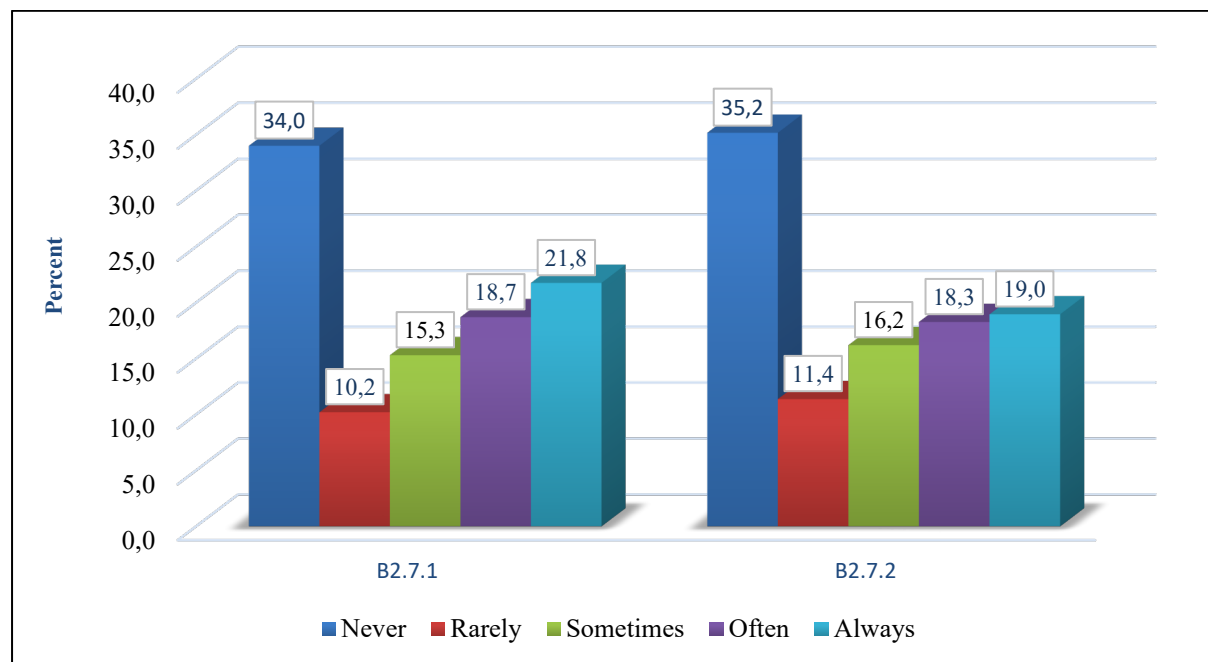


Figure 5.8: Usage of AI-driven Chatbots for Customer Support

In Figure 5.8, the findings on the usage patterns for blockchain-based solutions for secure transactions and identity verification revealed varying levels of adoption amongst respondents. For digital identity for travel documents, 34.0% of respondents reported "Never" using this technology, while 21.8% indicated they "Always" use it. An additional 18.7% use it "Often". The results show a moderate level of adoption of blockchain technology by the respondents. Smart contracts for automating bookings showed similar usage patterns, with 35.2% of respondents "Never" using them and 19.0% "Always" using these contracts. Additionally, 18.3% use them "Often". These findings also highlight a moderate level of engagement with this Blockchain-based solution. All statements showed statistically significant differences in usage patterns across the various Blockchain-based technologies ($p < 0.001$).

These findings highlight variability in adopting secure transactions and identity verification technologies within the Tourism industry. While some respondents have fully integrated these solutions into their operations, a significant portion still has not utilised blockchain technology, which was also mentioned in similar research conducted by Corne, Massot and Merasli (2023:606-608) within the Tourism industry. This suggests opportunities for the further integration and promotion of blockchain-based technologies to enhance security and efficiency in accommodation establishments. Moreover, the results demonstrate that adopting blockchain-based solutions has been conducted moderately. Therefore, in terms of data privacy and protection, innovation is diffusion and adoption is at a snail's pace.

5.6.2.10 Benefits and Challenges Associated with Smart Tourism and 4IR Applications in the Accommodation Sector

Table 5.15 below shows the perceived benefits and challenges associated with adopting Smart Tourism and 4IR applications within accommodation establishments in KZN.

Table 5.15: Perceived Benefits and Challenges with the Adoption of Smart Tourism and 4IR Applications

	SA		D		N		A		SA		Mean
	N	%	N	%	N	%	N	%	N	%	
Smart Tourism and applications of the Fourth Industrial Revolution (4IR) raise the overall quality of the tourist experience	33	11.3	14	4.8	49	16.8	79	27.1	117	40.1	3.80
These technologies boost the accommodation establishment's operational effectiveness	28	9.6	13	4.4	49	16.7	75	25.6	128	43.7	3.89
These technologies improve strategic efficiency in the Accommodation sector	30	10.3	16	5.5	45	15.5	90	31.0	109	37.6	3.80
Concerns about data security and privacy prevent these technologies from being widely adopted	32	10.9	17	5.8	67	22.8	88	29.9	90	30.6	3.64
The cost associated with putting these technologies into use and keeping them up to date is a challenge	33	11.3	15	5.1	52	17.7	78	26.6	115	39.2	3.77

Learning to use Smart Tourism and 4IR applications can be quite challenging	37	12.6	30	10.2	67	22.8	70	23.8	90	30.6	3.50
---	----	------	----	------	----	------	----	------	----	------	------

SA=Strongly Agree, A= Agree, N=Neutral, D=Disagree, SD=Strongly Disagree

The following are the perceived benefits and challenges associated with adopting Smart Tourism and 4IR applications within accommodation establishments in KZN. Operational Effectiveness (mean =3.89) showed the highest perceived benefits with the adoption of Smart Tourism and 4IR Applications, while Learning to use Smart Tourism and 4IR applications (mean=3.50) showed the highest challenge.

Quality of the Tourist Experience: Most respondents (40.1%) strongly agreed, while 27.1% agreed that Smart Tourism and 4IR applications raised the overall quality of the tourist experience. Only 4.8% disagreed, while 11.3% strongly disagreed, thereby indicating a generally positive perception of these technologies in enhancing tourist satisfaction. This indicates a clear positive perception of technology-driven tourism and shows that digital transformation enhances customer satisfaction and overall service delivery in the Tourism industry. This finding corroborates the literature, which reaffirms that technology is central to service innovation in terms of customer experience and engagement (Park, Lee and Back, 2023:4502).

Operational Effectiveness: A notable 43.7% of the respondents strongly agreed that these technologies boosted the operational effectiveness of accommodation establishments. However, a minimal proportion (9.6%) expressed strong disagreement, showcasing strong support for the operational benefits of 4IR applications in the Accommodation sector. The perceived operational benefits likely stem from the automation of bookings, real-time data analytics and streamlined check-in processes, which are becoming more common in technologically adaptive establishments (Anwar, Dliana and Suyamto, 2024).

Strategic Efficiency: Regarding strategic efficiency, 37.6 % of the respondents strongly agreed and 31% agreed that these technologies improved strategic operations within the Accommodation sector. Those who strongly disagreed were relatively low at 10.3 %, further emphasising the strategic advantages perceived by respondents. This indicates a positive perception of how adopting Smart Tourism and 4IR applications can improve strategic efficiency in the Accommodation sector. It can therefore be mentioned that it is important to

think and act strategically when working in the Accommodation sector because when there are crises, such as pandemics and economic volatility, then businesses in this sector need to reassess their strategies and make use of innovation to achieve a competitive advantage (Ledi *et al.* 2024:1-2).

Data Security and Privacy Concerns: Data security and privacy concerns were significant, with 29.9% agreeing and 30.6 % strongly agreeing that these issues prevented the widespread adoption of these technologies. Only 10.9 % strongly disagreed, highlighting the critical need to address security concerns to facilitate broader adoption. Therefore, there is a need for establishments to address and improve issues related to data security and privacy concerns. As the industry attempts to keep pace with rapid technological changes, data security technology is no longer avoidable. As such, positive developments in the Accommodation sector require strong technological advances and any technological challenges related to data security and privacy concerns should be addressed meticulously. A study by Mchunu (2025:56) highlighted that e-Tourism companies should implement robust data governance measures and the author further indicated that blockchain and biometrics could assist in securing data and managing third-party risks.

Cost Challenges: The costs associated with implementing and maintaining these technologies were cited as another challenge. Most respondents agreed (26.6 %) or strongly agreed (39.2%) that technology repair costs were a significant barrier. A mere 11.3% strongly disagreed, indicating a widespread concern about financial constraints. This finding is supported by a study conducted by Singh, Sharma and Bangad (2024:336), which revealed that the costs associated with implementing technology are high and that hotels need to seek affordable solutions to incorporate 4IR technologies and make Smart hotel technologies more accessible.

Learning Challenges: Learning to use Smart Tourism and 4IR applications was also perceived as challenging by 30.6 % who responded with ‘strongly agree’ and 23,6% who responded ‘agree’. Only 22.8% remained neutral and 10.6% disagreed, while 12.6 % strongly disagreed, suggesting that a substantial portion of the workforce found these technologies difficult to master. The cross-tabulation patterns could mean that larger accommodation establishments that have set training budgets could have fewer challenges, whereas smaller establishments could have limited training budgets. Hence, the staff struggle to work with and

understand 4IR technologies. Moreover, research by Thakur and Sharma (2025:242) states that even though **smart technologies** benefit the Accommodation sector, they pose challenges for staff. Therefore, staff need to undergo intensive training programmes on digital literacy and new technologies to understand and use them effectively and efficiently in the industry (Thakur and Sharma, 2025:242).

These findings underscore the importance of addressing learning barriers to fully leverage the benefits of Smart Tourism and 4IR applications in enhancing tourist experiences and operational efficiency in accommodation establishments. Establishments need to recruit employees with technology talent or conduct training programmes to equip employees with 4IR technology skills and knowledge.

5.6.3 Section C Analysis: Assessing 4IR Skills and Training Needs for Employability

This section evaluates the essential 4IR skills and training needs required for employability in accommodation establishments within KwaZulu-Natal. The assessment focuses on two primary areas, namely the importance of various 4IR skills for new graduates seeking employment in the Tourism industry and the specific 4IR skills deemed critical for current positions within the Accommodation sector. By understanding these requirements, the goal is to identify the key competencies that enhance employability and support the development of a workforce capable of thriving in the evolving landscape of Smart Tourism and Fourth Industrial Revolution technologies.

5.6.3.1 Important Factors for New Graduates to find a job in the Tourism Industry

Table 5.16 shows various 4IR skills for new graduates aiming to secure employment in the tourism industry. Respondents rated the importance of different skills, including digital literacy, data analysis, AI and automation, cybersecurity and remote collaboration. The analysis highlights the critical competencies perceived as essential for enhancing employability in the technologically evolving Tourism industry.

Table 5.16: 4IR Skills for New Graduates

	Not important at all		Slightly Important		Moderately Important		Very Important		Extremely Important		Mean
	N	%	N	%	N	%	N	%	N	%	
Using basic computer applications (word processing, spreadsheets, etc)	18	6.1	25	8.5	30	10.2	76	25.9	144	49.1	4.03
Using mobile apps for tourism-related activities	27	9.2	5	1.7	33	11.2	85	28.9	144	49.0	4.07
Using social media for marketing and communication purposes	21	7.1	7	2.4	39	13.3	73	24.8	154	52.4	4.13
Mastery of virtual reality (VR) and augmented reality (AR) technologies for enhancing tourism experiences	33	11.3	14	4.8	43	14.7	86	29.4	117	39.9	3.82
Examining and interpreting data related to tourism to gain business insights	31	10.5	23	7.8	63	21.4	104	35.4	73	24.8	3.56
Using data visualisation tools (e.g. Tableau, Infogram, Google Data Studio, Power BI) to represent tourism trends and patterns	33	11.2	21	7.1	53	18.0	102	34.7	85	28.9	3.63
Familiarity with chatbots and AI-powered customer service in tourism	60	20.4	21	7.1	70	23.8	69	23.5	74	25.2	3.26
Comprehension of how AI can improve tourism offerings being tailor made	55	18.7	19	6.5	66	22.4	70	23.8	84	28.6	3.37
Knowledge of cybersecurity risks and best practices for data protection in the tourism industry	35	11.9	18	6.1	48	16.4	69	23.5	123	42.0	3.77
Experience with remote collaboration tools (e.g., video conferencing, project management software)	26	8.9	18	6.1	58	19.8	57	19.5	134	45.7	3.87

The following are the 4IR skills that new graduates should have in order to secure employment within the Accommodation sector of the Tourism industry. Social media and Marketing (mean=4.13), Using mobile apps for tourism-related activities (mean=4.07) and Digital Literacy and Technology Skills (mean=4.03) were the highest rated 4IR Skills for new graduates. Familiarity with chatbots and AI-powered customer service in Tourism (mean=3.26) was the lowest-rated 4IR skill for new graduates.

Digital Literacy and Technology Skills: Most respondents considered skills such as using basic computer applications to be ‘very important’ (26%) and ‘extremely important’ (49.1%). Regarding the use of mobile apps, a significant number of participants considered them ‘very important’ (28.9%) and ‘extremely important’ (49.0%) for Tourism-related activities. It has been observed that most respondents indicated that digital literacy and the usage of Tourism mobile apps are extremely important. The results highlight the use of basic computer applications, such as word processing and spreadsheets and the use of mobile apps for Tourism-related activities as critical for new graduates seeking to find employment in the Tourism industry. The results indicate the foundational necessity of digital literacy for new graduates to secure employment in the Tourism industry.

Studies by Farias-Gaytan *et al.* (2023:1) reveal that due to digital information technologies, HEIs offering Tourism-related programmes need to ensure that the curriculum includes digital literacy skills and should therefore collaborate with the industry to identify which digital or 4IR skills graduates should have. Studies conducted by Rodrigues, Breda and Rodrigues (2024:1-2) underscored that in the context of the 4IR, digital literacy is an essential competency required of the Tourism industry. The increasing use of technology in all aspects of the Tourism business has resulted in industry stakeholders realising the value of graduates with strong digital abilities. This skill set encompasses social media management, data analytics proficiency and proficiency in using new technologies for marketing and customer engagement.

Social Media and Marketing: Using social media for marketing and communication purposes was viewed as ‘extremely important’ by 52.4% of respondents, whilst 24.8% viewed it as ‘very important’. Essentially, these percentages show that many respondents highlighted the critical role of social media proficiency in the Tourism industry. This concurs with the findings of the

literature, which report that social media platforms are widely used in the Tourism industry for promotional purposes for destinations (Tolossa, Umema and Gota, 2023:1).

Advanced Technologies: Mastery of VR and AR technologies was also regarded as highly important, with 39.9% of respondents rating it as ‘extremely important’, whilst 29.4% viewed advanced technology as ‘very important’. Studies by Adeyinka-Ojo *et al.* (2020:114) demonstrate that the advent of 4IR has caused significant disruptions in conventional industries and instigated a fundamental transformation in the operational dynamics of businesses and how individuals engage with technology. Hence, it is important for graduates to be equipped with knowledge and skills of VR and AR technologies and it should be included in their curriculum.

Data Analytics and Interpretation: A significant 60% of the respondents viewed skills in data analytics in Tourism as ‘very important’ and ‘extremely important’, whilst 63.6% expressed the same regarding the usage of data visualisation tools, thus underscoring the importance of data-driven decision-making in the industry. Studies by Javadi (2022:141) revealed that data analytics is crucial for Tourism, as it helps companies understand client preferences, predict trends and make Smart strategic decisions. The lack of data analytics training in the curriculum hinders graduates' ability to use data for strategic planning and operational improvements (Javadi, 2022:141). The results show that the majority of respondents viewed data analytics and interpretation as a vital skill for employability in the Accommodation sector.

AI and Automation: Regarding AI and Automation, the results on familiarity with chatbots and AI-powered customer service showed that 25.2% of the respondents agreed that they were important. Moreover, 28.6% of the respondents indicated that comprehension of AI’s potential to tailor tourism offerings was important. Manos *et al.* (2024:1-2) observed that AI, AR, VR and the IoT are technologies utilised to provide personalised services and enhance the physical world. These tools are important in that travellers can visit far-off or unreachable locations using VR and AI can provide tailored suggestions to enhance the passenger experience. Study results, therefore, indicate that AI is a vital skill for those seeking employment in the Accommodation sector, as it can offer unique insights to customers and also enhance their experiences. The low consensus evident in Table 5.9 can be attributed to limited exposure, as

the widespread usage of AI is considered to be an emerging field (Knani, Echchakoui and Ladhari, 2022:11).

Cybersecurity: Regarding cybersecurity, 23.5% of the respondents highlighted that knowledge of cybersecurity risks and best practices was very important, while 42.0% considered knowledge of cybersecurity and best practices extremely important, reflecting the critical need for securing digital transactions and data in Tourism. In total, 65.5% of the respondents concurred that knowledge of cybersecurity was critical in helping them obtain jobs in the Tourism industry. Furthermore, studies by Fernández Alcantud and García Moreno (2022:19) revealed that cybersecurity measures have become increasingly crucial in the digital age, encompassing a range of strategies and technologies aimed at safeguarding computer systems, networks and data from unauthorised access, breaches and malicious activities. Therefore, the results indicate a growing recognition amongst the respondents in safeguarding computer and data systems from malicious and fraudulent activities.

Remote Collaboration: Experience with remote collaboration tools was also highly valued, with 45.7% of the respondents considering it extremely important, highlighting the importance of graduates being trained on remote work capabilities in the modern workplace. This finding corroborates the literature, which has indicated that knowing remote collaboration tools is important, especially after the COVID-19 pandemic and when wanting to engage in modern conferences and industry operations (Shi, Cai and Wolfe, 2022:199-200). The COVID-19 pandemic has forced the industry to have more virtual engagement and allow staff to have flexible working arrangements. Moreover, this pandemic also forced the Tourism industry to adopt and embrace digital transformation (Shi, Cai and Wolfe, 2022:199-200).

5.6.3.2 4IR Skills Important to Employees in Current Positions

This section evaluates the importance of various 4IR skills for current positions within accommodation establishments in KwaZulu-Natal. Understanding the perceived value of these skills aims to identify the critical training needs that will enhance employability and support the development of a workforce equipped to handle the demands of the 4IR technologies in the Tourism industry.

Table 5.17 shows the importance of various 4IR skills for current positions within accommodation establishments in KZN.

Table 5.17: Importance of Various 4IR Skills for Current Positions in Accommodation Establishments

	Skill is not required		Slightly Important		Moderately Important		Very Important		Extremely Important		Mean
	N	%	N	%	N	%	N	%	N	%	
Digital Literacy	27	9.3	10	3.4	34	11.7	81	27.8	139	47.8	4.01
Data Analysis	32	10.9	14	4.8	32	10.9	84	28.6	132	44.9	3.92
Artificial Intelligence Integration	43	14.6	20	6.8	53	18.0	71	24.1	107	36.4	3.61
Virtual Reality and Augmented Reality	50	17.0	18	6.1	53	18.0	83	28.2	90	30.6	3.49
Cybersecurity Awareness	29	9.9	15	5.1	36	12.2	69	23.5	145	49.3	3.97
Remote collaboration	36	12.2	19	6.5	39	13.3	94	32.0	106	36.1	3.73

The following are the important 4IR skills for current positions in the accommodation establishments in KZN. Digital Literacy (mean=4.01), Cybersecurity Awareness (mean=3.97) and Data Analysis (mean=3.92) were the top three 4IR Skills for Current Positions in accommodation establishments.

Digital Literacy: Nearly half of the respondents (47.8%) considered digital literacy as extremely important in their current roles, highlighting the foundational necessity of digital skills in the Tourism industry. A smaller portion of 9.3% believed that this skill was not required, suggesting varying levels of digital adoption across different roles. However, most respondents highlighted the importance of basic computer skills and digital literacy of Tourism apps as critical for their current position in the Accommodation sector. As indicated, digital literacy is the first step graduates must take to enter the industry. The results suggest that computer and internet skills are vital for those employed within the Accommodation sector. This finding aligns with the literature, which notes that digital technologies are used to ensure transparency, enhance daily operations and boost productivity levels in the workplace (Peng 2024:39-40).

Data Analytics: A notable 44.9% of respondents deemed this skill ‘extremely important’, indicating the critical role of data analytics in making informed decisions and driving business insights. Furthermore, 28.6% of the respondents considered data analytics to be ‘very important’. In total, 73.5% of the respondents confirmed that data analytics skills were vital in their current employment positions. The results underscored the relevance of the skill in the Accommodation sector. Data analytics is essential to making business projections and forecasts, as well as for informing strategic decisions in this sector (Yallop and Seraphin, 2020:258-259). Moreover, knowing data analytics allows establishments to be better capacitated with sufficient staff, as it would enable them to forecast the arrivals and length of stay of guests, thereby raising the service levels offered (OECD, 2025:1). It is therefore necessary for those employed to exhibit excellence in this skill within the Tourism industry.

AI Integration: In this regard, 36.4% of respondents rated AI integration as ‘extremely important’ in their current positions at work. Moreover, 24.1% of the respondents noted that AI integration in their current job positions was ‘very important’. A significant 14.6% believed the skill was not required, reflecting a diverse range of perspectives on the necessity of AI skills in current roles. However, most respondents viewed AI integration as critical in their current positions in the Accommodation sector, even though the technology has not been prevalent in practice.

VR and AR: A notable 30.6% of respondents considered VR and AR technologies ‘extremely important’, while 28.2% revealed that advanced technologies were also critical in their current work positions. However, 17.0% believed that these skills were not required. The results indicate that while these advanced technologies are valued, their widespread application has not yet occurred. However, according to Lim, Jasim and Das (2023:1-2), VR and AR are being used to develop innovative methods where there are resource constraints. Moreover, the use of these advanced technologies has led to a transformation in hotel operations, which allows for an enhanced guest experience, which ultimately results in repeat usage (Bogicevic *et al.* 2021:1-2; Pillai *et al.* 2021:1). It is therefore necessary for those currently working in the Accommodation sector to be capacitated on VR and AR technology to enhance their competence.

Cybersecurity Awareness: This skill had the highest importance rating, as 49.3% of the respondents considered it ‘extremely important’. Therefore, the results underscore the critical need for cybersecurity in protecting sensitive information and ensuring data privacy within the Tourism industry. Similarly, in other research conducted, over 40% of the employees within the industry stated that cybersecurity and data privacy are crucial knowledge areas (Yallop and Seraphin, 2020:259). These authors further stated that Tourism and Hospitality organisations must look into the security of their data, which can be done through data governance frameworks, especially with companies becoming more automated and data-driven (Yallop and Seraphin, 2020:259).

Remote Collaboration: In this area, 36.1% of the respondents rated it as ‘extremely important’ as remote collaboration skills are perceived as essential for effective communication and project management, especially in increasingly digital and distributed work environments (Shi, Cai and Wolfe, 2022:199-200). These findings highlighted the diverse technological training needs of graduates currently employed in the sector.

The results indicated that cybersecurity, digital literacy and data analytics were regarded as critical competencies in the current positions. Variability in the responses also indicated that some 4IR technologies had not yet been widely adopted, such as artificial intelligence integration, advanced technologies and remote collaboration. The results emphasise the importance of equipping employees with a broad range of 4IR competencies to enhance their performance, competence and adaptability in a rapidly evolving industry.

5.6.3.3 Most Essential 4IR Skills for the Tourism Industry

Table 5.18 shows the 4IR skills considered most essential for the future of the Tourism industry in KwaZulu-Natal.

Table 5.18: Most Essential 4IR Skills for the Tourism Industry

	Not Important at all		Slightly Important		Moderately Important		Very Important		Extremely Important		Mean
	N	%	N	%	N	%	N	%	N	%	
Digital Literacy	19	6.6	16	5.5	29	10.0	74	25.5	152	52.4	4.12

Data Analysis	25	8.5	12	4.1	38	13.0	95	32.4	123	42.0	3.95
Artificial Intelligence Integration	33	11.2	26	8.8	39	13.3	86	29.3	110	37.4	3.73
Virtual Reality and Augmented Reality	38	13.0	22	7.5	32	11.0	85	29.1	115	39.4	3.74
Cybersecurity Awareness	28	9.6	25	8.5	28	9.6	74	25.3	138	47.1	3.92
Remote collaboration	29	10.0	25	8.6	27	9.3	72	24.8	137	47.2	3.91

The following are the 4IR skills that are most essential to have in the Tourism industry. Digital Literacy (mean=4.12), Data Analysis (mean=3.95) and Cybersecurity Awareness (mean=3.92) were the top three 4IR Skills that were considered to be the most essential to have when working in the Tourism industry.

Digital Literacy: Analysis of the most essential 4IR skills in the Tourism industry revealed varying responses. Over half of the respondents (52.4%) considered digital literacy to be extremely important for the future of the industry. This highest-rated skill underscores the foundational role of digital skills in the adoption and effective use of 4IR technologies. Mhango *et al.* (2025:25) and Nikolskaya *et al.* (2021:623) also highlighted the importance of having digital literacy skills when working in Hospitality and Tourism. These authors mentioned that by having these skills, employees could use automated technology, which will in turn enhance operational efficiency (Mhango *et al.* 2025:25-26; Nikolskaya *et al.* 2021:623-624). Therefore, the curriculum must prioritise basic and advanced digital competencies for operational staff and management in hospitality establishments

Data Analytics: Data analytics was viewed as extremely important by 42.0% of the respondents. This highlights the critical need for skills that enable the interpretation of data to drive business insights and strategic decisions in the Tourism industry. Moreover, research has found that data analytics has transformed businesses' productivity, streamlined processes and personalised products and services, which have significantly impacted the Tourism industry (Verma *et al.* 2021: 1-2; Lan, 2023: 1-5). It is therefore necessary for this skill to be taught in the curriculum so that graduates entering the Tourism industry can effectively analyse data to make better-informed business decisions.

AI Integration: AI integration was considered extremely important by 37.4% of the respondents. The findings reflect the growing relevance of AI in personalising tourist experiences and improving operational efficiencies in the sector. Knowledge of AI integration is important as AI can now look at creating travel plans that are personalised for travellers. Additionally, AI is able to assist companies with marketing, waste reduction, energy reduction and to streamline services. Even though AI can perform these functions, employees still need to know how to use the AI tools and have AI skills, which will allow them to interpret outputs for efficient daily operations (Li *et al.* 2025:1-3). Other benefits include staff becoming more creative in their thinking and their productivity levels increasing using AI tools, resulting in cost savings and improved customer experiences (Li *et al.* 2025:7).

VR and AR: VR and AR technologies were perceived as extremely important by 39.4% of the respondents. These technologies are crucial for creating immersive and enhanced tourism experiences, which can significantly improve customer satisfaction and engagement (Siddiqui *et al.* 2022:13). Immersive technologies are increasingly used for virtual tours, destination previews and interactive customer experiences. Moreover, Tussyadiah *et al.* (2018:140-141) report that VR and AR enhance destination engagement and intention to visit, which also allows for marketing to be transformed and experiential learning. It is therefore suggested that students should have practical exposure to AR and VR tools in their curriculum.

Cybersecurity Awareness: Almost half of the respondents, 47.1% regarded cybersecurity awareness as extremely important. The results emphasised the need for robust security measures to protect vast amounts of sensitive data and maintain the trust of tourists in a digital landscape within the Tourism industry. This could be due to the Tourism industry having an immense amount of data, which is both personal and financial and could be in the form of credit card details and passport information. Cybercriminals could target the Tourism industry for this information as it is the third most targeted industry for cyberattacks (SiteMinder, 2025:1). Moreover, Gretzel *et al.* (2015) identified cybersecurity as a critical enabler and risk factor in Smart Tourism, demanding a proactive curriculum focus. It is therefore important that modules such as cyber hygiene, privacy law and secure system usage are included in Hospitality and Tourism education.

Remote Collaboration: Remote collaboration skills were rated as ‘extremely important’ by 47.2% of the respondents. The ability to effectively collaborate using digital tools was perceived as essential for managing dispersed teams and maintaining productivity in the Tourism industry. The workplace has transformed post the COVID-19 period, where it requires virtual team management and the use of collaborative technologies (Walhidayah, 2024:373). According to Mirčetić and Mihić (2022:116-117), remote collaboration tools have become integral to flexible tourism operations, especially within administrative functions, the provision of customer support and the planning of functions. Hence, when programmes are developed, they should include training in virtual platforms such as Zoom, Microsoft Teams, Trello and should also incorporate remote etiquette and digital teamwork strategies.

The study findings generally demonstrated that the most essential 4IR skills were mainly digital literacy, cybersecurity awareness, data analysis and remote collaboration. These findings suggest a strong consensus on the necessity of these 4IR skills for the future success of the Tourism industry in KZN. The emphasis on digital literacy, data analysis, AI integration, VR and AR technologies, cybersecurity and remote collaboration highlights the areas where workforce training and development should be focused to ensure that the industry remains competitive and innovative.

5.6.4 Section D Analysis: Exploring the Perceptions of General Staff on their 4IR Competencies

5.6.4.1 Perception of Graduates’ Smart Tourism and 4IR Skills

Table 5.19 shows the perceived competence of graduates in various Smart Tourism skills.

Table 5.19: Perceived Competence of Graduates in Various Smart Tourism Skills

	Poor		Fair		Average		Good		Excellent		Mean
	N	%	N	%	N	%	N	%	N	%	
Digital Marketing and Social Media Management	44	15.0	43	14.7	60	20.5	77	26.3	69	23.5	3.29
Data Analytics and Insights	76	25.9	49	16.7	53	18.1	60	20.5	55	18.8	2.89
Customer Relationship Management (CRM) Systems	65	22.2	42	14.3	56	19.1	51	17.4	79	27.0	3.13
Mobile App. Management	80	27.3	40	13.7	53	18.1	57	19.5	63	21.5	2.94
Use of Internet of Things in Guest Services	77	26.6	28	9.7	50	17.2	57	19.7	78	26.9	3.11

This section assesses the skills of Tourism graduates in Smart Tourism and 4IR areas, including digital marketing, data analytics, CRM systems, mobile app management and IoT use in guest services. It also gauges their preparedness for Accommodation sector employment, aiming to identify gaps and areas for improvement in education and training. Including the mean score in the analysis offers a quantitative indicator of how graduates are perceived across key Smart Tourism domains. The mean enables standardised comparison across competencies and assists curriculum planners in identifying skills gaps.

Digital Marketing and Social Media Management: The analysis of respondents' perceptions regarding graduates' competence in Smart Tourism skills produced valuable insights. It was found that 26.3% of the respondents rated graduates as "Good", 23.5% as "Excellent" and 15.0% as Poor in terms of their skills. Thus, almost 50% of the respondents revealed that their competencies were good. Digital Marketing and Social Media Management (mean=3.29) was the highest perceived competence of graduates in various Smart Tourism skills. Variations in the responses indicate that digital marketing and social media management skills were moderately adopted. These responses indicated that graduate skills in digital marketing and social media management were average. Graduates need to be more capacitated in digital marketing and social media management to sharpen their competencies.

Data Analytics and Insights: The results indicated that opinions on data analytics were divided, as 25.9% of the respondents rated graduates as "Poor", while 18.8% rated it as "Excellent". The variation in responses indicates a mixed perception of competence in data analytics. Data Analytics and Insights (mean=2.89) shows the lowest perceived competence of graduates. A lower-than-expected average highlights a critical shortfall in data literacy, a core skill in Smart Tourism decision-making. Advanced modules in data interpretation and business intelligence tools are needed. The results reinforce the need for graduates to be trained more in data analysis.

Customer Relationship Management (CRM) Systems: The results show that 27.0% of the respondents rated graduates as "Excellent" in CRM systems, whilst 22.2% rated them as "Poor". The results indicated moderate adoption and suggested a need for enhanced training for graduates in CRM to achieve more consistent proficiency (mean=3.13).

Mobile App Management: Graduates received mixed reviews, as 27.3% were rated as "Poor" by the respondents, while 21.5% were viewed as "Excellent". The mean score of 2.94 indicated varying levels of competence that require attention, particularly in the Mobile App Management. Smart Tourism, driven by technologies like IoT, big data and AI, requires graduates to be digitally fluent. The mean values (e.g., 2.94 in Mobile App Management) suggest sub-optimal competence levels. As per Gretzel *et al.* (2015:179), Smart Tourism thrives when human capital is equipped with technical and analytical skills.

Use of IoT in Guest Services: The ratings for IoT skills were polarised, with 26.6% of respondents rating graduates as "Poor" and 26.9% as "Excellent". The mean score of 3.11 underscored the need for targeted training to bridge this competence gap. It reflects moderate understanding. Yet, 4IR demands a deep integration of IoT applications such as Smart room control, automated check-ins and real-time service personalisation. Overall, while some graduates demonstrated high competence in key Smart Tourism skills, there were notable areas requiring improvement. Addressing these gaps through focused training and education is believed to enhance graduates' readiness to meet industry standards and expectations.

The inclusion of mean values in Table 5.19 is not only appropriate but essential for guiding the transformation of higher education curricula in the Smart Tourism domain under the 4IR agenda. The statistical insight provides an empirical foundation for re-designing curriculum content, delivery and assessment to better equip graduates for Smart Tourism roles in KZN's Accommodation sector.

5.6.4.2 Perceived Competence of Graduates in Various 4IR Skills

In this section, the researcher assesses graduates' perceived competence in 4IR skills, including AI, AR, VR, cybersecurity and blockchain technology. It helps identify areas of excellence and areas for improvement in line with technological advancements in the tourism industry. Table 5.20 and Figure 5.9 show the perceived competence of graduates in various 4IR skills.

Table 5.20: Perceived Competence of Graduates in Various 4IR Skills

	Poor		Fair		Average		Good		Excellent		Mean
	N	%	N	%	N	%	N	%	N	%	
Artificial Intelligence	99	34.0	27	9.3	75	25.8	45	15.5	45	15.5	2.69
Augmented Reality and Virtual Reality	102	34.8	44	15.0	50	17.1	62	21.2	35	11.9	2.60
Cybersecurity	94	32.1	51	17.4	50	17.1	55	18.8	43	14.7	2.67
Blockchain Technology	114	39.0	46	15.8	38	13.0	45	15.4	49	16.8	2.55

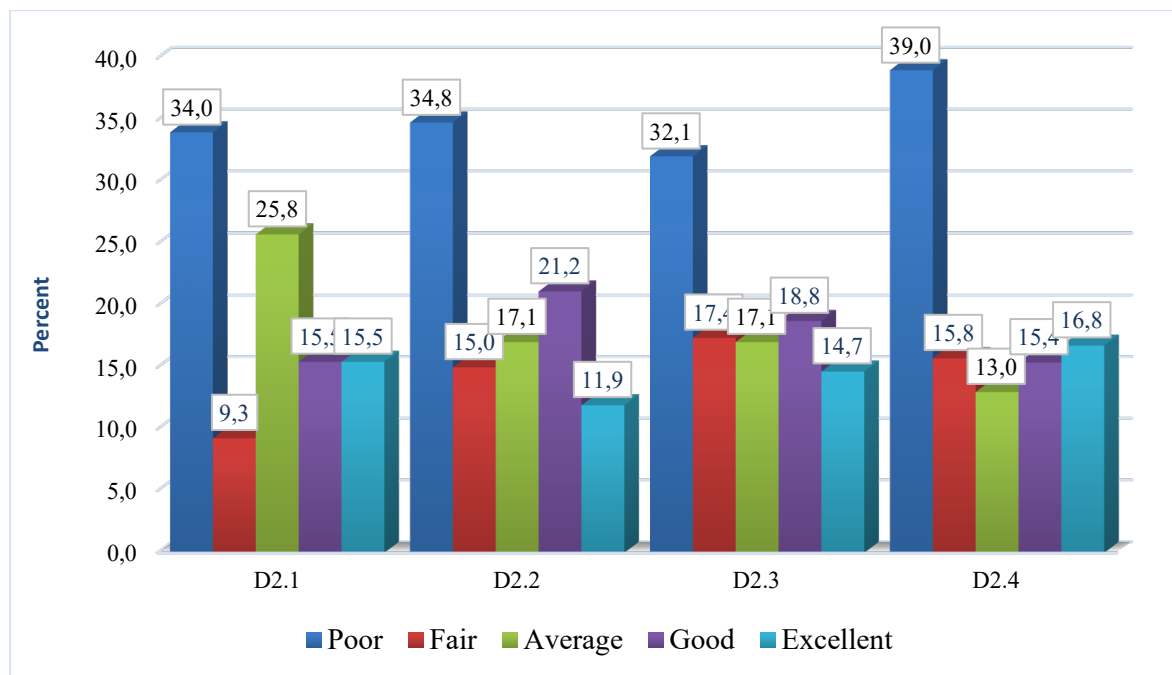


Figure 5.9: Perceived Competence of Graduates in Various 4IR Skills

As illustrated in Figure 5.9, D2.1 signifies AI; D2.2 denotes AR and VR; whilst D2.3 represents Cybersecurity; and D2.4 designates Blockchain Technology.

Artificial Intelligence: The analysis of respondents' perceptions regarding graduates' competence in 4IR skills revealed the following results: A significant portion of respondents (34.0%) rated graduates' AI skills as "Poor", while only 15.5% rated them as "Excellent". The low mean value (mean=2.69) indicates a need for substantial improvement in AI training to meet industry expectations. AI is a core driver of the 4IR, influencing tourism through Smart personalisation, chatbots and predictive analytics. The literature notes that graduates often lack practical AI exposure, making integration into the workforce challenging. Despite AI's

prominence in the 4IR, there is a significant gap in AI competence amongst Tourism and Hospitality graduates (Oh, 2020: 17-19).

Augmented Reality and Virtual Reality: Graduates' competence in AR and VR was perceived as lacking, with 34.8% rating them as "Poor" and only 11.9% rating them as "Excellent". The low mean value (mean =2.60) underscores the necessity for enhanced education and practical training in AR and VR technologies. AR and VR are central to immersive tourism and digital storytelling, yet most Tourism graduates lack technical proficiency in developing or deploying these tools as the integration into the Tourism curriculum is limited (Yung and Khoo-Lattimore, 2019:2056-2057).

Cybersecurity: Cybersecurity skills were also considered deficient, with 32.1% of respondents rating them as "Poor" and 14.7% as "Excellent". The low mean value (mean =2.67) highlighted the critical need for improving cybersecurity knowledge to ensure that graduates can effectively protect sensitive information and systems. Moreover, with the rise of IoT in Tourism and online bookings, cybersecurity becomes critical. However, Hospitality and Tourism curricula often omit cybersecurity fundamentals. The Accommodation sector is facing cyberattacks, yet cybersecurity training in Tourism programmes remains minimal (Tussyadiah, 2020:1-2). Furthermore, Karadayi-Usta (2024:397) stated that when graduates enter the industry, they are not knowledgeable about how to handle data privacy, even though this is a growing concern in the 4IR era.

Blockchain Technology: This area showed the greatest perceived deficiency, with 39.0% rating graduates' blockchain skills as "Poor" and only 16.8% rating them as "Excellent". The low mean value (mean=2.55) indicates that blockchain technology was a major area where current training programmes fall short and require significant enhancement. Overall, the findings indicate that while some graduates possess strong 4IR skills, substantial gaps need to be addressed through improved educational curricula and practical training programmes. Enhancing graduates' proficiency in these critical technologies, especially in Blockchain technology, is believed to better prepare them for the demands of the modern Tourism industry, ensuring they can contribute effectively to the technological advancements and operational efficiency within the sector (Styianou and Pericleous, 2025:18). Blockchain is touted to

revolutionise travel operations, yet it is rarely taught in Tourism or Hospitality courses. The data show an apparent urgency for inclusion in curriculum design.

5.7 Cross-Tabulations

Cross-tabulation was used to examine the relationship between pairs of categorical variables, presenting the frequency distribution of responses for each combination of categories. The Pearson Chi-Square test was employed to assess the statistical significance of these associations. The null hypothesis states that there is no association between the two. The alternate hypothesis indicates that there is an association. The relationship is significant if the p-value is less than 0.05 (Msuha and Mdendemi, 2019: 10-11). The analysis primarily focused on identifying statistically significant associations between various survey variables.

5.7.1 Cross-Tabulation: “I am familiar with the concept of Smart Tourism” vs “Age”

Table 5.21 shows the cross-tabulation of “I am familiar with the concept of Smart Tourism” vs “Age”.

Table 5.21: Cross-Tabulation: “I am familiar with the concept of Smart Tourism” vs “Age”

			Age (years)					Total
			18 - 24	25 - 34	35 - 44	45 - 54	≥ 55	
I am familiar with the concept of Smart Tourism.	Strongly Disagree	Count	3	5	18	11	9	46
		% within Age (years)	10,0%	6,6%	16,4%	22,0%	32,1%	15,6%
	Disagree	Count	3	9	5	6	5	28
		% within Age (years)	10,0%	11,8%	4,5%	12,0%	17,9%	9,5%
	Neutral	Count	10	31	25	9	0	75
		% within Age (years)	33,3%	40,8%	22,7%	18,0%	0,0%	25,5%
	Agree	Count	9	23	35	16	4	87
		% within Age (years)	30,0%	30,3%	31,8%	32,0%	14,3%	29,6%
	Strongly Agree	Count	5	8	27	8	10	58
		% within Age (years)	16,7%	10,5%	24,5%	16,0%	35,7%	19,7%
Total		Count	30	76	110	50	28	294
		% within Age (years)	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

Table 5.21 presents a cross-tabulation of the relationship between age and familiarity with the concept of Smart Tourism. The key differences reveal that the 18 to 24 age group shows a more balanced distribution across different familiarity levels, with a notable percentage of 33.3% being neutral. The combined agreement (Agree and Strongly Agree) is 46.7%, indicating moderate familiarity amongst younger respondents. The 25 to 34 age group had the highest percentage of respondents, with 40.8% being neutral. However, 40.8% also agree or strongly agree with the statement, showing that a significant portion of this group is familiar with Smart Tourism. The 35 to 44 year age group shows a high level of agreement, with 56.3% either agreeing or strongly agreeing. The percentage of neutral respondents is 22.7% and those who disagree or strongly disagree make up 20.9%. Like the 35 - 44 age group, in the 45 to 55 year age group, 48.0% agree or strongly agree with the statement. However, there is a higher percentage of strong disagreement at 22.0% compared to younger age groups, indicating varied familiarity within this age group. Lastly, in the ≥ 55 -year age group, the highest percentage of strong disagreement was 32.1% and the lowest percentage of neutrality was 0.0%. However, 50.0% agree or strongly agree, suggesting a polarised familiarity with Smart Tourism amongst older respondents. The significant p-value (< 0.001) confirms that age is an essential factor in how respondents view their familiarity with Smart Tourism. Younger respondents (18-24 years) tend to have higher levels of neutrality or moderate familiarity, while older respondents (45 years and above) show more polarised views, either being very familiar or unfamiliar with the concept. This suggests that targeted education and awareness campaigns might be needed to bridge the familiarity gap across different age groups.

5.7.2 Cross-Tabulation: “Perception of Graduate Preparedness” vs “Gender”

Table 5.22 shows the cross-tabulation of “Perception of Graduate Preparedness” vs “Gender”.

Table 5.22: Cross-Tabulation: “Perception of Graduate Preparedness” vs “Gender”

			Gender		Total
			Male	Female	
To what extent do you believe recent graduates are well-prepared for employment	Not at all prepared	Count	8	15	23
		% within to what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	34,8%	65,2%	100,0%
		% within Gender	6,6%	8,8%	7,8%

in the Accommodation sector with their current skill set?		% of Total	2,7%	5,1%	7,8%	
	Somewhat unprepared	Count	28	37	65	
		% within to what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	43,1%	56,9%	100,0%	
		% within Gender	23,0%	21,6%	22,2%	
		% of Total	9,6%	12,6%	22,2%	
	Neutral	Count	36	53	89	
		% within to what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	40,4%	59,6%	100,0%	
		% within Gender	29,5%	31,0%	30,4%	
		% of Total	12,3%	18,1%	30,4%	
	Somewhat prepared	Count	27	50	77	
		% within to what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	35,1%	64,9%	100,0%	
		% within Gender	22,1%	29,2%	26,3%	
		% of Total	9,2%	17,1%	26,3%	
	Very well prepared	Count	23	16	39	
		% within to what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	59,0%	41,0%	100,0%	
		% within Gender	18,9%	9,4%	13,3%	
		% of Total	7,8%	5,5%	13,3%	
	Total		Count	122	171	293
			% within to what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	41,6%	58,4%	100,0%
			% within Gender	100,0%	100,0%	100,0%
% of Total			41,6%	58,4%	100,0%	

Table 5.22 presents the cross-tabulation of the gender of the respondents against their perceptions of the preparedness of recent graduates for employment in the Accommodation sector. As shown in the table, the perceptions of both male and female respondents appear to be similar. For instance, 34.8% of the males and 65.2% of the females felt that graduates were “Not at all prepared” for the industry. Conversely, 59.0% of the males responded that graduates were “very well prepared”, whilst 41.0% of the females felt the same. This suggests that the

males perceive graduates to be more prepared for the industry. Furthermore, 29.5% of the male respondents and 31.0% of the females were neutral about the preparedness of the graduates, followed by 29.2% of females indicating that graduates were ‘somewhat prepared’, with only 22.1% of the males sharing this view. It can be noted that these differences are statistically insignificant as the p-value is 0.150, which exceeds 0.05. Therefore, it can be concluded that there is no statistically significant association between gender and perceptions of graduates' preparedness for the industry.

5.7.3 Cross-Tabulation: “Examining and Interpreting Data related to Tourism to Gain Business Insights” vs “Highest Qualification in Tourism”

Table 5.23 shows the cross-tabulation of “Examining and Interpreting Data related to Tourism to Gain Business Insights” vs “Highest Qualification in Tourism”.

Table 5.23: Cross-Tabulation: “Examining and Interpreting Data related to Tourism to Gain Business Insights” vs “Highest Qualification in Tourism”

			What is your highest qualification in Tourism?							Total
			Higher Certificate	Diploma	National Diploma	Bachelor's Degree	Honours Degree	Master's Degree	No Tourism related qualification	
Examining and interpreting data related to tourism to gain business insights.	Not important at all	Count	13	3	3	2	1	0	9	31
		% within What is your highest qualification in tourism?	22,4%	7,3%	6,8%	7,4%	11,1%	0,0%	8,7%	10,5%
	Slightly Important	Count	9	4	0	3	0	0	7	23
		% within What is your highest qualification in tourism?	15,5%	9,8%	0,0%	11,1%	0,0%	0,0%	6,7%	7,8%
	Moderately Important	Count	10	10	5	6	2	4	26	63
		% within What is your highest qualification in tourism?	17,2%	24,4%	11,4%	22,2%	22,2%	36,4%	25,0%	21,4%
	Very Important	Count	12	18	18	6	3	4	43	104
		% within What is your highest qualification in tourism?	20,7%	43,9%	40,9%	22,2%	33,3%	36,4%	41,3%	35,4%
	Extremely Important	Count	14	6	18	10	3	3	19	73
		% within What is your highest qualification in tourism?	24,1%	14,6%	40,9%	37,0%	33,3%	27,3%	18,3%	24,8%
Total		Count	58	41	44	27	9	11	104	294
		% within What is your highest qualification in tourism?	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

The cross-tabulation in Table 5.23 shows that respondents with higher qualifications, particularly Honours and Master's degrees, are significantly more likely to rate their skill or the importance of this skill as "Extensively" or "Frequently". This underscores the increasing emphasis on data analysis skills for higher-level Tourism professionals. The analysis of the relationship between examining and interpreting data related to tourism to gain business insights and the highest qualification shows a statistically significant association. The Chi-square test of the relationship of “Examining and Interpreting Data related to Tourism to Gain Business Insights” vs “Highest Qualification in Tourism” provides a p-value of 0.012. This is statistically significant as the Pearson Chi-square p-value is less than 0.05.

5.7.4 Cross-Tabulation: “Perception of Graduate Preparedness” vs “Digital Literacy”

Table 5.24 shows the cross-tabulation of **“Perception of Graduate Preparedness” vs “Digital Literacy”**

Table 5.24: Cross-Tabulation- “Perception of Graduate Preparedness” vs “Digital Literacy”

			To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?					Total
			Not at all prepared	Somewhat unprepared	Neutral	Somewhat prepared	Very well prepared	
Digital Literacy	Skill is not required	Count	11	1	9	1	5	27
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	47,8%	1,6%	10,2%	1,3%	12,8%	9,3%
	Slightly Important	Count	1	1	4	1	3	10
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	4,3%	1,6%	4,5%	1,3%	7,7%	3,4%
	Moderately Important	Count	1	5	11	11	6	34
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	4,3%	7,8%	12,5%	14,5%	15,4%	11,7%
	Very Important	Count	0	20	31	23	7	81
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	0,0%	31,3%	35,2%	30,3%	17,9%	27,9%
	Extremely Important	Count	10	37	33	40	18	138
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	43,5%	57,8%	37,5%	52,6%	46,2%	47,6%
Total		Count	23	64	88	76	39	290
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

The cross-tabulation in Table 5.24 shows the relationship between the perceived graduate preparedness for employment in the Accommodation sector and the perceived importance of digital literacy. It can be noted that 57.8% of the respondents considered graduates to be “Somewhat Unprepared”, whilst 52.6% of these respondents indicated that the graduates are “Somewhat prepared”. These respondents also emphasised that digital literacy is “Extremely Important”. Moreover, although 43.5% felt that graduates were “Not at all Prepared”, they also considered digital literacy “Extremely Important”. Whilst 35.2% and 30.3% of the respondents who identified digital literacy to be “Very Important”, only 17.9% of respondents believed that graduates are “Very Well Prepared”. In the categories where the graduates were seen to be “Not at all Prepared”, 47.8% of respondents believed that digital literacy is not required. The Chi-square test of the relationship of “Perception of Graduate Preparedness” vs “Digital Literacy” provides a p-value of 0.000. This is statistically significant as the Pearson Chi-square p-value is less than 0.05. This indicates that the perceptions of digital literacy are not independent of perceptions of graduate readiness. Rather, it can be noted that there is a meaningful relationship whereby, when there is an increased importance placed on digital literacy, it correlates with critical evaluations of graduate skill levels. It can therefore be stated from the results that digital literacy is a fundamental factor in terms of identifying how prepared graduates are for the Accommodation sector and that there is a fairly substantial percentage of graduates who seem to be insufficiently prepared with this skill, which indicates a critical skills gap. Therefore, it is important for academia to collaborate with industry and align its curriculum in line with industry requirements.

5.8 Correlation Insights on Smart Tourism and 4IR in KZN Accommodation Establishments

This section interprets the significant correlations from the provided data, regarding Smart Tourism and 4IR applications used within accommodation establishments in KZN. The analysis is based on Spearman's rank correlation coefficients, with the statistical significance determined by a p-value of less than 0.05 (indicated by ** for $p < 0.01$). Refer to Table 5.25, which provides a snapshot of the correlations.

Table 5.25: Correlations

			I am familiar with the concept of Smart Tourism.	I am aware of the Fourth Industrial Revolution (4IR).	I know how 4IR impacts the tourism industry	I have personally used 4IR technologies or Smart Tourism application	Road trippers	Social media adverts	Facebook	Pinterest	Google Maps	LinkedIn
Spearman's rho	I am aware of the Fourth Industrial Revolution (4IR).	Correlation Coefficient	0.624**									
		Sig. (2-tailed)	0.000									
		N	294									
	I know how 4IR impacts the tourism industry.	Correlation Coefficient	0.659**	0.814**								
		Sig. (2-tailed)	0.000	0.000								
		N	294	295								
	I have personally used 4IR technologies or Smart Tourism applications	Correlation Coefficient	0.502**	0.542**	0.522**							
		Sig. (2-tailed)	0.000	0.000	0.000							
		N	292	293	293							
	Google Maps	Correlation Coefficient				0.606**						
		Sig. (2-tailed)				0.000						
		N				289						
	YouTube	Correlation Coefficient				0.497**						0.725**
		Sig. (2-tailed)				0.000						0.000
		N				290						289
	Netflix	Correlation Coefficient				0.386**						
		Sig. (2-tailed)				0.000						

		N				289						
	Amazon	Correlation Coefficient				0.381**						
		Sig. (2-tailed)				0.000						
		N				284						
	Facebook	Correlation Coefficient				0.443**	0.404**					
		Sig. (2-tailed)				0.000	0.000					
		N				292	287					
	Social Media Adverts	Correlation Coefficient				0.461**	0.389**	0.725**				
		Sig. (2-tailed)				0.000	0.000	0.000				
		N				293	287	293				
	Pinterest	Correlation Coefficient				0.446**			0.480**			
		Sig. (2-tailed)				0.000			0.000			
		N				289			290			
	Airbnb	Correlation Coefficient				0.402**				0.622**	0.473**	
		Sig. (2-tailed)				0.000				0.000	0.000	
		N				288				289	287	
	Smart Tourism and applications of the Fourth Industrial Revolution (4IR) raise the overall quality of the tourist experience.	Correlation Coefficient	0,235**	0,306**	0,311**	0,481**						
		Sig. (2-tailed)	0,000	0,000	0,000	0,000						
		N	291	292	292	291						
	Apple Maps										0,382**	
											0,000	
											287	

The data reveals several strong and highly significant positive correlations related to the awareness and usage of Smart Tourism and 4IR applications.

Awareness and Knowledge of 4IR and Smart Tourism

A very strong positive correlation exists between "I am familiar with the concept of Smart Tourism" and "I am aware of the Fourth Industrial Revolution (4IR)" ($r = 0.624, p < 0.01$). This indicates that familiarity with Smart Tourism is strongly linked to general awareness of the 4IR. There is also a very strong positive correlation between "I am aware of the Fourth Industrial Revolution" and "I know how the 4IR impacts the tourism industry" ($r = 0.814, p < 0.01$). This suggests that awareness of 4IR is closely associated with understanding its impact on the Tourism industry. A strong positive correlation is observed between "I am familiar with the concept of Smart Tourism" and "I know how 4IR impacts the tourism industry" ($r = 0.659, p < 0.01$). This highlights a clear link between understanding Smart Tourism and knowing the 4IR's industry impact.

Personal Usage of 4IR Technologies/Smart Tourism Applications

"I have personally used 4IR technologies or Smart Tourism applications" shows strong positive correlations with familiarity with Smart Tourism ($r = 0.502, p < 0.01$), awareness of 4IR ($r = 0.542, p < 0.01$) and knowing how 4IR impacts Tourism ($r = 0.522, p < 0.01$). This indicates that individuals who are more aware and knowledgeable about these concepts are also more likely to have personally used such applications.

Specific Application Usage

Usage of general mapping applications like Google Maps ($r = 0.606, p < 0.01$) is strongly correlated with having "personally used 4IR technologies or Smart Tourism applications".

Popular social media platforms and travel booking sites like Facebook ($r = 0.443, p < 0.01$), Social media adverts ($r = 0.461, p < 0.01$), Pinterest ($r = 0.446, p < 0.01$) and Airbnb ($r = 0.402, p < 0.01$) show strong to moderate positive correlations with personal usage of 4IR/Smart Tourism applications. This suggests that these platforms are integral to how individuals engage with such technologies. Streaming and e-commerce platforms like YouTube ($r = 0.497, p < 0.01$), Netflix ($r = 0.386, p < 0.01$) and Amazon ($r = 0.381, p < 0.01$) also have significant positive correlations with personal 4IR/Smart Tourism application usage, albeit with moderate strength, possibly indicating a broader digital engagement that includes these platforms. The

correlation analysis highlights a strong consensus amongst respondents regarding the interconnectedness of 4IR awareness, Smart Tourism concepts and their practical application and benefits within the KZN Accommodation sector. There is a clear indication that the personal usage of general and specific 4IR/Smart Tourism applications is positively associated with a deeper understanding of these concepts.

5.9 Measurement Model and Structural Equation Modelling (SEM)

The SEM analysis was conducted to validate the model developed for this research. Figure 5.10 presents the path diagram illustrating the measurement and structural components. The diagram shows how the latent constructs—Usage of Smart Tourism and 4IR Applications (B), 4IR Skills and Training Needs (C) and Perceptions of Graduates' 4IR Competencies (D)—are measured by observed variables derived from the questionnaire.

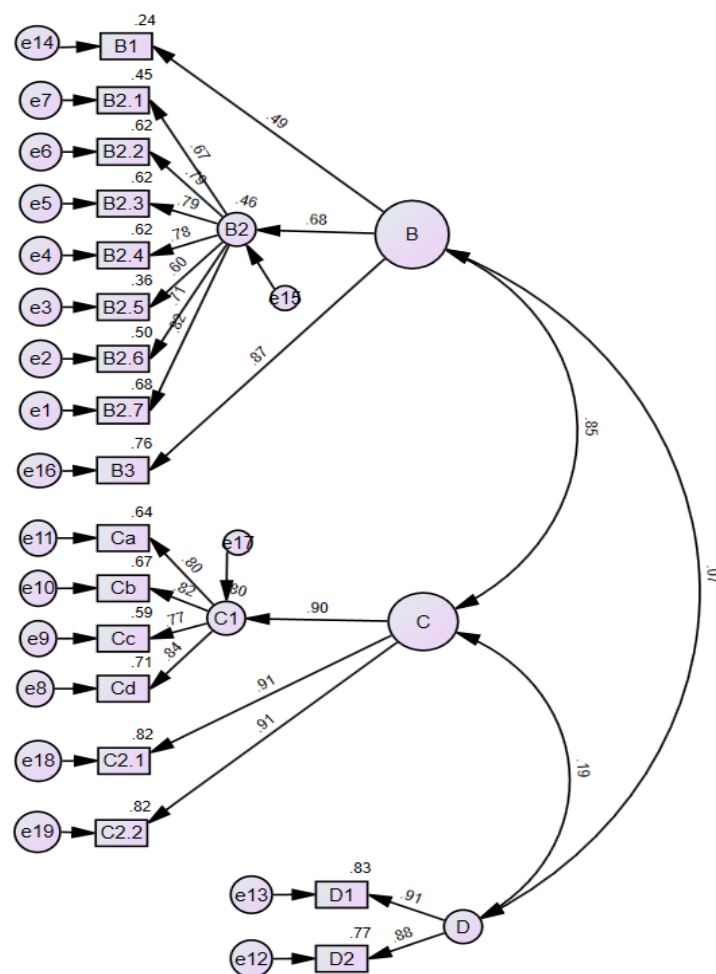


Figure 5.10: Structural Equation Model Illustrating the Relationships Among Smart Tourism Usage, Skills and Training Needs and Perceptions of Graduate Competencies

The model demonstrates that:

- **B** is measured by indicators representing awareness and types of Smart Tourism and 4IR applications (**B2.1–B2.7**), derived from **Section B** of the questionnaire.
- **C** is measured by indicators reflecting skills assessment and training needs (**C1** and **C2**), from **Section C**.
- **D** is measured by perceptions of graduates' readiness (**D1** and **D2**), from **Section D**.

Each observed variable is linked to its latent construct through standardised factor loadings, all exceeding the recommended threshold of 0.60, confirming acceptable reliability and convergent validity.

Model Interpretation

The structural paths indicate that higher levels of Smart Tourism and 4IR adoption (**B**) are strongly associated with increased training needs and expectations (**C**), which in turn significantly influence perceptions of graduate preparedness (**D**).

- **B** → **C**: Strong and significant, suggesting that as Tourism establishments adopt more 4IR technologies, the demand for upskilling and reskilling increases.
- **C** → **D**: Strong and significant, indicating that perceptions of graduate readiness are largely shaped by the extent to which training and skills development meet industry requirements.
- **B** → **D**: Weak and non-significant, implying that technology adoption alone does not directly enhance perceptions of graduate competence. The effect is mediated through training and skills.

Regression and Correlation Analysis

Relationship	Estimate	S.E.	p-value	Correlation
C ↔ B	0.627	0.086	< 0.001	0.847
C ↔ D	0.210	0.078	0.007	0.187
D ↔ B	0.063	0.066	0.342	0.066

These results indicate:

- A **strong and significant** relationship between B and C, highlighting that technological adoption and skills/training requirements are closely aligned.
- A **moderate but significant** relationship between C and D, suggesting that improvements in training and skills can positively influence perceptions of graduate competence, although the impact may take time to manifest.
- An **insignificant** relationship between B and D, reinforcing that training acts as a mediator.

Model Fit and Validation

The model demonstrated an adequate overall fit:

- **CFI** = 0.894
- **TLI** = 0.885
- **RMSEA** = 0.077 (moderate fit)
- **All standardised loadings** > 0.60

While the chi-square statistic ($\chi^2 = 496.051$, $df = 114$, $p < 0.001$) was significant, this is common with large samples. Other fit indices support the adequacy of the model in representing the data.

Extended Discussion

The strong $B \rightarrow C$ pathway confirms global research findings that adopting 4IR technologies in Tourism directly drives the need for advanced digital and technical skills (UNWTO, 2022). In practice, as more hotels, resorts and tourism operators use AI chatbots, automated booking systems and data analytics tools, there is a parallel demand for employees trained in these systems. The $C \rightarrow D$ relationship highlights the crucial role of higher education in bridging the skills gap. If training provided by universities and vocational institutions aligns with industry needs, perceptions of graduate readiness improve. However, the weaker correlation between C and D (0.187) may reflect a lag effect as curriculum changes often take years to fully translate into perceived graduate competence in the workforce. The absence of a significant direct relationship between B and D suggests that simply increasing technology use in the Tourism industry will not automatically improve graduate readiness. Without targeted training (C), graduates may lack the skills required to operate effectively in technology-rich environments. This reinforces the mediating role of C in the model.

Implications for the Transformative Curriculum Model

These findings validate the proposed Transformative Higher Education Curriculum Model in Smart Tourism for the 4IR era. They highlight that:

1. Curriculum design must prioritise practical, industry-aligned digital skills training.
2. Partnerships between universities and the Tourism industry are essential to ensure training content reflects real-time technological developments.
3. Without such alignment, graduates risk entering the workforce underprepared, despite rapid technological adoption in the sector.

5.10 Chapter Summary

This chapter presented the quantitative analyses from data obtained from the structured survey administered to staff working within the Accommodation sector in KZN. As highlighted above, there were several key trends in relation to the readiness of the Tourism industry for the adoption of 4IR technologies and graduates' competencies relative to industry expectations. In summary, the survey results showed that while some digital tools, for example, booking systems and property management systems, were moderately adopted, most businesses were not using more advanced technologies such as AI chatbots or data analysis tools. The digital maturity gap amongst establishments has implications for the digital preparedness expected from graduates. The SEM results provided further support for the relationships between core variables. There was a significant path from using 4IR technologies to skills and training needs and from these training needs to perceptions of graduate competence. These findings suggest that digital adoption increases demand for digitally competent graduates, but universities are not preparing their students to meet these expectations. The next chapter presents the analysis of the qualitative data.

CHAPTER SIX: PRESENTATION OF THE QUALITATIVE RESULTS

6.1 Introduction

Figure 6.1 provides an overview of the phases undertaken in this study using the explanatory sequential mixed-method approach. This chapter presents the thematic analysis of the qualitative data collected from interviews with eleven participants in management roles at various accommodation establishments across KwaZulu-Natal (KZN).

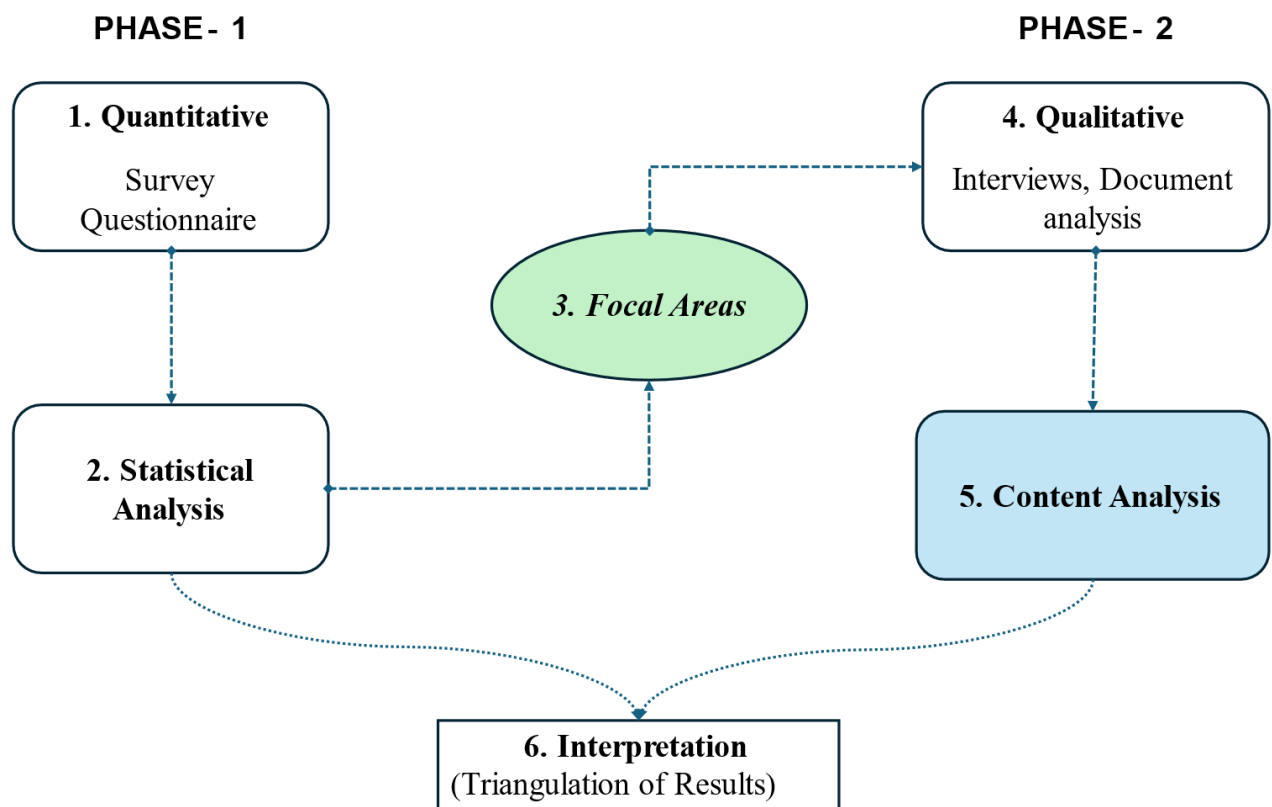


Figure 6.1: Explanatory Sequential Representation of the Study

Source: Researcher's Construction

The interviews explored perspectives on integrating Fourth Industrial Revolution (4IR) technologies; the preparedness of graduates entering the Tourism industry; and the adequacy of current higher education curricula in equipping graduates for a technology-driven industry (Refer to Annexure J for a copy of the Interview Schedule). In addition, this chapter adopts the

Innovative Technologies Framework for Hospitality and Tourism Curriculum Development (Chapter Three, Figure 3.2) to interpret the emerging themes. The qualitative themes are interpreted alongside the Structural Equation Model (SEM) results (Chapter Five, Section 5.9) to explain *why* the observed quantitative relationships occur in practice and to inform curriculum design choices presented in Chapter Seven.

This framework provides the foundation for assessing the current state of Tourism education against the technological transformation expectations of 4IR, particularly around curriculum design, technology use, and the employability of graduates. Additionally, the Multi-Dimensional Conceptual Framework (Chapter Three, Figure 3.3) helped to guide the data analysis by identifying relationships between each theme, each sub-theme, and the core constructs of the framework, such as curriculum responsiveness, 4IR readiness, and Smart Tourism adoption. This two-fold theoretical lens of interpretation facilitates continuity in data interpretation arising from a consistent analytical framework, which privileges both educational and technological imperatives.

Furthermore, to supplement and triangulate the primary data collected through interviews, a document analysis was performed to examine how the Tourism and Hospitality curricula offered by selected universities in the province represent the skills, technologies and competences necessary in relation to 4IR and Smart Tourism. The document analysis served two purposes, namely to understand the degree to which higher education incorporates digital competences into formal training, as well as to corroborate the themes that emerged from stakeholder interviews relating to the curriculum gap, graduates' readiness and the industry's changing demands.

6.2 Visualisation of Key Concepts from the Interview Data

Using the NVivo12 software, a word frequency search was conducted to highlight the most mentioned terms in the interviews. The results are illustrated by the word cloud in Figure 6.2. In this visual, the key concepts that stand out are depicted, with bigger words showing a higher mention rate. This word cloud proffers a straightforward insight into the main issues, priorities and focus areas for industry stakeholders, touching on topics associated with the Fourth Industrial Revolution and Smart Tourism preparedness.

Table 6.1: Stakeholders Interviewed for the Study

Stakeholder	Establishment	Establishment Size	Location	Number interviewed
Front Office Manager	Hotel	Approximately 80 Staff	Nkwazi, KwaZulu-Natal	1
Reservations Manager	Hotel	Approximately 120 Staff	Durban, KwaZulu-Natal	1
Front Office Manager	Hotel	Approximately 80 Staff	South Coast, KwaZulu-Natal	2
Food and Beverage Manager				
Owner/Management	Bed and Breakfast	Approximately 5 staff	North Coast, KwaZulu-Natal	1
Reservations Manager	Hotel	Approximately 80	Umzumbe, KwaZulu-Natal	2
General Manager				
General Manager	Hotel	Approximately 120 staff	Amanzimtoti, KwaZulu-Natal	3
Front Office Manager				
Food and Beverage Manager				
Owner/Management	Lodge	Approximately 10 staff	Drakensberg, KwaZulu-Natal	1

6.4 Outcome of the Coding Process

The coding process entailed clustering concepts and codes that were conceptually related and emerging from the qualitative data into overarching thematic categories. This process enabled an ordered interpretation of participant perspectives and aligned with the overall research aim. As seen in Table 6.2, a total of four main themes were generated through this analytic process, based on clusters of related responses. These themes highlight the study's aim of developing a Transformative Higher Education Curriculum Model in Smart Tourism within the 4IR, aligned with emerging technological mechanisms in the Tourism industry.

Table 6.2: Thematic Clustering and Alignment with the Research Aim

Clustering	Themes	Research Aim
Digital skills Software literacy Communication preparedness	T1: Gaps in Graduate Readiness for the 4IR Tourism Workplace	To develop a Transformative Higher Education Curriculum Model in Smart Tourism within the 4IR to ensure that higher education is aligned with the technological developments in the tourism industry.
Use of booking systems Mobile apps. AI-enabled interfaces	T2: Adoption and Application of Smart Tourism and 4IR Technologies	
Organisational barriers to Digital upskilling Cybersecurity concerns	T3: Institutional and Individual Challenges to 4IR Skills Development	
Curriculum revision needs, Experiential learning Digital literacy	T4: Curriculum Reform and Future Role of 4IR in Tourism Education	

6.5 Summary of Themes and Sub-Themes

Table 6.3 illustrates the four main themes (T) and sub-themes (ST) that emerged from the interviews. Each of the distinctive themes is considered in the context of the theoretical and conceptual frameworks covered in Chapter 3: Innovative Technologies Framework for Hospitality and Tourism Curriculum Development; the Technology Acceptance Model (TAM); and the researcher's own Multi-Dimensional Conceptual Model for integrating 4IR skills into Tourism curricula (Figure 3.3).

The Innovative Technologies Framework for Hospitality and Tourism Curriculum Development provides a curriculum focus for evaluating the readiness of higher education to respond to digital requirements in Tourism. It enabled an investigation of the sub-themes of curriculum content, institutional capacity and the integration of Smart Tourism. Themes that explored the gaps regarding graduate readiness, curriculum change and the inclusion of digital innovation were located within this framework's focus on education facilitating industry technology relevance.

The Technology Acceptance Model (TAM) explains how individuals and institutions interact

with technology. Constructs that contribute to the understanding of TAM, such as perceived ease of use, perceived usefulness and external variables, were useful in analysing the themes related to graduates' digital preparedness; the use of artificial intelligence (AI) tools; and institutional barriers to digital professional development. They provide insight into graduate ambivalence and inconsistent institutional engagement with 4IR technologies.

The researcher's Multi-Dimensional Conceptual Model for integrating 4IR skills into Tourism curricula also served as an integrative tool that could link the theoretical and empirical bases for the study. It clearly defined the relationships between curriculum design, graduate outcomes, 4IR and stakeholder engagement issues. The model provided considerable aid in defining the thematic coding structure and arranging the interconnections between the higher education offerings and Smart Tourism requirements.

Taken together, these frameworks helped shape the analytical interpretation of the qualitative data whilst also helping to situate the outcomes against a strong theoretical background. Therefore, there are no thematic outcomes in Table 6.3, which should be regarded as independent, but rather relevant to a conceptual understanding of Tourism education reform in relation to 4IR.

Table 6.3: Themes, Sub-Themes and Framework Alignment

Main Theme	Sub-Themes	Theoretical/Conceptual Framework Alignment	Linked Research Objectives
T1: Gaps in Graduate Readiness for the 4IR Tourism Workplace	ST1: Limited foundational digital skills ST2: Inadequate knowledge of industry-specific systems ST3: Deficiency in soft skills ST4: Disconnect between HE curriculum and industry demands ST5: Inconsistent application of 4IR	TAM – 'Perceived ease of use' explains weak digital confidence among graduates. Innovative Technologies Framework for Hospitality and Tourism Curriculum Development – Emphasises foundational digital skills as a baseline for Smart Tourism readiness. Multi-Dimensional Conceptual Model for integrating 4IR skills into tourism curricula (Fig. 3.3) – Highlights gaps in curriculum	RO2, RO4

	skills among graduates	readiness and digital competency development.	
T2: Adoption and Application of Smart Tourism and 4IR Technologies	ST1: Use of booking and property management systems ST2: Integration of travel and navigation applications ST3: Social media as a marketing and engagement tool ST4: Emergence of AI-driven technologies and chatbots ST5: Disparities in technological adoption	Innovative Technologies Framework for Hospitality and Tourism Curriculum Development – Emphasises institutional responsiveness to emerging tools. TAM – 'Perceived usefulness' and 'actual system use' relate to the adoption patterns in industry. Multi-Dimensional Conceptual Model for integrating 4IR skills into tourism curricula – Aligns emerging technology applications with curriculum adaptation.	RO1
T3: Institutional and Individual Challenges to 4IR Skills Development	ST1: Time and resource constraints ST2: Limited access to ongoing training ST3: Organisational readiness for digital training ST4: Cybersecurity and data privacy challenges	TAM – Explains low training uptake through 'external variables' like cost and complexity. Innovative Technologies Framework for Hospitality and Tourism Curriculum Development – Identifies organisational bottlenecks in upskilling and training integration. Multi-Dimensional Conceptual Model for integrating 4IR skills into tourism curricula – Links workforce capacity with institutional support systems and digital transition planning.	RO2
T4: Curriculum Reform and Future Role of 4IR in Tourism Education	ST1: Real-world system training requirements ST2: Suggested curriculum inclusions ST3: Vision of 4IR in higher education	Innovative Technologies Framework for Hospitality and Tourism Curriculum Development – Supports redesign of tourism education for 4IR relevance. TAM – Links curriculum	RO3

	ST4: Importance of cybersecurity education	relevance to student attitudes toward emerging technologies. Multi-Dimensional Conceptual Model for integrating 4IR skills into tourism curricula – Emphasises curriculum innovation, teaching strategies and technology integration.	
--	--	---	--

6.6 Theme 1: Gaps in Graduate Readiness for the 4IR Tourism Workplace

This theme explores the extent to which Tourism graduates are adequately prepared for the demands of a digitally evolving Accommodation sector within the 4IR. The research data shows that participants lack essential digital skills and industry-specific system competencies, as illustrated in Figure 6.3. The findings demonstrate that higher education training does not match the technological competencies needed in the workplace.

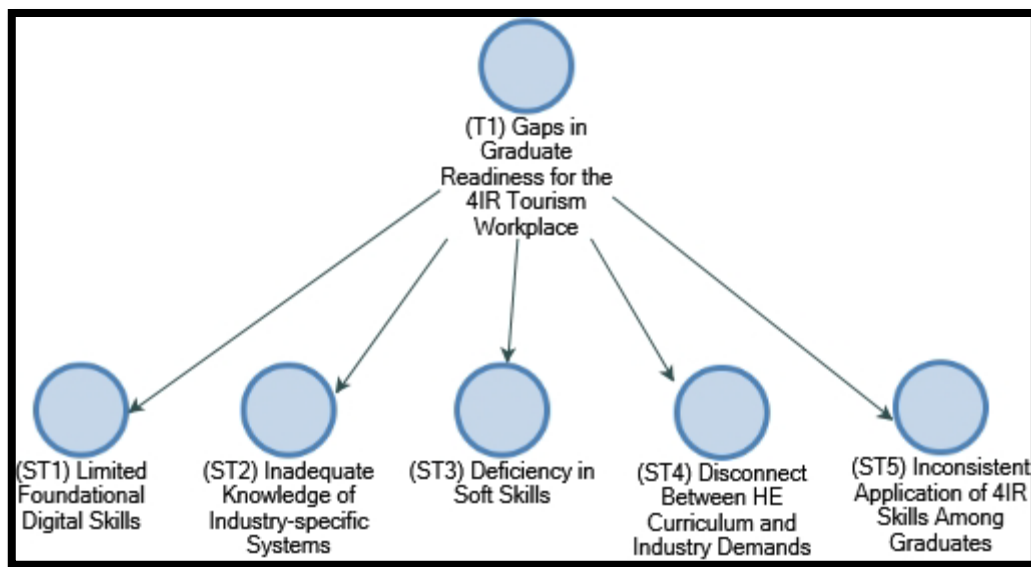


Figure 6.3: Visual representation of Theme 1 and Sub-themes

6.6.1 Sub-Theme 1: Limited Foundational Digital Skills

One of the most cited concerns amongst participants was the lack of basic digital literacy amongst graduates. Respondents noted that many new employees are not proficient in simple yet essential computer operations, such as using Microsoft Word, Excel, PowerPoint, sending professional e-mails, or navigating the internet. These foundational skills are considered baseline competencies in today's accommodation establishments, where administrative and

guest services are increasingly digitised.

Participant #1 expressed the concern as follows:

“Graduates lack knowledge on technology especially with the systems that hotels use... the graduates lack internet use, Microsoft skills and communicating via email professionally.”

Participant #10 elaborated on the time-consuming nature of onboarding graduates who lack even the most basic skills:

“In my opinion, I feel that most graduates lack basic computer skills. We have a system known as Opera and when we try to teach the system, we find ourselves having to learn how to exit a programme, start a computer, use Microsoft Word, Excel etc.”

This feedback reveals that the challenge is not just about lacking experience with advanced tools, but rather a basic difficulty in functioning within a digital environment. These shortcomings cause significant delays in adapting to work roles; impose extra training demands on employers; and hinder the organisation’s overall effectiveness. Akther (2022:2690-2692) argues that graduates often lack skills related to the 4IR because the education curriculum does not adequately comprehend or incorporate 4IR technologies like virtual and augmented reality, big data analysis, artificial intelligence and the Internet of Things (IoT). Pervez, Mahmood and Akram (2024:397-398) agreed that Tourism graduates frequently finish university without the fundamental technological skills required to succeed in their careers.

6.6.2 Sub-Theme 2: Inadequate Knowledge of Industry-Specific Systems

Participants expressed concern that graduates also lack proficiency in hospitality-specific technologies integral to daily operations in accommodation establishments. Tools such as Opera Cloud, Protel, Mews and Global Distribution Systems (GDS) were frequently cited as platforms with which graduates had little to no experience.

Participant #3 noted:

“There are many systems being used and students don’t have knowledge on systems used in the industry. Protel system is used by industry for making reservations and capturing bookings. This is what students are lacking knowledge on. The other system is Mews which students don’t have knowledge on.”

Participant #1 expressed the view that:

"Graduates lack knowledge on technology especially with the systems that Hotels used. Graduates are lacking on knowledge on the Global Distribution systems and understanding how the online booking platforms operate."

This deficiency reinforces the opinion that colleges and universities are not thoroughly preparing students for the technology demands of today's Tourism industry. This disconnection not only makes the transition into the workforce slower but also hampers new graduates' ability to impact their first few months on the job significantly. Raj and Sharma (2023:86) stressed the importance of teaching students industry-specific software. Syafruddin *et al.* (2025:290) argued that HEIs do not often provide practical, systems-based training that matches the Tourism workplace needs. This shortcoming supports the belief that universities are not preparing students for the tech-savvy environment of today's Tourism industry. This gap slows down how quickly graduates settle into their jobs and limits their ability to make valuable contributions during their first few months of employment.

6.6.3 Sub-Theme 3: Deficiency in Soft Skills

Besides the technical shortcomings, some participants expressed dissatisfaction with graduates' lack of interpersonal skills, especially regarding communication, professionalism and flexibility in a digital work setting. Employers shared examples of graduates having trouble with professional e-mail interactions or not demonstrating the manners needed for roles that interact with customers in a tech-driven service industry. As described by Participant #8:

"Many graduates struggle with effective communication, both written and verbal. This includes the ability to clearly articulate ideas, negotiate and resolve conflicts."

Participant #9 reflected similarly:

"They don't know how to deal with people, especially in a difficult situation. You can see some don't have patience or professionalism. This can cause guests to complain."

These quotes highlight a gap in emotional intelligence and a focus on serving customers well, which are key qualities of the strong interpersonal skills crucial for hospitality roles. It also subtly indicates a wider issue: a lack of self-directed education, resourcefulness and the ability

to tackle challenges, which are qualities typically linked to being prepared for the workforce in 4IR. Without these interpersonal skills, it becomes even more challenging for graduates to move from academic environments to dynamic, customer-focused business settings. Dhaliwal and Misra (2020: 18-34) emphasised that HEIs often neglect these soft skills, which are becoming more valued by employers than just technical expertise.

6.6.4 Sub-theme 4: Disconnect Between HE Curriculum and Industry Demands

Many participants highlighted a misalignment between university training and the practical demands of the Accommodation sector. As noted by Participant #8:

“Graduates are not at all familiar with all the modern-day hotel technology being used in the industry.”

This highlights an ongoing gap between theory and practice. Lubinga, Maramura and Masiya (2023:1) link the lack of readiness for 4IR to a misalignment between classroom teachings and actual industry requirements. Simultaneously, Abbasi, Ali and Bibi (2018: 354-367) point out that there are doubts about the value of hospitality education because it lacks practical, sector-specific training. In summary, this theme indicates that the current educational system is failing to adequately prepare students in Tourism for the challenges posed by a technologically advanced work environment. These findings resonate with existing research critiquing the sluggish pace at which higher education is adapting to technological progress (Vasconcelos and Balula, 2019: 729-737), highlighting the urgent need to revamp the curriculum to include both digital and interpersonal skills in Tourism education.

6.6.5 Sub-theme 5: Inconsistent Application of 4IR Skills amongst Graduates

Although many graduates do not possess core 4IR competencies, a few in the workplace do and they exhibited tangible advantages-efficiency, error reduction, digital marketing capabilities and innovation, according to some of the participants. This sub-theme illustrates the performance differential between graduates with and without 4IR skills, as well as inconsistencies in the quality of graduate output, partly due to uneven exposure to curriculum mapping and partly due to personal initiatives. For example, Participant #3 asserted that:

“Employees with high 4IR skills managed to provide efficient and effective service leading to satisfied customers”.

Participant #4 shared an example about a digitally minded graduate who made an operational difference immediately:

“Last year we had a student from Walter Sisulu who was brilliant in technology. We were busy in December and our Point of Sale got stuck and this student was able to assist and fix the error within five minutes.”

These examples highlight quick and effective decision-making to solve a technical issue and the immediate usefulness and effective application of their educational experience. There is an evident lack of consistency with graduates being ready for the demands of 4IR and only a small percentage have the necessary digital skills to advance and enhance tourism operations. The literature and voices of stakeholders have outlined that these digitally competent graduates provided excellent value as they added efficiencies and reduced mistakes and resulting in innovation (Carvalho *et al.* 2023:1; Chávez-Márquez *et al.* 2023:74). On the contrary, most graduate programmes are not in-depth enough to realise expected output consistently and to close the gap between education and industry expectations. This represents a strong need for regularised, advanced and comprehensive 4IR-related training in higher education to prepare future-ready Tourism graduates.

6.7 Theme 2: Adoption and Application of Smart Tourism and 4IR Technologies

The next theme from the data highlights how accommodation establishments in KwaZulu-Natal are weaving Smart Tourism tools and 4IR technologies into their everyday routines. This theme captures what participants have experienced with digital platforms designed to boost efficiency, elevate customer service and sharpen competitiveness in the fast-changing world of Tourism. The results are organised into five sub-themes, each highlighting a distinct dimension of technological adoption, namely (1) the use of booking and property management systems; (2) the integration of travel and navigation tools; (3) the utilisation of social media as a marketing and engagement platform; (4) the growing role of AI-driven technologies and chatbots in service delivery; and (5) the persistent disparities in technology adoption across establishments. As illustrated in Figure 6.4, these findings provide a nuanced understanding of the digital environment that Tourism graduates are entering and they emphasise the urgent need for higher education curricula to adapt to these emerging industry expectations.

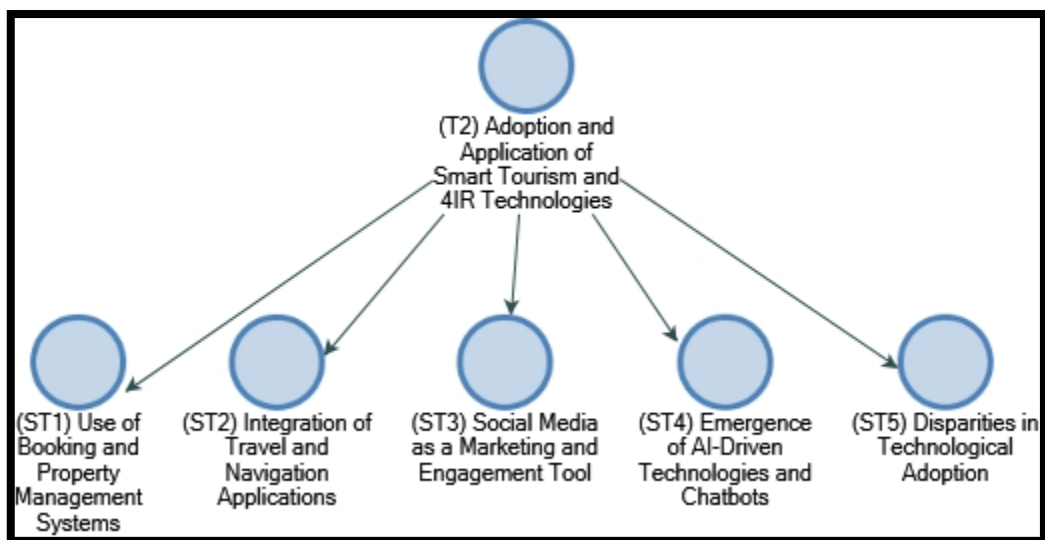


Figure 6.4: Visual Representation of Theme 2 and Sub-Themes

6.7.1 Sub-theme 1: Use of Booking and Property Management Systems

Participants emphasised the importance of digital booking platforms and property management tools like Opera, NightsBridge, Protel and GuestRevu. They viewed these resources as essential for handling reservations, monitoring guest information and streamlining automated services. These systems were seen as crucial for boosting efficiency, minimising mistakes in administration and increasing customer satisfaction by providing instant data access and seamless operations. Participant #3 explained:

“For bookings – the hotel uses Protel. Microsoft Office is used for e-mails, Word, Excel, PowerPoint. Social media apps. – Booking.com for advertising and Expedia, Agoda, Lekkerslaap, TripAdvisor for travelling, are used currently.”

Similarly, Participant #5 highlighted the multi-functional nature of their digital ecosystem:

“NightsBridge and Booking.com are the platforms used to allow guests to book themselves in. The owner uses a NightsBridge app. on her phone. Bookings are viewed by phone and on e-mail.”

Participant #11 articulated the operational complexity of these systems and the advantage students would gain through multi-system familiarity:

“So, we’re currently on Opera. Bridge does their own system. All these online booking systems and integrated solutions... I think if somehow there

could be more exposure to the different systems out there, it would be a huge help with students coming in saying 'I've had a bit of experience with this' as opposed to 'I'm only exposed to Opera.'"

These accounts highlight how property management systems act as essential tools for today's accommodation managers, allowing for automation, improving precision and fostering services that put customers first. These insights align with Provenzano and Baggio (2020:847-848), who explain that e-Tourism is essentially about digitalising how Tourism businesses operate, such as booking hotels and renting cars through online platforms. Likewise, Khan, Khan and Khan (2023:7823-7833) asserted that technology in travel and hospitality is crucial for contemporary tourism, making booking easier and improving customer service. These technologies highlight progress and show a fundamental shift in how tourism businesses connect with customers and handle their operations.

6.7.2 Sub-theme 2: Integration of Travel and Navigation Applications

Participants also observed that travel apps have become popular tools for helping guests get around and plan their trips. Apps like Google Maps, TripAdvisor and Road Trippers help travellers find their way and shape how they explore and rate the places they visit.

As Participant #10 observed:

"Google Maps, TripAdvisor, social media, Facebook, personalised lighting and AI-chatbots. With these 4IR-related technologies, people will have access to information at any given time."

Participant #11 noted the critical role of travel applications in supporting tourist experiences:

"People will have access to 4IR technologies such Google Maps and TripAdvisor at any given time."

This move towards tourism makes mobile platforms not just marketing tools but also essential for enhancing visitor experiences, fundamentally changing how accommodation establishments engage with their guests. Gračan, Zadel and Pavlović (2021: 185-186) support this trend by describing m-Tourism as using mobile apps. tailored to help travellers with their various needs. Moreover, Si-Tou (2024:2643) highlights how mobile technology is reshaping traditional tourist information systems by offering instant access to multimedia content and rapid information sharing.

6.7.3 Sub-theme 3: Social Media as a Marketing and Engagement Tool

Social media platforms such as Facebook, Instagram, Twitter (X) and TikTok were emphasised as crucial tools for engaging with customers and showcasing products or services. Participants discussed how these sites aid in attracting clientele, building brand image and interacting with both prospective and current clients in dynamic, digital spaces.

Participant #9 illustrated this point:

“In our organisation we are currently using different Smart Tourism application systems such as Chatbots, Virtual assistants, Mobile check-ins, Facebook, Twitter and Instagram and Google Maps to attract clients and stakeholders.”

Participant #3 added a pedagogical dimension:

“Students need to have knowledge on social media apps. such as Booking.com, TripAdvisor, Expedia, Hotel.com, Lekkerslaap and Airbnb.”

These insights demonstrate that being skilled in social media is not just an option but an essential skill for those working in the Tourism industry. The literature affirms this shift. Ding (2022: 85-88) pointed out the fast-growing use of social media in the Tourism industry, with Facebook emerging as a standout platform for engaging with global audiences. Tarigan and Tinambunan (2022:505) and Ly and Ly (2024:44-46) emphasised the crucial role of social media in promoting tourism, enabling information exchange between individuals and influencing travel choices. Furthermore, Wibisono and Lale (2024: 141-142) discussed how the skilful use of social media can shape how a tourism destination is perceived, directly impacting consumer behaviour. As a result, being digitally savvy in managing social media has become a critical skill for those working in the Tourism industry.

6.7.4 Sub-theme 4: Emergence of AI-Driven Technologies and Chatbots

A few participants shared that they are using artificial intelligence, particularly AI-driven chatbots. These advancements are being used to simplify everyday communication tasks, lighten employees' workloads and ensure that guests receive 24/7 support.

Participant #6 described his implementation:

“AI chatbots reduced my workload and improved my response time. I have implemented a Chatbot solution into WhatsApp using Meta WhatsApp API.”

Participant #8 noted:

“Chatbots provide round-the-clock customer support, ensuring that guests can get assistance at any time, even outside of regular business hours.”

These examples demonstrate a rising digital sophistication in some areas of the Accommodation sector, where intelligent technologies are being utilised to improve responsiveness, automation and guest convenience. This is supported by Mazumdar, Karim and Banerjee (2025:1), who describe AI as technologies replicating human intelligence to tackle complex challenges. Lin, Huang and Yang (2023:4012) classify chatbots as tools for real-time conversational customer interaction, a feature that is increasingly needed in digital service environments. Ferràs *et al.* (2020:1) emphasised the role of AI in aligning customer needs with personalised tourism offerings, while Sofiyah *et al.* (2024:2127) suggested that AI chatbots boost convenience and satisfaction for both service providers and users. Tussyadiah (2020:1-2) additionally noted that AI facilitates better decision-making and more personalised travel experiences, underscoring its strategic importance in the tourism ecosystem.

6.7.5 Sub-theme 5: Disparities in Technological Adoption

However, despite these advancements, not all participants reported a smooth transition to integrating 4IR technologies. Many participants mentioned obstacles like insufficient infrastructure, budgetary limitations and a lack of digital training for their reluctance to embrace these changes.

Participant #10 candidly shared:

“At the moment we do not have 4IR applications being used at our establishment.”

These acknowledgments highlight a fragmented technological environment throughout the region, indicating that the shift to digital is not consistent and could widen gaps in the Tourism industry. Margit (2023:120-121) points out that the reasons for the sluggish uptake of new technologies often stem from their hefty price tags and the operational hurdles they present, making them particularly challenging for small and mid-sized businesses to handle. Lucks (2022:47-48) adds that moving to systems based on the Fourth Industrial Revolution demands significant changes in strategic planning and company culture, which are frequently missing in resource-poor organisations. If these technological gaps are not addressed, they could widen

inequalities within the Tourism industry and prevent the region from becoming more digitally competitive overall.

The insights from this theme highlight an industry undergoing change, grappling with the conflicting realities of rapid digital advancements and uneven technological abilities. Bigger companies have adopted reservation systems and property management tools, helping to simplify operations and enhance guest experiences. At the same time, the rising popularity of travel apps and mobile guides illustrates the trend of tech-savvy travellers looking for smooth and personalised adventures.

6.8 Theme 3: Institutional and Individual Challenges to 4IR Skills Development

This theme delves into the challenges, both personal and organisational, that hinder tourism employees in the Accommodation sector across KwaZulu-Natal from developing skills necessary for the 4IR. The results indicate that both individual workers and their companies encounter significant obstacles in embracing and enhancing digital skills. These challenges are divided into four categories, namely time and resource constraints; limited access to ongoing training; organisational readiness for digital transformation; and cybersecurity and data privacy concerns, as shown in Figure 6.5.

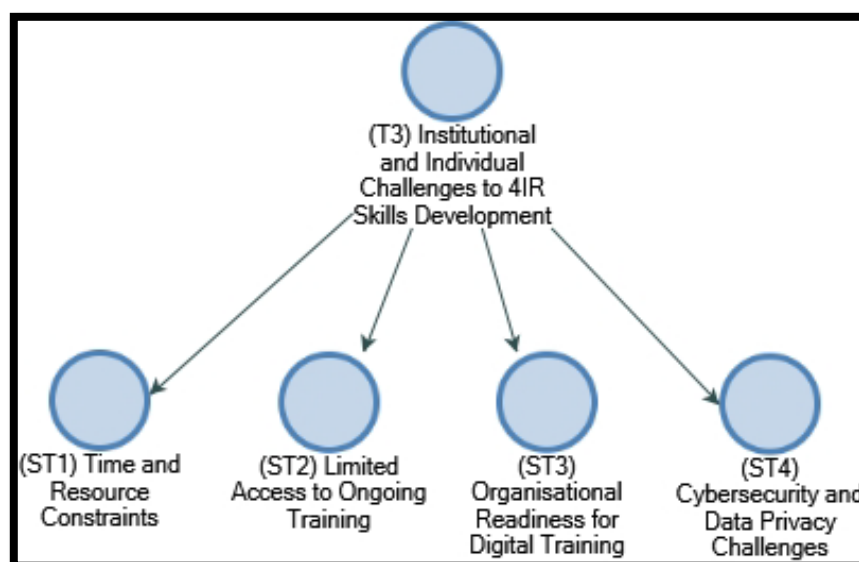


Figure 6.5: Visual Representation of Theme 3 and Sub-Themes

6.8.1 Sub-theme 1: Time and Resource Constraints

Participants cited limited time and tight budgets as major barriers to their professional growth.

Although eager to enhance their skills, employees frequently felt overwhelmed with their daily tasks, which made it difficult to focus on training. Moreover, limited financial resources restricted both company-funded learning opportunities and self-financed training efforts.

Participant #4 expressed:

“Yes, I do face challenges. The company does allow us to learn whatever we want to learn, but the thing is we don’t get time to go for this training. We are really busy at work so this does not allow us to improve our knowledge and skills.”

Similar sentiments were expressed by Participant #2:

“The challenges that I have been facing include having limited employer budgets and also needing to adhere to the standard operating procedures of the company which hindered me from developing my 4IR skills.”

These quotes highlight the inherent obstacles in everyday tasks that stop employees from engaging in 4IR training, even when they are eager and have approval from the organisation. This is consistent with broader findings in the literature showing that financial limitations constitute a significant hurdle to technological progress in the Tourism industry. According to Zsifkovits, Woschank and Pacher (2021:233-236), the costs associated with acquiring, installing and maintaining 4IR technologies are high, making it difficult for smaller companies to implement changes. Li (2023:425-426) also noted that significant technological innovations put a great deal of pressure on management systems, particularly in independently managed enterprises. These structural challenges make it tough for the industry to develop a workforce that is digitally skilled.

6.8.2 Sub-theme 2: Limited Access to Ongoing Training

Another commonly mentioned challenge was the scarcity of consistent, pertinent and easily accessible training options. Although a few participants noted occasional workshops hosted by local tourism organisations, the majority felt that opportunities for professional growth were irregular and inadequate to keep up with the changing demands of technology. According to Participant #6:

“The trainings are very limited and we mostly attend those organised by TKZN and Durban Tourism. Thus, staff members become complacent.”

This sentiment was echoed by Participant #8 who reflected on the regional disparities in training provision:

"Yes, staff in the tourism industry often face several specific challenges when it comes to developing or improving their 4IR skills: Limited Access to Training – High-quality training programmes that focus on 4IR technologies may not be readily available, especially in certain regions. This can make it difficult for staff to gain the necessary skills."

This showcases how the absence of organised learning routes hampers the ongoing development of 4IR skills, causing employees to feel unprepared for new technologies like artificial intelligence, cybersecurity measures, or data management systems. Syafruddin *et al.* (2025:290) share this concern, highlighting how crucial internships and learnerships are for overcoming skill gaps in the Tourism industry. Djunaid (2023:238) supports this by illustrating how well-structured training programmes notably enhance service quality and boost customer satisfaction. Sumitha *et al.* (2021:856) argued for the importance of continuously engaging with new technologies, recommending on-site education, hands-on demonstrations and access to knowledge platforms through mobile devices. Together, these studies indicate that regular hands-on training programmes are vital for developing a tourism workforce that is adaptable and resilient.

6.8.3 Sub-theme 3: Organisational Readiness for Digital Training

Beyond barriers at the individual level, an organisation's culture and infrastructure also play a role in the ability to develop skills for the Fourth Industrial Revolution. Some participants mentioned that their workplaces have not yet embraced digital technologies and still depend on manual processes, thereby hindering the development of digital skills and the integration of relevant training.

As Participant #10 reflected:

"Yes, we are not yet digitised, we have a manual system. So, we are always busy and are not always available to attend skills training to better equip us for advanced technology."

Participant #8 emphasised the implications of inadequate digital integration:

"Technological infrastructure may not support the latest 4IR technologies, making it challenging to implement and practice new skills."

These quotations highlight a more profound challenge of organisational preparedness, whereby companies need to update their systems and emphasise digital know-how amongst their teams before anticipating staff skill enhancement. The literature supports this observation by

indicating that a lack of technological infrastructure can slow down both the implementation and acceptance of 4IR tools. Sumitha *et al.* (2021:850) suggested that companies need to prioritise getting ready internally by adopting technology and changing the culture before they can expect effective skills development. Furthermore, the study results indicate that digital transformation should be a part of an organisation's strategy to support long-term skill growth.

6.8.4 Sub-theme 4: Cybersecurity and Data Privacy Challenges

Several participants voiced concerns about cyber threats and inadequate training in cybersecurity, suggesting that even when some technologies are implemented, staff often lack confidence in handling them securely. The absence of fundamental data protection understanding exposes organisations to breaches and legal issues.

To underscore this concern, Participant #3 highlighted the critical need for awareness, stating:

“Cybersecurity is important because in this time with the usage of technology, one needs to know of their safety. Be aware of which are legit websites to use.”

Expanding on the institutional response, Participant #11 explained the practical steps taken to manage data privacy, noting:

“We would be very careful how we store information and ensure that it is deleted after a month... all the hard copies are going to a locked storage area and then they are properly destroyed after a couple of years. It is something that we are concerned of and aware of.”

The growing shift towards digital solutions in Tourism means that employees not only need to embrace new technologies but also to develop skills in cybersecurity. Jamal, Algeelani and Al-Sammararraie (2024:46-47) averred that many businesses in the Accommodation sector encounter major threats to data privacy and security, especially from online platforms managing personal and financial details. Merdovic and Jovanovic (2024:18-20) discussed the risks of identity theft and unauthorised use of data in the e-Tourism industry. At the same time, Sharma (2023:33-35) emphasised the susceptibility of customer information on digital travel and lodging sites. Consequently, employees' insufficient cybersecurity skills put businesses at risk of damage to their reputation, financial loss and regulatory challenges. Mongia (2024:1-2) stressed that accommodation establishments need to integrate data protection into organisational practices to ensure compliance and foster customer trust.

The findings on this theme shed light on the various challenges that accommodation businesses encounter when building skills related to 4IR. For individuals, employees struggle with a lack of time, heavy workloads and restricted opportunities for professional growth. For organisations, financial constraints, ageing systems and the absence of organised training programmes hinder their ability to provide staff with crucial digital skills.

6.9 Theme 4: Curriculum Reform and the Future Role of 4IR in Tourism Education

The final theme highlighted by the data revolves around the pressure on universities to update tourism courses, considering the changing digital economy. Those involved acknowledged the immediate necessity of curriculum updates to prepare students with the hands-on and mental abilities needed in a tech-focused field. This theme is articulated through four sub-themes, namely real-world system training requirements; suggested curriculum inclusions; the projected role of 4IR in higher education; and the critical importance of cybersecurity education. This is illustrated in Figure 6.6.

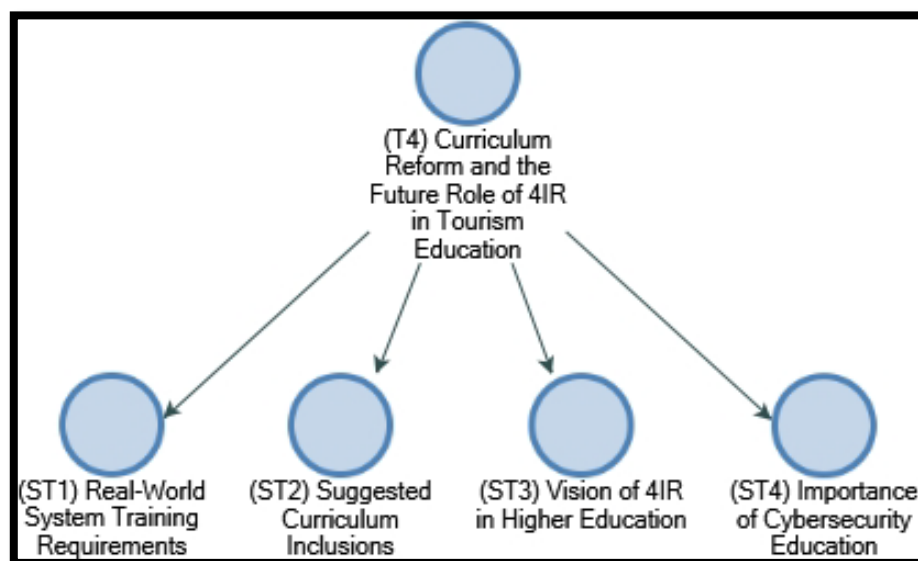


Figure 6.6: Visual Representation of Theme 4 and Sub-themes

6.9.1 Sub-theme 1: Real-World System Training Requirements

A common recommendation from industry participants was that universities should incorporate practical training in the hotel technology systems currently in use. This encompasses booking systems such as Opera, Protel, Hotelia, Semper and GDS platforms. Professionals contend that

without familiarity with these systems, graduates miss the immediate job-ready skills that employers anticipate.

As one Participant #1 emphasised:

“The curriculum should work on training graduates on Global Distribution Systems such as Opera Cloud. Understanding market segments. Different methods of payments, process payments, revenue management, how the industry manages low and peak season, reading of bar levels, Finance and Accounting knowledge, posting of payments.”

Participant #11 articulated a similar sentiment, highlighting that the lack of exposure to these systems during tertiary education places a burden on employers:

“Definitely. I think just from a point of view. So, the different platforms like booking.com and that TripAdvisor, Knightsbridge, you need to be perfectly affiliated with the different systems to be able to update rates and update specials... if somehow there could be more exposure to the different systems out there would be a huge help with students coming in saying I've had a bit of experience with this.”

This sub-theme highlights the importance of a hands-on learning style that goes beyond theoretical understanding to incorporate practical skills related to modern tourism practices. This resonates with research by Sahin and Celikkan (2020:339-341), who observed that many HEIs do not focus enough on information technology in their programmes, causing a gap between what graduates can do and what the industry needs. Additionally, Tsiligiris and Bowyer (2021:625) emphasised that the 4th Industrial Revolution is changing the job market, making it crucial for curricula to include operational technologies to stay current. This sub-theme therefore, highlights the importance of hands-on, system-focused training as a vital part of updating Tourism education.

6.9.2 Sub-theme 2: Suggested Curriculum Inclusions

Participants suggested that academic institutions expand their curriculum to cover essential areas of digital literacy and management, including customer service technology, social media promotions, financial systems and project coordination. They emphasised adjusting educational methods to incorporate practical simulations and extended hands-on learning opportunities.

Participant #4 recommended a holistic curriculum revision that includes both digital tools and managerial competencies:

“Point of Sale, Semper, Tall Order and Micros should be covered in the curriculum. Students also need to do Microsoft Package, MS Word, MS PowerPoint, MS Excel. Project Management is also important. A module on Smart Tourism should be incorporated. Other modules which are important is Communication, Basic Finance Knowledge. Human Resource Knowledge is also important as graduates need to understand the law and also what is expected from them.”

Participant #11 similarly emphasised the importance of digital literacy and administrative accuracy in the Tourism curriculum:

“Probably one of the biggest things that we battle with is not getting accurate data capture... It still is important taking messages that you're getting the right information... It's being able to listen and accurately record things. I think it's a human skill, which is needed.”

These inputs reflect a wish for an adaptable and modular curriculum, allowing it to be customised according to student interests and industry specialisations, thus creating graduates who are more focused and prepared for the workforce. Supporting this perspective, Syafruddin (2025:290-291) highlighted that intelligent Tourism programmes should improve technical and critical thinking abilities. Vasconcelos and Balula (2019:729-730) also called for the inclusion of data literacy, technology literacy and human literacy to nurture flexibility in ever-evolving digital work settings. By incorporating these skills, Tourism graduates would be better equipped to meet market demands while promoting continuous learning and innovation.

6.9.3 Sub-theme 3: Vision of 4IR in Higher Education

The participants firmly believed that technologies from the Fourth Industrial Revolution would significantly influence the future of Tourism education. They anticipate that these tools will overhaul both what is taught and how it is taught. Digital resources are viewed not merely as subjects to learn but as facilitators for cognitive growth, finding solutions and sparking creativity. Participant #1 indicated:

“It's going to create a positive impact on the students because it will prepare the students for the industry needs and wants as most students are turned down because they don't have the knowledge.”

Meanwhile, Participant #5 believed:

“4IR technology will create a situation whereby graduates are trained in computer and internet skills such as MS Word, MS Excel, MS PowerPoint, Internet. Chatbots are important as they need to use these for filtering information.”

These insights demonstrate a forward-thinking approach to higher education, emphasising digital skills in intellectual growth and career readiness. Zulkifli *et al.* (2024:3500-3501) supported this view by suggesting that colleges and universities should revise their teaching models to incorporate project-based learning, flipped classrooms and practical applications. Similarly, Phi and Clausen (2021:1-4) advocate for including digital literacy, creativity and problem-solving in Tourism education to foster innovation. Additionally, Xu *et al.* (2022:1-4) predict that nearly half of the current jobs could be automated within the next ten years, highlighting the pressing need for changes to educational curricula.

6.9.4 Sub-theme 4: Importance of Cybersecurity Education

Participants also highlighted the importance of including cybersecurity, data protection and ethical online behaviour in the educational programme. As the Accommodation sector embraces more digital systems, the dangers of cyberattacks and data leaks increase. Participants considered cybersecurity education crucial for protecting both guests and businesses.

As Participant #11 expressed:

“It’s obviously huge because of the POPI Act and the implications if you get it wrong and there is a leak. You are very much liable for it.”

This quote reflects concern over the legal and reputational risks tied to inadequate data security practices in the Tourism industry. Moreover, Participant #3 noted:

“Cybersecurity is important because in this time with the usage of technology, one needs to know of their safety. Be aware of which are legit websites to use.”

This sub-theme highlights the importance of making digital ethics and cyber-awareness core elements of any updated Tourism education programme. Ghaderi *et al.* (2024:1-2) highlighted that not having enough cybersecurity knowledge can leave tourism businesses vulnerable to scams, cheating and identity theft. Similarly, Mijwil *et al.* (2023:57) described cybersecurity as essential to minimise risks in digital activities. Research outcomes support this perspective

by showing that cybersecurity know-how is no longer a luxury but a necessity to safeguard the reputation and smooth functioning of Tourism enterprises.

The findings generated in this theme highlight an urgent call for updating the curriculum to include practical 4IR tools that align with the ongoing digital changes in the Tourism industry. Participants frequently voiced their worries that colleges and universities are lagging in staying current with technology, resulting in graduates who are not fully ready for jobs where being digitally savvy is not just advantageous but necessary.

6.10 Thematic Document Analysis: University Curricula and 4IR, Smart Tourism

This study conducted a document analysis of official university handbooks from three Higher Education Institutions (HEIs) offering Tourism and Hospitality programmes in KZN. These institutions were selected because they offer specialised Tourism and Hospitality programmes designed to prepare students for careers in the industry. The analysis evaluated how technology implementation and, particularly, artificial intelligence applications appear within the academic programmes.

Table 6.4 summarises comparative modules with technology-related content within Tourism and Hospitality programmes in three universities within KZN.

Table 6.4: Technology-Related Modules in Tourism and Hospitality Programmes at Selected Universities in KwaZulu-Natal

University	Programme	Year/Semester	Module Description
Rural Comprehensive University	Bachelor of Tourism Studies	3 rd Year	Information Technology (IT) & Distribution Channels This module focuses on understanding IT within recreation and tourism, including current technologies, competitive strategies, tourism distribution systems and global and South African distribution channels.
Rural Comprehensive University	BA Honours in Recreation and Tourism	1 Year / Sem 2	Information Technology in Recreation & Tourism (No module description provided)

University of Technology	Higher Certificate in Tourism – HCTRS1 (120 Credits)	1 Year / Sem 1	Technology Applications in Tourism (TAIT101) Introduces students to tourism industry technologies including computer information systems, data capture for tourism services and internet use for information management.
University of Technology	Diploma in Tourism – DITRS1 (360 Credits)	1 st Year / Sem 2	Technological Applications in Tourism (TEPT101) Focuses on foundational computer information systems use in tourism operations, including managing and capturing service-related data.
University of Technology	Diploma in Tourism – DITRS1 (360 Credits)	2 nd Year / Sem 3	Technological Applications for Travel & Tourism (TATT101) Builds on TAIT101 with emphasis on industry-specific systems, virtual professionalism and advanced booking systems.
University of Technology	Higher Certificate in Culinary Skills (HCCSK1)	1 Year / Sem 1	Hospitality Information Technology (HINT101) Introduces theory and practical application of software for hospitality operations, including report compilation and stakeholder communication.
University of Technology	Diploma in Catering Management (DICTM1)	3 rd Year / Sem 5	Catering Information Systems (CISY101) Equips students with IT knowledge for efficient catering enterprise management.
University of Technology	Higher Certificate in Hospitality and Leisure Studies	1 Year / Sem 1	Hospitality Information Technology (HIFT101) Focuses on basic IT tools for reporting, communication and hospitality software usage.
University of Technology	Diploma in Hospitality Management	1 st Year / Sem 1	Hospitality Information Systems (HINS101) Provides basic IT knowledge and skills for hospitality industry application.
University of Technology	Advanced Diploma in Hospitality	1 Year / Sem 2	Hospitality Innovations Examines trends and technological innovations in

	Management (NQF 7)		accommodation, food and beverage sectors.
Urban Comprehensive University	Culture and Heritage Tourism	3 rd Year	Research Methods and IT for Heritage Tourism (CHTM304 H2) Focuses on research methodologies and introduces computer skills to prepare students for employment or postgraduate study.

The document analysis sought to highlight how HEIs in KZN are embedding concepts of 4IR and Smart Tourism within their curricula. The document analysis supplements the interviews described above, presenting institutional data on aspects of the curriculum, hierarchy and responsiveness to the growing digital transformation demand within Tourism. The analysis ultimately highlighted five emergent themes, as discussed below.

6.10.1 Theme 1: Lacking in Graduate 4IR Readiness

The analysis revealed that although programmes included modules entitled 'Information Technology', the breadth of content offered is limited regarding the essential IT skills required. The modules called Technological Applications in Tourism (TEPT101) and Technology Applications in Tourism (TAIT101) at the University of Technology introduce students to using a computer to manage Tourism-related information. However, 4IR technologies, including AI, machine learning and predictive analytics, are not articulated in detail. Similarly, in the Information Technology and Distribution Channels, the third-year module offered at the rural comprehensive university alludes to the usage of technology in distribution channels in tourism, but does not elaborate on advanced technology.

The analysis validates the perceptions from the data collected during the interviews, where participants were cautious about graduates being unprepared for jobs with substantial technology demands. This theme also continues to identify the diminished practical exposure to 4IR technologies that are quickly becoming standard offerings in accommodation environments, such as automated bookings and data analytics software.

6.10.2 Theme 2: Curriculum does not align with Industry Technologies

The curriculum documents reference technologies but do not clearly articulate the specific types of tools and platforms used in the Tourism industry. In the case of technology mentioned by industry stakeholders as being normally used when operating in venues, reference was made to the Opera and NightsBridge booking software, Protel and chatbots. Instead, modules of study talk about general outcomes as follows:

“Students will learn to compile report and communicate with stakeholders as per appropriate software programmes”. (HIFT101, DUT)

The generalised nature of the outcome statement does not just lack specificity, but also ultimately does not respond to industry or stakeholder needs, suggesting that universities are not being agile and responsive to the technology transformation occurring and captured in their teaching and learning practice. This theme also represents a corroboration of educational and career readiness studies that tertiary education is not preparing students with sufficient systems knowledge of the technologies to be immediately employable in Tourism workplaces.

6.10.3 Theme 3: Lack of Smart Tourism and AI in Curriculum Content

Although it is acknowledged that Smart Tourism is relevant in the global discourse, none of the reviewed programmes specifically mentioned Smart Tourism. Even the advanced level qualifications, such as the University of Technology’s Advanced Diploma in Hospitality Management, which did mention "innovations", did not include a definition or cover Smart Tourism technologies (e.g., IoT systems, mobile apps, or virtual worlds) in their course outlines. Likewise, the urban comprehensive university’s CHTM304 module did include IT, but only as a vehicle for research and did not include Smart systems as operational innovations. This is significant because many people see Smart Tourism as a minimum competency in digitally competitive accommodation and destination contexts. The gap in not including these concepts in formal training structures legitimises the participants' reported requests for more transformative curricula that ensure digital realities.

6.10.4 Theme 4: Limited Interdisciplinary and Experiential Learning

Another ongoing theme was the lack of interdisciplinary and applied learning opportunities available to learners. Some modules across the three universities mention using IT when

learners are writing reports or communicating. Still, there was very little experiential learning or integrated real-life simulations, applied internships, or experiential learning in a technology-rich environment. In addition, none of the programmes contained cross-cutting content that connected tourism with, for instance, digital marketing, cybersecurity, data ethics or entrepreneurship in the digital economy. These interpretations are consistent with the qualitative data from the interviews, where participants identified gaps between the WIL periods, their suggested technology workshops and project-based learning to connect theory to practice.

6.10.5 Theme 5: Limited References to AI, Data and Innovation Ecosystems

The curricula did not mention the data-driven context of today's tourism eco-systems. For example, the broader application of AI, predictive analytics, automated risk, blockchain and personalised content were absent in any programme descriptions. Furthermore, in the literature included in this document analysis, including Aydin and Sirkeci (2024:49-50), Alashwal (2024:201-202) and Erkunt (2023:33-34), all appealed for the importance of embedding AI within the education curriculum in Tourism, yet it remains aspirational in the local programme context. The absence of these issues implies that the Tourism educational sector as a whole was not part of the innovation ecosystems, which was also an issue raised by interviewees, noting the students' lack of AI fluency and awareness of cybersecurity and digital decisions.

The document analysis on university handbooks revealed that although some technology-related components were found in Tourism curricula, there is a significant lack of inclusion of Smart Tourism and AI concepts. With technology continuing to advance at a rapid pace, academic curriculum changes will also be needed for Tourism programmes. As Ma (2024:89-91) stated, with AI and big data in Tourism, consumers would have more personalised experiences and more efficiency with existing trips and travels. This is not too dissimilar to the comments offered by Xing (2022:6) that AI applications should be made in Tourism education and training for change to happen and to enhance the quality of the education. Avgeli *et al.* (2020:8-10) added that if AI can be systematically developed in Tourism curricula, this could be a significant aid for students coping with the complexities that exist in Tourism, namely the environment and the market, constantly changing the global spread of AI, enabling innovations and potential changes to work and leisure. The present research confirmed and supported the integration of AI in Smart Tourism and Hospitality education at South African universities.

Aydin and Sirkeci (2024:49) highlighted AI as becoming a key influence in Tourism decision-making and warned that educational institutions unable to recognise this trend are at risk. These authors predict that AI will become fundamental and existential to the tourism space and therefore, the integration of AI into Tourism educational programmes is timely and necessary. Collins, Ali and Yilmaz (2024:35-37) also suggest that AI and machine learning could greatly enhance Tourism education through stimulating learning, real-time data access and immersive simulations. Li, Du and He (2022:1) emphasised that introducing AI into higher education could support students' Smart Tourism applications' ability to pertain to, for example, ecotourism and natural heritage conservation. The ability to investigate the value of AI in Tourism education is not yet fully realised. However, an appreciation of AI's significance is supported across a range of literature.

While the analysis provided a strong rationale for technology in Tourism education, it further showed that it is often only delivered in discrete modules. That is, while some modules are technology-related, they can hardly be considered to be integrated across the programmes (Kinyanjui, 2019:1-2). Furthermore, Kinyanjui's (2019:9) study focused on various constraints to ICT integration in Tourism education, such as low implementation by institutions, lecturers' resistance to using technology and a lack of the infrastructure required for teaching with technology. However, no technology innovations were present in the explored curricula. Therefore, there is an urgent need for investment in AI and Smart Tourism-focused curricula in Hospitality and Tourism education.

The analysis was primarily focused on understanding the extent to which Smart Tourism is recognised and included in the design of programmes. The analysis results did point out places within modules that referred to technological operations and even the notion of "virtual professionalism", but these references were not rigorous and did not appear to capture the full range of Smart Tourism. Ma (2024:90-93) cautioned that the transition to data-driven Tourism will require a paradigm shift. Since AI delivery processes and machine learning can mimic intelligent services, these can immensely enhance and foster African economies through intelligent data collection and service responses. This position is supported by Buhalis, O'Connor and Leung (2022:1-3), which suggests further developing Smart Tourism and adding it into curricula and innovation to prepare future competencies in Tourism.

While it is evident that the University of Technology (UoT) and the Rural Comprehensive University recognise, at a minimum, technology's role in Tourism education, the focus is largely on the delivery concept of digital literacy and administration skills. The UoT's handbook continually connects descriptions of “technological operations” or “computer systems related to industry”, but this can only represent a very brief acknowledgement of the digital processes that should define the Tourism industry. There appears to be little emphasis on Smart Tourism development or AI innovation. This omission warrants further investigation and the development of content to ensure an appropriate curriculum. Muhie and Woldie (2020:1-3) stated that African HEIs must create AI-based Learning tools aligned to tourism students' requirements. The development of these tools, along with the curricular development to realise these opportunities, must take priority. Otherwise, the divide between training and stakeholder needs will only increase.

In summary, despite the existing curricula of Tourism and Hospitality programmes in KZN highlighting, to some extent, engagement with IT and operational technologies, there is insufficient reference to higher levels of and relevance to the key elements of the Smart Tourism industry in line with AI trends. There appears to be a significant opportunity and indeed a need for a curriculum change to parallel global trends and provide graduates with the advanced digital skills required for Tourism industry advancements.

The themes highlighted in this document analysis roughly mirror the themes identified in the interview data, particularly about graduate preparedness for Tourism careers; the relevance of the curriculum to the educational industry; the use of technology in curricula and experiential learning. The qualitative convergence occurring at various levels between both data sources reinforces the systemic nature of the gap between higher education and industry in graduate preparedness for Tourism careers in the 4IR. This data supports the call for a transformational curriculum model that embeds Smart Tourism technology and interdisciplinary skillsets and ensures that South African graduates can turn any tourist touchpoints in the digitally transformed global tourism landscape into opportunities.

6.11 Chapter Summary

This chapter presented a thematic analysis of qualitative information collected from eleven management professionals in various hotels, guest houses and lodges in KZN. The findings were categorised or themed into four areas corresponding to the research aims, providing a richer understanding of how 4IR technologies intersect with Tourism education and how graduates were prepared for the challenges they will face as the Tourism industry evolves.

The first theme revealed considerable gaps in graduates' 4IR technology readiness for the workplace, including competence in essential digital skills, knowledge of systems and protocols relevant to the industry and practical soft skills like communication and agility. The fissure between university curricula and the workplace was echoed by participants in relation to the requirement for a change in curriculum to better integrate theoretical teaching with practical application.

The second theme explored the state of adoption of 4IR technologies and Smart Tourism by the Tourism industry. Participants identified their use of booking systems, navigation applications, social media and AI Chatbots as significant in transforming tourism business operations. Many businesses are embracing technologies. However, clearly, the uneven playing field in relation to 4IR technologies is a real issue of concern for many, including establishments with comparatively minimal or less resourced infrastructure.

The third theme expounded on the organisational and personal barriers to developing 4IR skills. These barriers included restricted time and budget; continuing training access; unpreparedness for digital advancement at the organisational level; and a lack of focus and awareness of cybersecurity. These comments revealed quite complex relationships that embody structural constraints and workforce development, which have enormous implications for the overall developmental potential of the industry's digital readiness.

The fourth theme explored participants' and their expectations of universities to change their curriculum programmes for Tourism. Participants argued that the Tourism curriculum cannot neglect theoretical change with relevant, key considerations for teaching materials, such as practical training on current systems of hotels, better linkages to industry types of demands and specific 4IR issues such as cybersecurity, digital literacy and project-based learning. These

advances can only be achieved if the curriculum is responsive to industry and the focus is on future momentum.

In addition to these insights, a qualitative document analysis of university Tourism and Hospitality education programmes in KZN was undertaken. The analysis confirmed and reinforced the findings from the interviews. The current programme handbooks for the reviewed universities highlighted that while there were some basic IT modules present in their programme of work and education, there was a critical lack of advanced or contemporary 4IR content, such as artificial intelligence, Smart Tourism applications, big data analytics, or cybersecurity content within their modules. The present curriculum was largely theoretical in nature and mostly devoid of practical, interdisciplinary and experiential engagement in their studies or aligned with contemporary industry practices.

Moreover, the document analysis also highlighted the systemically lagging curriculum ambition across South African universities. Not one of the reviewed programmes had a module on Smart Tourism in their curriculum and nowhere did the proposed programme education reflect the technological advancement and innovations currently applied and embraced by for-profit and non-profit accommodation organisations within the industry. This disparity in institutional provision and professional practice solidifies the need for universities to rethink their curriculum to adequately prepare graduates to be digitally competent, operationally competent and competent to adapt in a Tourism industry shaped by 4IR technologies.

The interviews and document analysis present a fragmented Tourism education landscape that must be able to change quickly to be relevant and responsive to technology and employer demands. The next chapter will triangulate the quantitative and qualitative findings to propose a Transformative Higher Education Curriculum Model that integrates 4IR competencies into Tourism training.

CHAPTER SEVEN: TRIANGULATION AND MODEL DEVELOPMENT

7.1 Introduction

This chapter triangulates the results of the quantitative data (Chapter Five) and qualitative thematic analysis (Chapter Six) to address the final research objective: **to develop a Transformative Higher Education Curriculum Model in Smart Tourism within the Fourth Industrial Revolution (4IR)**. By utilising stakeholder perspectives from the Accommodation sector in the Tourism industry, as well as reviewing university curriculum documents, this study was able to bring together the findings to identify areas for improvement and provide recommended actions. This integration is influenced by theoretical perspectives of tourism and hospitality curriculum development in the context of innovative technologies and information and communication technologies, including the Technology Acceptance Model (TAM) and the Multi-Dimensional Conceptual Model presented in Chapter Three (Figure 3.3). These theoretical frameworks provided a theoretical lens to conceptualise where and how 4IR technologies may be integrated into the higher education curriculum within the tourism and hospitality context, thereby further developing graduate readiness and industry alignment. This chapter presents a new Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education for a higher education curriculum that will prepare Tourism graduates for a dynamic and digitally evolving Tourism industry. The model aims to provide graduates with the skills, competencies and experiential learning required to succeed in a rapidly changing tourism regime.

7.2 Triangulation of Quantitative and Qualitative Findings

To ensure the validity of the findings, the study utilised methodological triangulation in data collection by drawing on three interrelated data collection methods: quantitative survey data (which included Structural Equation Modelling (SEM)), qualitative interview data and document analysis. The sequential integration of this evidence helped to develop a multi-dimensional understanding of the current alignment of Smart Tourism to 4IR practices in the Tourism industry and higher education curriculum in KwaZulu-Natal (KZN).

These triangulations are structured by the conceptual foundations in the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development (Figure 3.2), the TAM model (Figure 3.1) and the Multi-dimensional Conceptual Model for integrating 4IR

skills into Tourism curricula (Figure 3.3), which identify 4IR, Smart Tourism, curriculum design and employability as connected constructs within the context of Tourism curriculum reform.

Table 7.1 presents a triangulation of key findings from the quantitative survey, qualitative interviews and document analysis, illustrating the convergence and complementary insights that collectively inform the development of the proposed Transformative Higher Education Curriculum Model in Smart Tourism within the 4IR era.

Table 7.1: Triangulation of Key Findings from Quantitative, Qualitative and Document Analysis

Data Source	Key Findings	Implications for Model Development
Quantitative Survey (Accommodation Establishments)	• High usage of booking systems, navigation tools and some AI applications. • Strong demand for digital and 4IR-related competencies. • SEM showed strong relationships between Smart Tourism usage and skills development. It also showed a somewhat but not strong relationship between the latter and the perceptions of graduate preparedness.	<i>Validates the industry's demand for digital and 4IR integration in higher education. SEM confirms strong linkages between workplace technology use and graduate training needs.</i>
Qualitative Interviews (Management Staff at Accommodation Establishments)	• Graduates lack foundational digital skills, knowledge of industry systems and soft skills. • Limited 4IR and Smart Tourism adoption in the workplace. • Curriculum misalignment noted by management staff.	<i>Emphasises the need for reform in curriculum design to close graduate skills gaps. Supports inclusion of practical, interdisciplinary and tech-aligned components in tourism education.</i>
Document Analysis (University Handbooks)	• Technology and IT content are present in modules, but no direct mention of Smart Tourism or AI. • Modules are fragmented, with little evidence of integrated,	<i>Confirms that current curricula are insufficient for 4IR demands. Justifies the need for explicit inclusion of Smart Tourism, AI and innovation ecosystem</i>

	future-facing curriculum design.	<i>concepts in future curriculum design.</i>
--	----------------------------------	--

The quantitative findings in Chapter Five revealed both a widespread and uneven adoption of Smart Tourism tools and 4IR technologies amongst the selected participants employed at accommodation establishments in KwaZulu-Natal. As depicted in Figure 5.5 (Chapter Five, Section 5.6.2.2), 34.5% of respondents reported that they "Always" use these technologies, 15.7% stated they use them "Often", while 17.4% indicated they have "Sometimes" used these technologies. In general, this means that a total of 67.6% were engaging with these technologies, which indicates an increase, albeit not an uptake, in user adoption of 4IR technologies. Also concerning is that a total of 32.4% of respondents either "Rarely" (10.6%) or "Never" (21.8%) used 4IR technological tools, meaning that there is a significant minority of employees who are not engaging with digital technologies at any level. These technologies are both useful and necessary for the functions of daily operations for an accommodation enterprise through streamlining reservations, guest communication and inventory management. This disparity illuminates a limited level of digital maturity, a finding echoed in the qualitative interviews. It aligns with Theme 2: Adoption and Application of Smart Tourism and 4IR Technologies, specifically Sub-Themes 1 and 4, which demonstrate a reliance on basic booking systems and the growing role of AI-driven technologies and chatbots (Chapter Six, Section 6.7).

The SEM analysis reiterated the relationship between Smart Tourism usage and the perceived competence of graduates. The path coefficient was strong, from the usage of 4IR Technologies to skills and training needs and then from skills and training needs to perceptions of graduate competence (Chapter Five, Section 5.9). These findings indicate that accommodation establishments expect new graduates to have the skills and training attributes related to the digital tools they adopt, acknowledging that skills and attributes expectations were not being adequately met due to curriculum gaps. This observation aligns with the qualitative findings under Theme 1: Gaps in Graduate Readiness, particularly Sub-Themes 2 and 4, which point toward a lack of applied systems knowledge and a disconnect between content in higher education and requirements in the real world (Chapter Six, Section 6.6).

Document analysis supported the themes identified in the qualitative interviews, as the institutional handbook analysis indicated that although some universities contained references to "*industry-related systems*", they had little or no formal inclusion of Smart Tourism ideas like AI, IoT, or data-driven service design. In the analysis, for example, the handbook for a University of Technology referenced "technological operations", but did not mention Smart Tourism, chatbots, or simulation-based learning (Chapter Six). This document-based insight supports the interview analysis under Theme 4: Curriculum Reform and Future Role of 4IR in Tourism Education, particularly Sub-Themes 2 and 3 (Chapter Six, Section 6.9).

Furthermore, the themes from the qualitative interviews (Chapter Six) were closely related to the survey responses (Chapter Five). Both datasets indicated inadequate digital readiness by graduates and critical exposure to systems operating in practice. Overall, both data sources indicated correspondence between curriculum-specific content in relation to industry needs, as referred to above. Moreover, this is highlighted in Theme 4, especially Sub-Theme 1, where participants emphasised the need for experiential system-based education in the Tourism curriculum. This particular theme correlates with the findings in Table 5.17 (Chapter Five, Section 5.7.4), where over 89% of respondents rated digital literacy as "*Very Important*" or "*Extremely Important*". Notably, 43.5% of respondents indicated that graduates were "*Not at all prepared*", while 57.8% reported being "*Somewhat unprepared*", indicating a substantial perceived discrepancy between graduate capabilities and industry expectations regarding digital literacy skills.

Overall, this supports the need for curriculum consideration of the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development (Chapter Three, Figure 3.2). The framework details a practical curriculum context within a specific pedagogical design to embed digital tools, practice learning solutions and institutional embrace. The Multi-Dimensional Conceptual Model for integrating 4IR skills into Tourism curricula, developed in Chapter Three, Figure 3.3, illuminates the interactions between technology adoption anchored against pedagogical strategy and stakeholder influence.

As a collective, the triangulated findings suggest clear convergence across the quantitative and qualitative aspects of the research. The SEM offers confirmation of the structural dependencies between technology adoption, skill needs and views of readiness. The qualitative interviews

reveal the practical implications of having gaps in the field, while the document analysis indicates that the existing curricula are not yet ready to address 4IR imperatives.

In summary, the triangulation identified the following key themes across data sources:

- I. Industry adoption of Smart Tourism tools is occurring, although in an inconsistent manner;
- II. Graduates do not manifest an adequate foundation in digital skills and 4IR technologies; and
- III. As a result, the curriculum needs to be reviewed to include hands-on system training, AI and data literacy.

7.2.1 Structural Equation Model Findings

Quantitative – Qualitative Triangulation of SEM Findings

B→C (adoption drives training needs), C→D (training needs shape perceptions), weak B→D (mediation). This aligns with interview themes (e.g., skill gaps in AI/data, Property Management Systems use and digital marketing).

Curriculum Design Implications from SEM

The C1/C2 gaps point towards modules/work-integrated learning, micro-credentials and partnerships. Hence, “The final model embeds these competencies across core/major/electives”.

Together, this triangulated evidence base and the Structural Equation Model findings support the emergence of a Transformative Higher Education Curriculum Model in Smart Tourism within the 4IR age, which is the focus of the next section.

7.3 Proposed Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education

The newly developed Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education, which is presented in Figure 7.1, uses a product model approach to systematically address curriculum delivery, graduate preparedness and technology use in the context of the 4IR. This model structures the curriculum around functional domains that

perform interdependently and flexibly, enabling modular curriculum design, responsiveness to industry needs and relevance to global Smart Tourism developments. The model addresses RO5 by providing a theoretically backed, empirically driven, holistic and implementable curriculum proposal.

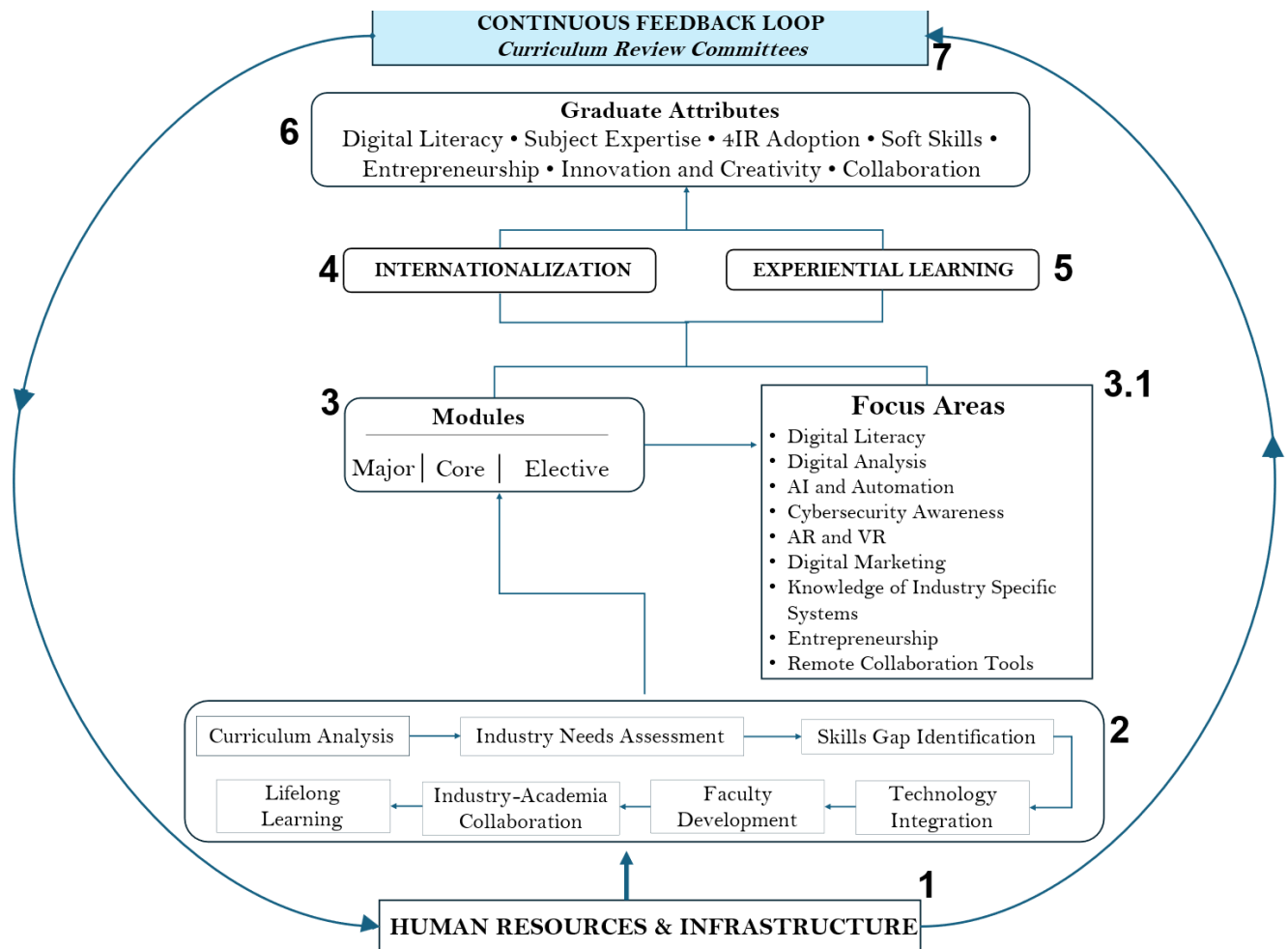


Figure 7.1: Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education

7.3.1 Conceptual and Empirical Foundations

The following theoretical frameworks inform the model:

TAM (Chapter Three, Figure 3.1): It explores perceptions of technology use and the significance of technology adoption for education. A primary explanation of the limited use of Smart systems in both the workplace and the academic curriculum is related to the perceived ease of use and perceived usefulness.

Innovative Technologies Framework for Hospitality and Tourism Curriculum Development (Chapter Three, Figure 3.2): It emphasises the importance of newly emerging technologies such as AI, data analytics and immersive systems in Tourism curricula, thereby allowing higher education to remain responsive to employment trends.

Multi-Dimensional Curriculum Conceptual Model (Chapter Three, Figure 3.3): This conceptual model has been informed by TAM, Innovative Technologies Framework for Hospitality and Tourism Curriculum Development and the study. It provides a springboard for a model that incorporates pedagogical strategy, curriculum content, digitalisation and stakeholder engagement in a continuous loop of feedback.

The model empirically informs findings from the quantitative survey (Annexure I), SEM (Chapter Five, Section 5.9), qualitative semi-structured interviews (Annexure J) with management staff and document analysis of institutional handbooks (Chapter Six, Section 6.10).

Chapter Five and Chapter Six key thematic outcomes include:

Theme 1: Inadequate foundational digital skills and applied systems knowledge in graduates.

Theme 2: Inconsistent uptake of Smart Tourism tools and readiness in the industry.

Theme 3: Institutional factors related to time, training and infrastructure.

Theme 4: Need for reform-led curriculum content, including artificial intelligence (AI), augmented reality (AR), virtual reality (VR), data analytics, cyber security and practical experiential learning.

7.3.2 Model Domains and Integration

The product-based model has seven interconnected domains, each representing a key component of the 4IR-ready curriculum or 'product' transformation:

Block 1 - Human Resources and Infrastructure

This model aims to empower students to become critical thinkers and encourage them to become agents of positive change. The successful implementation of this model depends on the support of human resources and appropriate infrastructure. Therefore, human resources and infrastructure are the two crucial pillars for educational change to take place. This domain within the model is fundamental as it highlights a commitment to investments in labs,

connectivity, digital resources and staff capacity to effectively implement curriculum transformation. Technology is important for transformative learning as the digital tools and resources would allow students access to more information and provide them with opportunities to collaborate. Therefore, having reliable internet access together with the specialised software as well as the online platforms that enable effective communication and research to take place is necessary.

In a transformative curriculum, the educator becomes a facilitator of learning, a coach, as well as a mentor. Therefore, HEIs should ensure that they recruit sufficient staff and offer them the professional development they require to be effective in their teaching. The role of the educator has been changing and they are required to facilitate open dialogues with their students and encourage critical thinking and reflection within the classroom. Consequently, they should have the necessary skills and knowledge to be able to guide students and prepare them for real-world problems through the content and delivery of the curriculum. In addition, educators should be willing to self-learn and keep up with trends in the industry.

Furthermore, this domain has been situated at the base of the model as adequate human resources and technology infrastructure are essential for HEIs to effectively and efficiently update their current curriculum and develop new programmes using 4IR technologies. Moreover, the survey results indicate limited infrastructure at the institutional level (Chapter Six, Section 6.8.3), which was a core barrier to delivering Smart Tourism education content.

Block 2 – Tourism Curriculum Development

This domain includes the components of the emergent Multi-Dimensional Conceptual Model developed for this study (Chapter Three, Figure 3.3), which is necessary for integrating 4IR skills into Tourism curricula. Regarding Curriculum Analysis and Industry Needs Assessment, this domain captures relevance and contextual alignment and forms the foundation of the Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education. Informed by feedback loops, environmental scans and skills auditing, this domain connects stakeholders' offerings with the practical realities of operating in the Tourism industry. It is theoretically framed and guided by the Multi-Dimensional Conceptual Model.

Given that educators are the key elements of education development, the Faculty Development and Technology domain focuses on creating a 'skilled' academic who is aware of and able to adopt and teach content utilising the 4IR tools in resources. The interviews identified a lack of awareness of any digital system by academic staff, supporting the need for an institutional support structure (Chapter Six, Section 6.6.2).

Industry-academic collaboration is a critical component as it highlights the need for collaborative efforts between the Tourism industry and HEIs. This can be done through collaborative research projects, internships, guest lectures and industry advisory boards.

Lifelong Learning and Flexibility will allow for a culture of continuous learning in Tourism curricula. It is crucial to equip graduates with the necessary skills to effectively navigate and stay current with emerging technologies throughout their professional journeys.

Block 3 – Curriculum Modules and Primary Learning Aims

In this domain, the Curriculum Modules are organised into three integrated layers, namely:

a. ***Core Modules:*** Focuses on topics related to tourism, technology and sustainability and could include modules such as:

- Tourism and Hospitality Overview
- Smart City Principles
- Tourism and Digital Transformation
- Sustainable Tourism
- Research Methods and Data Analysis

The core modules provide students with a foundational literacy level in the interrelated disciplines underpinning Smart Tourism.

b. ***Major Modules:*** Focuses on the areas of specialisation in Smart Tourism and technology application, such as:

- Smart Tourism Technology (Internet of Things (IoT), AI, AR/VR)
- Tourism Data Analytics and Decision Making
- Digital Experience Design
- Innovation and Entrepreneurship in Tourism

- Policies and Governance in Smart Destinations

These major modules allow for deeper technical competency and pave the way for a transition to strategic roles in the field.

c. ***Electives:*** Allows for student academic specification that includes an individual or interdisciplinary focus, such as:

- Geographic Information System (GIS) for Tourism
- Smart Mobility and Transport
- Digital Marketing and Social Media
- Blockchain Applications in Tourism
- Foreign Language for Tourism Professionals

These elective modules allow students to shape their educational journey in alignment with their career aspirations.

Block 3.1 – Curriculum Focus Areas

In this block, the primary areas of focus were highlighted in the results of the quantitative survey (Chapter Five, Section 5.6.3) and the qualitative interviews (Chapter Six, Section 6.9.2), such as cybersecurity, customer relationship management platforms, AI and immersive tech, which are infused throughout the modules. The survey and interview data highlighted sector-wide skills shortages in terms of the focus areas presented.

Block 4 – Internationalisation

Internationalisation is an essential component of this model as it firstly allows for cross-cultural competence. When dealing with guests, staff need to be aware of cultural differences and expectations to offer personalised and enhanced guest experiences, as noted by Renfors (2018:315-317). Moreover, by including internationalisation within the curriculum, it will further assist in preparing graduates for the global workforce where international perspectives through case studies and textbooks are used (Renfors, 2018:315-317). Students can also attend initiatives such as student exchange programmes with international universities. It can be further noted that when a curriculum is internationalised, it allows students to be exposed to global best practices and innovation, which encourages creative and critical thinking (Thiart, 2025:1).

Block 5 – Experiential Learning

Since the Tourism industry is dynamic, it requires graduates to have a combination of both theoretical and practical knowledge. As a result, graduates should be completing experiential learning within their programmes to put into practice what they have learnt in the classroom. This experiential learning would further allow students to develop their soft skills, such as critical thinking, problem-solving, communication and adaptability within the workplace. Experiential learning can be carried out through offering student internships, taking them on field trips and providing them with problem-based projects. Moreover, by students completing experiential learning as part of their programme, it will allow them to build a portfolio of evidence of real-world experiences, which would provide them with a competitive advantage when applying for positions in industry, as employers are attracted to graduates who have practical experience.

Therefore, by drawing on TAM's notion of external variables, that is, perceived support, it is useful to consider experiential learning as one avenue in which the notion of internationalisation is essential. As indicated by the participants and the document analysis (Chapter Six), it can be argued that system-based training is missing from the current curricula. Based in part on the participant's ideal programme, this could involve (Lefrid *et al.* 2023:333-334):

- Simulations in hotel software;
- Internships in digitally advanced organisations; and
- International partnerships and case-based modules on global destinations.

Block 6 – Graduate Attributes

These are the "product" of the model: a digital, innovative and collaborative graduate. These attributes align with both student learning (employer expectations) and faculty delivery (pedagogically appropriate, technology-mediated methods), supported by the TAM and the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development. In addition, the SEM (Chapter Five, Section 5.9) showed a strong correlation between Block 3.1 and Block 6. In other words, the graduate attributes cannot be achieved without the focus areas.

Block 7 - Continuous Feedback Loop

This central and cyclical domain represents the ability to pivot and inform curriculum by engaging with stakeholders, tracking graduates and employing industry engagement, which can be done through Curriculum Review Committees for Tourism and Hospitality programmes. The feedback loop enables the iterative model with feedback, which in turn enables the ever-changing 4IR environment.

The product-based model described above suggests a modular, systematic and evidence-informed approach to help guide the transformation of existing Smart Tourism education curricula. It is structured in layers so that institutions can delineate incremental progression towards 4IR goals and align the appropriate teaching pedagogies and relevance to stakeholders and graduate employment.

7.4 Mobile Application - Technology Readiness Index (TRI) for Smart Tourism in Accommodation Establishments

A significant contribution of this research study is the design and development of a cloud-based mobile application (app) to determine the technology readiness of their staff. This app is also intended to be used during the recruitment process of staff in the Accommodation sector. A mock-up version of the app is shown in the figures below. This mobile app was developed based on the results of this study and can be used by the management of accommodation establishments to determine the Smart Tourism competency levels of their staff members. In addition, based on the results that staff obtain from completing this assessment, the accommodation establishment can use these results to provide training for its staff members in line with the company's expectations and requirements. Furthermore, it will assist staff with improving their knowledge of the technologies used in the industry. Figure 7.2 shows the landing screen, which users would need to click to access the information contained in the mobile application.

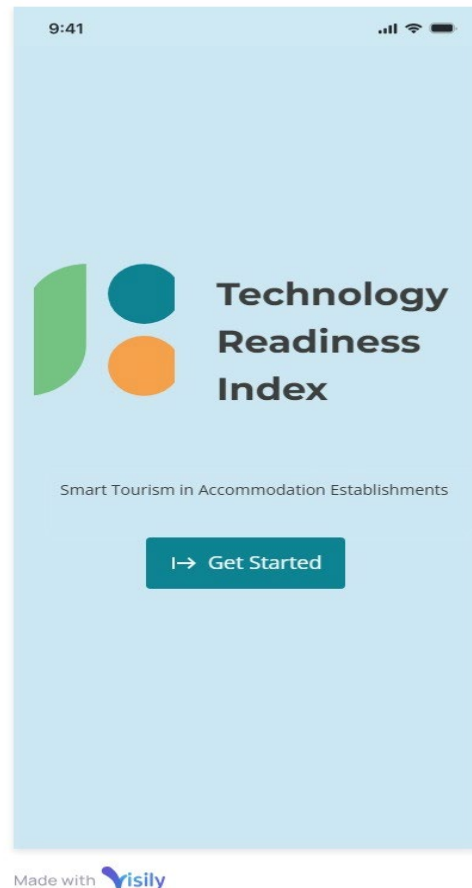


Figure 7.2: Technology Readiness Index Start Up Screen

Figure 7.3 provides a snapshot of the information that staff members working at accommodation establishments would need to complete before commencing the technology readiness test. All staff members are required to fill in their full name, the role that they are currently working in and can choose from the drop-down menu provided, which includes the following roles: reservations, food and beverage, housekeeping, marketing, front office, management, accounts and finance, human resources, events planning, marketing, purchasing, information technology and maintenance.

9:41

Capture Details

Enter your full name:

Select your role:

Select Role

Enter your mobile number:

+27 Mobile number

Continue

By signing up, you agree to our [Terms of Service](#) and [Privacy Policy](#).

Made with Visily

Figure 7.3: Technology Readiness Index User Information Screen

Figures 7.4 to 7.8 present screenshots of the Smart Tourism aspects that staff members would be rating their skill levels on. The following rating scale is being used to assess themselves. In Figure 7.4, rating 5 is selected for Google Maps and rating 4 is selected for Apple Maps.

The following rating scale can be used to assess the level of skill with Smart Tourism in accommodation establishments.

Rating: 1= Very Poor, 2= Poor, 3= Average, 4= Good, 5 = Very Good

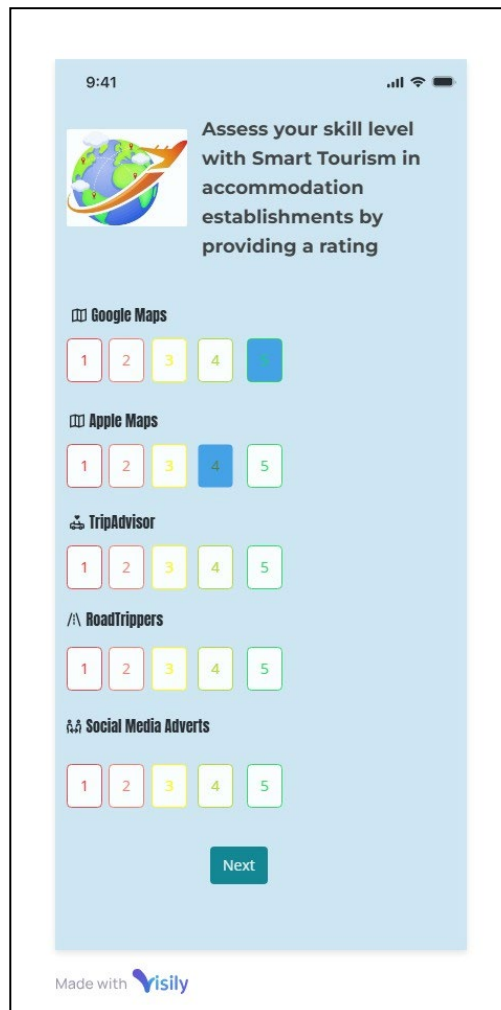


Figure 7.4: Google Maps, Apple Maps, TripAdvisor, Roadtrippers and Social Media Adverts

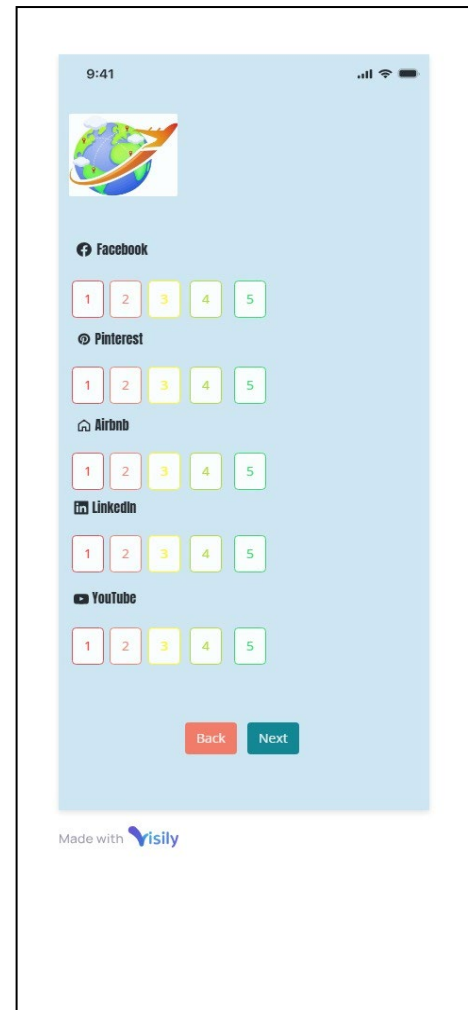
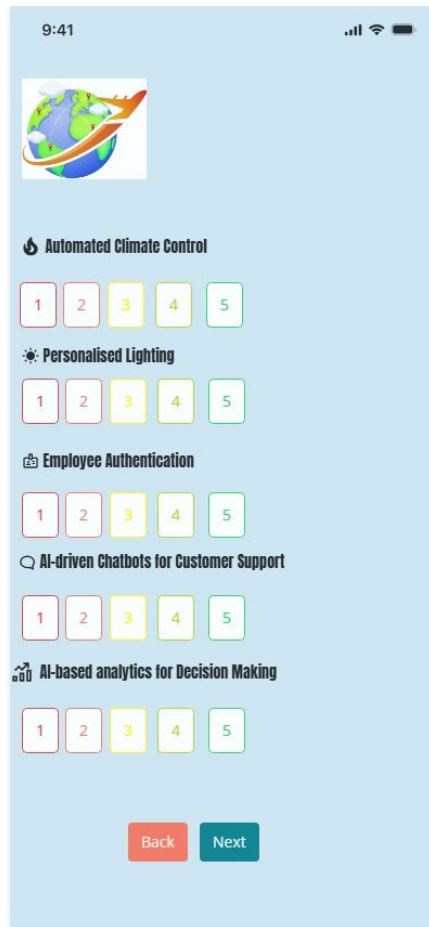


Figure 7.5: Facebook, Pinterest, Airbnb, LinkedIn, YouTube



Made with Visily

Figure 7.7 Automated Climate Control, Personalised Lighting, Employee Authentication, AI-Driven Chatbots for Customer Support, AI-Based Analytics for Decision Making



Made with Visily

Figure 7.6 Real-Time Analytics Dashboard, Digital Identity for Travel Documents, Smart Contracts for Automated Bookings, Digital Literacy, Data Analysis

Figure 7.8 Artificial Intelligence Integration, Virtual Reality and Augmented Reality, Cybersecurity, Remote Collaboration

Upon completing the assessment, the user's score is automatically calculated as a percentage based on the total score. Depending on the percentage they receive, a recommendation will pop up regarding which category they fall into in terms of the training that they require. Table 7.2 shows the TRI rating scale and provides the percentage for each category.

**Table 7.2: Output - Technology Readiness Index (TRI) for Smart Tourism in
Accommodation Establishments**

TRI 1 – No Skills (0 – 20%)
TRI 2 – Minimal Skills (21 – 49%)
TRI 3 - Average Skills (50 – 69%)
TRI 4 – Good Skills (70 – 79%)
TRI 5 - Excellent Skills (80 – 100 %)

Below are the recommendations for each of the TRI categories:

TRI 1 – Intensive training required in all areas of Smart Tourism for the Accommodation sector.

TRI 2 – Extensive training required in all areas of Smart Tourism for the Accommodation sector.

TRI 3 – Extensive training required in poor performing areas only, for example, Data analysis, Virtual Reality and Augmented Reality.

TRI 4 – General training in poor-performing areas only, for example, Google Maps and Cybersecurity.

TRI 5 – Minimal training to keep up with industry trends

Figure 7.9 provides a screenshot of the TRI score achieved for TRI category 4, where the user has obtained 71%. Hence, the recommendation for this user would be to receive training in poor-performing areas only, such as Google Maps and Cybersecurity.

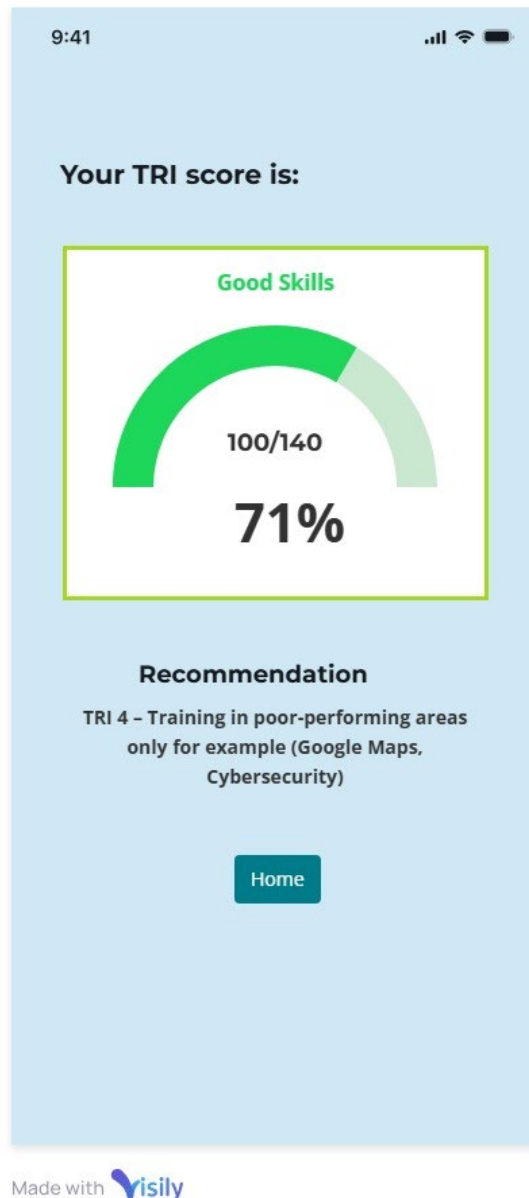


Figure 7.9: Technology Readiness Index Score – Good Skills

Figure 7.10 provides a screenshot of the TRI score achieved for TRI category 2, where the user has obtained 40%. Hence, the recommendation for this user would be to receive extensive training in all areas of Smart Tourism for the Accommodation sector.

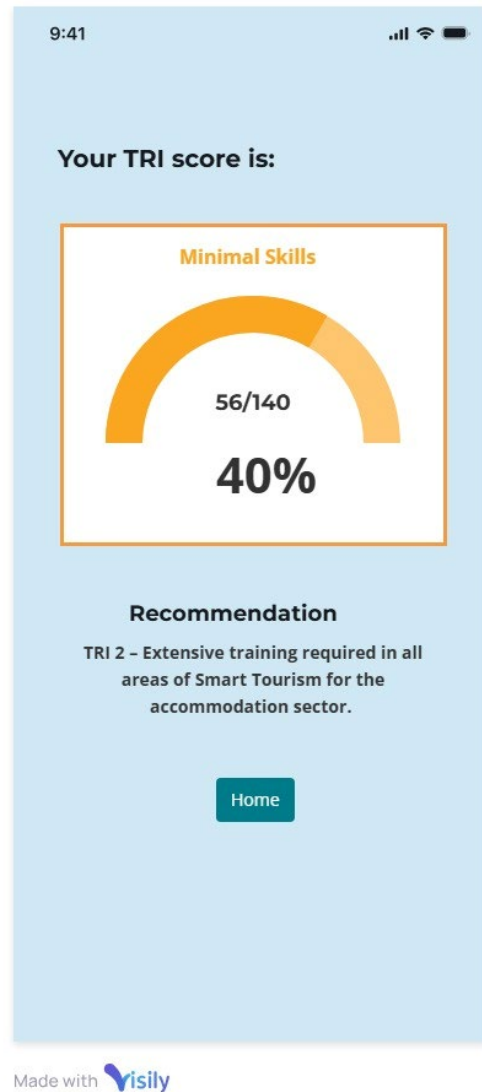


Figure 7.10: Technology Readiness Index Score – Minimal Skills

Figure 7.11 provides a screenshot of the TRI score achieved for TRI category 1, where the user has obtained 10%. Hence, the recommendation for this user would be to receive intensive training in all areas of Smart Tourism for the Accommodation sector.

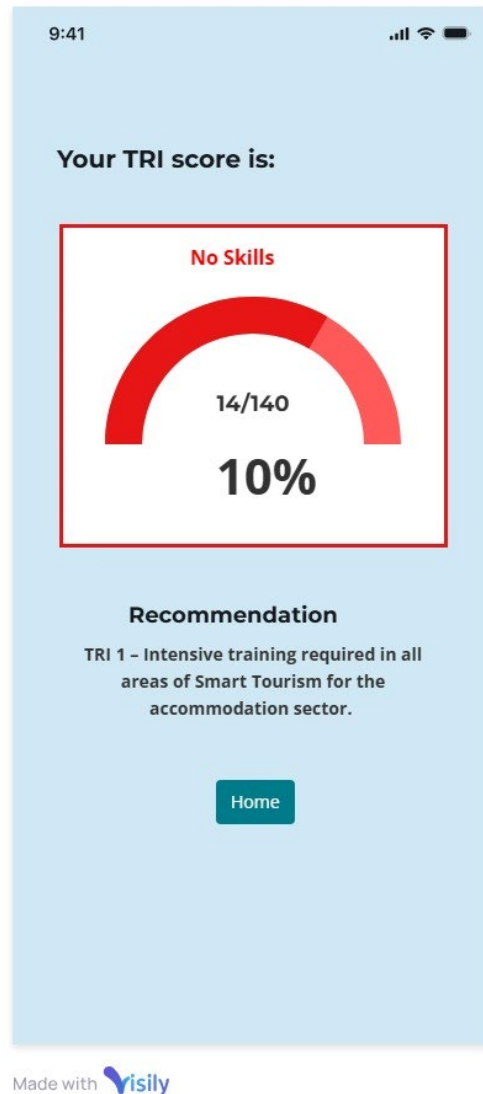


Figure 7.11: Technology Readiness Index Score – No Skills

7.5 Chapter Summary

This chapter outlined the central academic output of this research, that is, the Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education and based on the TAM, the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development and the Multi-Dimensional Conceptual Model for integrating 4IR skills into Tourism curricula. The Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education includes the following empirically informed domains: graduate attributes, curriculum modules, experiential learning, staff development and the enabling infrastructure. Each domain addresses one of the critical skill gaps and institutional misalignments surfaced through the triangulated qualitative and quantitative findings. The curriculum model is primarily aimed at promoting

higher education transformation. A second academic output of this research was a cloud-based mobile application, the TRI for Smart Tourism, for the Accommodation sector. The TRI application can assist accommodation staff by determining their technology applications and guiding the related training interventions, particularly when recruiting staff. The TRI application is not embedded within the academic model but complements the original intent of the research, increasing Smart Tourism capacity in education and industry settings. The next chapter presents the conclusion and recommendations of the study.

CHAPTER EIGHT: CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

This final chapter provides an overall synthesis of the study, integrating the main findings, conclusions, practical recommendations, and theoretical implications from the research. The study aimed to investigate and address the current disjuncture between the digital expectations of the Smart Tourism industry and the readiness of graduates from South African Higher Education Institutions (HEIs), specifically in the context of the Accommodation sector in KwaZulu-Natal. Utilising a mixed-method research design underpinned by key frameworks such as the Technology Acceptance Model (TAM), the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development and the Multi-Dimensional Conceptual Model integrating 4IR skills into Tourism curricula, the study provided empirical data from across quantitative surveys, structural equation modelling (SEM), qualitative interviews and document analysis. This data was triangulated and used to inform the design of two key deliverables: (I) a Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education and (II) a mobile app- the Smart Tourism Technology Readiness Index (TRI), designed to assess digital proficiency amongst employees in the Accommodation sector.

8.2 Conclusions of the Study

Each research objective is discussed below in relation to the study's mixed-methods research design. All objectives have been systematically achieved through the triangulation of literature (Chapter Two), survey results (Chapter Five), interviews and document analysis (Chapter Six).

8.2.1 Research Objective 1 [RO1]

Investigate the nature and extent of the usage of Smart Tourism and 4IR applications at accommodation establishments based in KwaZulu-Natal (KZN).

Finding 1: This objective was addressed through a quantitative survey of staff at accommodation establishments throughout KZN (Chapter Five) and semi-structured interviews with managers (Chapter Six). There were many references to booking and property management systems, but limited references to advanced 4IR technologies like artificial intelligence (AI)-powered chatbot technology, the Internet of Things (IoT), augmented reality (AR) and virtual reality (VR). As outlined in the triangulation results (Chapter Seven, Section 7.2), the quantitative data (Chapter Five, Section 5.6.2.2) indicated that 67.6% of respondents

had engaged with 4IR technologies: 34.5% "Always", 15.7% "Often", 17.4% "Sometimes" and 32.4% either "Rarely" (10.6%) or "Never" (21.8%) used them, indicating an uneven adoption level across establishments. Corresponding qualitative findings (Chapter Six, Section 6.7) reflected this trend, with one participant stating: "*currently we are not using 4IR applications at our establishment*" (P10) and another marking the desire for exposure to the wider anticipated system beyond Opera (P11). The findings indicate an ongoing gap in graduates' practical digital preparedness.

The fragmented adoption of these technologies is consistent with the "Actual system use" and "perceived usefulness" constructs in the TAM, as some establishments did not have the resources, but other establishments exhibited progressive implementation of the new technology. The literature complemented these findings by discussing the uneven global adoption of Smart Tourism technologies and the lack of adoption in developing economies.

8.2.2 Research Objective 2 [RO2]

Determine the 4IR skills and training needed to be employable at accommodation establishments based in KZN.

Finding 2: Skillsets and training gaps were highlighted through the survey (Chapter Five, Section 5.6.3.2) and qualitative interviews (Chapter Six, Section 6.6 and 6.9). Graduates were reported to be lacking not only technical digital skills but also soft skills, including, but not limited to, adaptability, problem-solving and communication in a technology-rich environment. The SEM validated the mediated pathway (B→C→D), confirming that digital adoption increases training needs, shaping perceptions of graduate readiness. Recommendations therefore prioritise embedding 4IR competencies within curricula, co-designed with industry and assessed via authentic tasks. This supported TAM's external variables, such as training availability and institutional support and the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development, which highlights workforce preparedness. Qualitative themes derived in Chapter Six, such as "*limited foundational digital skills*" and "*lack of knowledge of industry-specific systems*", supported these findings.

8.2.3 Research Objective 3 [RO3]

Ascertain the extent to which Smart Tourism and 4IR applications are included in the existing higher education curriculum at universities in KZN.

Finding 3: Document analysis of programme curricula and interviews with academic staff (Chapter Six, Section 6.10) found that the current programmes referenced technology, but there was little evidence of Smart Tourism or the 4IR. For example, Theme 3 (Section 6.10.3) found no modules that presented Artificial Intelligence, data analytics, or cybersecurity by themselves, nor any formal training in commonly used industry systems such as Opera, Protel, or integrated property management systems. In addition, there was no focus on Artificial Intelligence, data analytics, cybersecurity, or training on real-world systems (Theme 5, Section 6.10.5). This finding confirmed criticisms in the literature around curriculum inertia in Tourism education. Significantly, the Multi-Dimensional Conceptual Model (Chapter Three, Figure 3.3) clarified the disconnection between industry-aligned digital competency requirements and how the curriculum is currently configured.

8.2.4 Research Objective 4 [RO4]

Explore the perceptions of industry stakeholders from accommodation establishments towards the 4IR competencies and skills of tourism graduates from universities in KZN.

Finding 4: Thematic analysis of the interviews (Chapter Six, Section 6.6) with managers achieved this objective. The respondents expressed their dissatisfaction with graduate preparedness. For example, in Section 6.6, (P1) expressed the concern as follows: “*Graduates lack knowledge on technology, especially with the systems that hotels use... the graduates are lacking in terms of internet use, Microsoft skills and communicating via e-mail professionally*”. Describing the lack of a sense of practice around digital systems and an inability to transition into Smart workplaces, the dominant theme was an apparent “*disconnect between the HE curriculum and industry requirements*”. The literature review affirmed this sentiment and noted a global trend of underprepared graduates in relation to 4IR. The input from stakeholders guided the development of the curriculum reforms, including recommendations about experiential learning, working with industry partners and continuous updates to the curriculum.

8.2.5 Research Objective 5 [RO5]

Formulate a model for a Transformative Higher Education Framework for the inclusion of 4IR into the Tourism curriculum.

Finding 5: The product-based Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education, outlined in Chapter Seven (Section 7.3, Figure 7.1), represents a synthesis of the findings to complete RO1 to RO4. Its integrated core, major and elective

components related to the Smart Tourism competencies and included experiential learning and internationalisation. Moreover, it took into consideration faculty development and infrastructure support and included an iterative feedback process for evaluation purposes. The Multi-Dimensional Conceptual Model designed for this study underpinned the model, which allowed for theoretical, empirical and groundedness dimensions. The development of the mobile app, which is the Technology Readiness Index (TRI), also complemented the model by making an open intervention to assess staff competencies within operational accommodation businesses.

8.3 Recommendations of the Study

The study aimed to critically assess the relationship between Smart Tourism practices and the need for higher education curriculum readiness in the context of 4IR, with a focus on the Accommodation sector in KZN. Based on both the quantitative and qualitative strands of data, the study found significant misalignment between the skills produced by HEIs and the skills required by the Tourism industry in a digital economy.

While a few accommodation establishments are adopting some 4IR technologies like booking systems, social media and some automation, there was a fragmented adoption of technologies (like AI, data analytics, AR/VR and cybersecurity) or features within those technologies. The study also found that graduates entering the workforce were missing fundamental digital literacy and practical knowledge of how things work, that is, systems, in the 'real' world, often missing 'soft skills' like adaptability, communication and collaboration. The challenges of these gaps were compounded by institutional constraints like faculty with too few resources, little infrastructure for digital teaching practices and limited engagement with industry in developing the curriculum for the future of Tourism.

The results indicate that a transformative response to the curriculum is required, creating a coherent, enterprising and interdisciplinary modular curriculum based on an understanding of technological change, the implications of empirical realities and the needs of industry. The Product-Based Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education, produced as part of this research, offers a structured template to address the range of problems associated with the notion of curriculum. Moreover, a suggested mobile

application of the Technology Readiness Index (TRI) could provide a way of measuring workforce readiness and subsequent targeted training for employees.

This study highlights that significant shifts are needed in conceptualising and designing learning and teaching tourism professional education, delivery and evaluation that will close the digital divide between institutions and the Tourism industry. Furthermore, graduates need to contribute positively to Smart, sustainable and globally competitive Tourism systems.

Given the major findings described above, the following recommendations are made:

I. Curriculum Change

HEIs must implement a product-based, modular curriculum with core, major and elective modules related to Smart Tourism and 4IR competencies. To address current skill gaps, curricula must articulate critical digital aspects such as AI, data analytics, cybersecurity and simulation-based learning (Chapter Six, Section 6.9).

II. Strengthening Industry – Academia Collaborations

Industry needs assessments and graduate tracer studies should be institutionalised annually to ascertain whether academic content is evolving with real-world requirements. Higher Education Institutions should strengthen partnerships with Tourism industry stakeholders to provide internships, live projects and guest lectures (Chapter Seven, Section 7.3.2, Block 5).

III. Staff Development

Higher Education Institutions must invest in staff upskilling programmes focusing on digital pedagogy and Smart Tourism technologies to make curriculum delivery effective. Staff training and other professional development initiatives must be supported by institutional policies and resources that facilitate reducing barriers to adoption, closely aligned with the TAM concept of external variables (Chapter Five, Section 5.6.2.1 and Chapter Six, Section 6.8).

IV. Experiential Learning and Internationalisation

Learning activities must increasingly incorporate activity-based and simulation-based learning using related tourism-specific software and services. International collaborative partnerships must be encouraged and promoted to provide students with global awareness and cross-cultural competencies. Furthermore, Hospitality and Tourism programmes should include more

opportunities for students to complete experiential learning, preferably at each level of their programme, so that they can put into practice what has been learnt in the classroom (Chapter Six, Section 6.9.2).

V. Infrastructure and Digital Resources

Higher Education Institutions must prioritise investment in digital infrastructure, including labs, software licensing and access to cloud tools, to help drive curriculum innovation. The potential of public-private partnerships needs to be explored to resource these initiatives (Chapter Six, Section 6.8.3).

VI. Mobile Application Usage

The TRI mobile application should be piloted and co-created with accommodation establishments to support recruitment, training and staff development. The app. update could develop into a learning management module that links TRI assessments and training content (Chapter Six, Section 6.8.2).

VII. Continuous Feedback and Quality Enhancement

There is a need to establish feedback loops, including curriculum review committees, student surveys and industry advisory boards; to provide continuous, reflective feedback; and to improve the relevance of academic programmes. Data analytics could be used to monitor graduate performance and employer satisfaction, providing appropriate reflection in the iterative process of developing the curriculum.

These recommendations, through collaboration, aim to guide HEIs, Tourism stakeholders and policy-makers on re-designing Tourism education for the 4IR era, which will ensure continued relevance and responsiveness (Chapter Seven, Section 7.3.2, Block 2).

8.4 Recap of Significant Contributions to the Body of Knowledge

This research represents a multi-faceted contribution to the body of knowledge at the intersection of Smart Tourism, higher education curriculum development and the implementation of the Fourth Industrial Revolution (4IR). The contributions take theoretical and practical forms, providing value to the academy, government and industry executives.

I. Development of a Product-Based Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education

The research provides a Product-based Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education (Chapter Seven, Section 7.3) based on empirical data and theoretical support and highlights a distinction from conventional, linear, or cyclical curriculum approaches. The model advances a modular, domain-based structure that supports interdisciplinary learning, technological reflexivity and curriculum responsibility.

II. Integration of Theoretical Frameworks into Tourism Curriculum Reform

The research builds the area of curriculum theory through the application/integration of the TAM, the Innovative Technologies Framework for Hospitality and Tourism Curriculum Development and the Multi-Dimensional Conceptual Model for integrating 4IR skills into Tourism curriculum education. Together, these frameworks explicate the complex nature of 4IR readiness and the adoption of technology for faculty; the adoption of pedagogy within the heterogeneous network of students; and the degree of engagement from students in the digitally transforming education system. The Multi-Dimensional Conceptual Model was tested using the Mini Delphi method and provided the conceptual framework for this study.

III. Empirical Diagnosis of Graduate Skills Gaps and Institutional Readiness

The explanatory sequential mixed-methods approach consisted of administering surveys first and then conducting the interviews and the document analysis. This allowed the study to provide a comprehensive diagnosis of the digital skills gaps, curricular limitations and institutional shortcomings that exist in the Accommodation sector of KwaZulu-Natal (James, DeJonckheere and Guetterman, 2024). Each of the research outputs enables a regional and sector-specific understanding of 4IR readiness in the Tourism education domain.

IV. Design and Conceptualisation of a Mobile Application (TRI App.)

The research presents a new cloud-based mobile app. developed to measure technology readiness using the TRI for staff in accommodation establishments (Chapter Seven, Section 7.4). The app. has the potential to serve as (1) a recruitment and training tool for management in their search for levels of digital competency and (2) a systematic approach to constructing targeted staff development. The app. is a practical and scalable intervention that links academic research with the planning of real-world applications.

V. Contribution to the discourse on Smart Tourism and 4IR for the Global South

The study addresses a gap in the literature by contextualising the discourse on Smart Tourism and 4IR in the Global South, particularly in South Africa. By crossing theoretical disciplines, the research highlights the structural, infrastructural and pedagogical barriers that prevent the integration of 4IR into Tourism education and offers contextually relevant suggestions on responding to these gaps.

VI. Advancement of Methodological Approaches in Tourism Curriculum Research

The research study presents an innovative thematic lens for tourism and education research by triangulating quantitative, qualitative and document-based data together with SEM. Triangulating multiple fields of inquiry adds trustworthiness and depth to the findings and offers an imitable model for other studies conducted in similar contexts investigated by the tourism workforce and education scholars.

VII. Policy-Relevant Recommendations for Higher Education and the Tourism Industry

Apart from the academic dimension, the study also offers practical recommendations that align with national priorities of graduate employability, technological innovation and public-private partnerships for skills development. The insights can be used to reconfigure policy frameworks for Tourism planning and higher education.

In summary, this research not only addressed academic gaps and anticipated barriers to change but also offered scalable, context-responsive suggestions to be able to plan and implement digital transformation in Tourism education. The research outputs provide a trail map for curriculum renewal and workforce development within the constraints of a 4IR-dominated 21st Century.

8.5 Implications of the Study

The findings of this study have powerful implications for different stakeholders across tourism and education. For higher education providers, the study reveals the urgent need for a renewed direction in Tourism programmes by incorporating 4IR competencies and new technologies relevant to the industry to enhance graduate employability and digital readiness. For

policymakers, the model provides a basis for curating standards and scope for the curriculum, including courses that support national developmental agendas and digital transformation. For industry partners, specifically in the Accommodation sector, the study demonstrates the benefits of collaboration with academia in developing relevant training, as well as the TRI mobile application as a useful instrument to measure and develop the workforce's capability in specific sectors. Finally, for academia, the study offers a context-centric model and methodological contribution towards the literature, potentially serving as the impetus for future research in other geographic areas or sectors.

8.6 Limitations of the Study

The study's sole focus is on the Accommodation sector in KZN, making the findings not generalizable to other sectors in the Tourism industry, such as the Tour Operating sector, Transportation sector, Food and Beverage sector and Events sector. Due to limited finances and time constraints, it was difficult for the researcher to cover all the sectors within the Tourism industry as well as other provinces in South Africa.

8.7 Future Research

Since the study's sole focus was on the Accommodation sector in KZN, future studies can focus on including other sectors of the Tourism industry in KZN or could also extend to cover only accommodation establishments in other provinces within South Africa, to determine whether the findings vary. The mobile application referred to in Chapter Seven, Section 7.4, will be implemented in a programming language such as Flutter and deployed within the Accommodation sector of the tourism industry as part of a post-doctoral research project.

8.8 Chapter Summary

This chapter presented the study's key elements and information on how the research objectives were achieved. It then provided a summary of the overall conclusions drawn from both the empirical data and the theoretical frameworks, followed by recommendations for curriculum developers, HEIs and tourism decision makers. The chapter also synthesised the knowledge contributions that were made by the study, including a Product-Based Transformative Curriculum Model for Integrating 4IR into Smart Tourism Education and a mobile application to assist with technology readiness assessments for the Accommodation sector. The implications for policy and practice and recommendations for future research were presented,

ending with suggestions for applying the study to other Tourism sub-sectors and a refinement of the developed technological artefacts.

REFERENCES

- Abbasi, F.K., Ali A. and Bibi, N. 2018. Analysis of skill gap for business graduates: Managerial perspective from banking industry. *Education and Training*, 60(4):354-367.
- Abdel Hamid, M. M. 2024. Internet of Things as an instrument to improve businesses of Egyptian tourism companies. *Journal of Association of Arab Universities for Tourism and Hospitality*, 27(2):155-169.
- Adeyinka-Ojo, S., Lee, S., Abdullah, S. K. and Teo, J. 2020. Hospitality and tourism education in an emerging digital economy. *Worldwide Hospitality and Tourism Themes*, 12(2): 113-125.
- Ahmadi, M., Kheslat, N.K. and Akintomide, A. 2024. Generative AI impact on labour market: Analysing ChatGPT's demand in job advertisements, *ArXiv Preprint ArXiv*:1-27.
- Ahtamova, M. E. 2021. Directions of using foreign experience in the provision of ecological tourism services in the economy. *The American Journal of Management and Economics Innovations*, 3(9): 38-44.
- Ajibade, P. and M. Mutula, S. 2020. Big data, 4IR and electronic banking and banking systems applications in South Africa and Nigeria. *Banks and Bank Systems*, 15(2):187-199.
- Akther, W. 2022. 4th industrial revolution: Skill sets for employability of business graduates in Bangladesh. *International Journal of Multidisciplinary Research and Analysis*, 5(10):2690-2696.
- Alam, A. and Saputro, I. A. 2022. A qualitative analysis of user interface design on a Sharia Fintech application based on Technology Acceptance Model. *Journal TAM (Technology Acceptance Model)*, 13(1): 9
- Alekseeva, M., Kanyuk, Y., Osipova, Y. and Filimonova, E. 2024. The essence of the digital economy and the problems of its formation and development. *Aquaculture*, 138(1):1-10.
- Alet, J. 2022. Key pillars in a business ecosystem success. *Journal of Business Strategy*, 44(5):294-300.
- Alashwal, M. 2024. Empowering education through AI: Potential benefits and future implications for instructional pedagogy. In: *2024 EdTec – International Conference on Education & Learning Technology*, Singapore, 06-07 May 2024. Proceedings of Teaching and Education Research Association (TERA), 201-212.

- Alharahsheh, H. H. and Pius, A. 2020. A review of key paradigms: Positivism vs interpretivism. *Global Academic Journal of Humanities and Social Sciences*, 2(3):39-43.
- Almaiah, M.A., Alfaisal, R., Salloum, S.A., Hajjej, F., Shishakly, R., Lutfi, A., Alrawad, M., Al Mulhem, A., Alkhdour, T. and Al-Marroof, R.S. 2022. Measuring institutions' adoption of artificial intelligence applications in online learning environments: Integrating the innovation diffusion theory with technology adoption rate. *Electronics*, 11(20):3291.
- Almansour, M. 2022. Food start-ups: leveraging digital marketing and disruptive information systems innovations to survive in the post-COVID environment. *European Journal of Innovation Management*, 27(3):944-961.
- Anguera, M.T., Blanco-Villaseñor, A., Jonsson, G.K., Losada, J.L. and Portell, M. 2020. Best practice approaches for mixed methods research in psychological science. *Frontiers in Psychology*, 11:1-4.
- Anwar, F.A., Deliana, D. and Suyamto, A. 2024. Digital transformation in the hospitality industry: Improving efficiency and guest experience. *International Journal of Management Science and Information Technology*, 4(2):428-437.
- Apritado, J.M.M. and Borbonr, N.M.D. 2022. Challenges and opportunities in the hospitality and tourism education: A Phenomenological Study. *Asia Pacific Journal of Educational Perspective*, 9(1):36-44.
- Avelino, N. M. and Ismail, H. H. 2022. Teachers' levels of knowledge and readiness in integrating 4IR technologies: The primary ESL classroom context. *International Journal of Learning, Teaching and Educational Research*, 21(3):415-433.
- Avgeli, V., Dahlan, M. A., Bakir, A. and Wickens, E. 2020. 4IR impacts on tourism education and industry. *Journal on Tourism and Sustainability*, 4(1):6-15.
- Aydin, B. and Sirkeci, I. 2024. Navigating the frontier: Addressing artificial intelligence challenges in tourism and hospitality education. *Transnational Education Review*, 2(1): 49-53.
- Babbie, E. 2021. The practice of social research. 15th ed. Boston: Cengage Learning.
- Ballina Ballina, F. J. 2020. Smart tourism destination, physical experience and rural tourism. *Smart Tourism*, 1(2):1-11.

- Bans-Akutey, A. and Tiimub, B.M. 2021. Triangulation in research. *Academia Letters*, 2(3392):1-7.
- Barrett, D. and Heale, R. 2020. What are Delphi studies? *Evidence-Based Nursing*, 23(3):68-69.
- Baruch, Y. and Holtom, B. C. 2008. Survey response rate levels and trends in organisational research. *Human Relations*, 61(8):1139-1160.
- Ben Youssef A. and Zeqiri, A. 2022. Hospitality industry 4.0 and climate change. *Circular Economy and Sustainability*, 2(3):1043-1063.
- Bertacchini, F., Gabriele, L., Pantano, P., Romita, T. and Bilotta, E. (2021). Industry 4.0 technologies in tourism education. *Journal of Tourism and Hospitality*. S1(6):1-10.
- Bezuidenhout, R.M. and Strydom, A. 2021. Qualitative research designs and data collection. In: Du Plooy Cilliers, F., Davis, C. and Bezuidenhout, R. M. eds. *Research Matters*. 2nd ed. Claremont: Juta & Company Ltd, 199-224.
- Billiot, T. 2023. Continuous learning and advancing technologies: a framework for professional development and training in artificial intelligence. *Development and Learning in Organisations: An International Journal*, 37(3):28-31.
- Bilotta, E., Bertacchini, F., Gabriele, L., Giglio, S., Pantano, P.S. and Romita, T. 2021. Industry 4. technologies in tourism education: Nurturing students to think with technology. *Journal of Hospitality, Leisure, Sport and Tourism Education*, 29(1):1-11.
- Bishara, A. J. and Hittner, J. B. 2017. Confidence intervals for correlations when data are not normal. *Behavior Research Methods*, 49(1):294-309.
- Bogicevic, V., Liu, S.Q., Seo, S., Kandampully, J. and Rudd, N.A. 2021. Virtual reality is so cool! How technology innovativeness shapes consumer responses to service preview modes. *International Journal of Hospitality Management*, 93:1-10.
- Boone, H.N. and Boone, D.A. 2012. Analyzing Likert Data, *Journal of Extension*, 50(2):1–5.
- Bottazzi, R. 2024. *Impacts of Industry 5.0 target dimensions on the performance of intra-logistics systems: a proposed assessment framework* (Doctoral dissertation, Politecnico di Torino). Available: <http://webthesis.biblio.polito.it/id/eprint/32825> (Accessed 19 September 2024).

- Bouncken, R.B., Qiu, Y., Sinkovics, N. and Kürsten, W. 2021. Qualitative research: Extending the range with flexible pattern matching. *Review of Managerial Science*, 15(2):251-273.
- Buhalis, D. and Amaranggana, A. 2015. Smart tourism destinations enhancing tourism experience through personalisation of services. In: *Information and Communication Technologies in Tourism 2015: Proceedings of the International Conference in Lugano, Switzerland, 3-6 February 2015*, Springer International Publishing, 377-389.
- Buhalis, D., O'Connor, P. and Leung, R. 2022. Smart hospitality: from smart cities and smart tourism towards agile business ecosystems in networked destinations. *International Journal of Contemporary Hospitality Management*, 35(1):369-393.
- Buhler, M.M., Jelinek, T. and Nubel, K. 2022. Training and preparing tomorrow's workforce for the fourth industrial revolution. *Education Sciences*, 12:1-28.
- Cai, J., Neszmélyi, G.I. and Wei, Z. 2023. Evaluation of digital economy development in 31 Chinese provinces and cities. *Energy Crisis and Security Challenges in the World: Sustainable Responses of the Asian Economies and Societies*:15-31.
- Carlisle, S., Ivanov, S. and Dijkmans, C. 2023. The digital skills divide: Evidence from the European tourism industry. *Journal of Tourism Futures*, 9(2):240-266.
- Carvalho, L.P.D, Poletto, T., Ramos, C.C., Rodrigues, F.D.A., Carvalho, V.D.H.E. and Nepomuceno, T.C.C. 2023. Predictors of digital competence of public university employees and the impact on innovative work behavior. *Administrative Sciences*, 13(5): 1-25.
- CATHSSETA. 2021. Integrated 4IR sector skills strategy and plan: Final 4IR sector skills strategy report, including executive summary.
- Chaka, C. 2020. Skills, competencies and literacies attributed to 4IR/Industry 4.0: Scoping review. *IFLA Journal*, 46(4):369-399.
- Chávez-Márquez, I.L., Ordóñez Parada, A.I. and Flores Morales, C.R. 2023. Digital competencies in university students through educational innovations: A review of the current literature. *Apertura Guadalajara, Jal*, 15(2):74-87.
- Chen, L.T. and Liu, L. 2020. Methods to analyze Likert-type data in educational technology research. *Journal of Educational Technology Development and Exchange*, 13(2):39-60.

- Choi, Y. and Kim, D. 2024. Artificial intelligence in the tourism industry: Current trends and Future Outlook. *International Journal on Advanced Science Engineering Information Technology*, 14(6):1889-1895.
- Chugh, R., Grose, R. and Macht, A. 2021. Social media usage by higher education academics: A scoping review of the literature. *Education and Information Technologies*, 26(1):983-999.
- Cinar, K. 2020. The digital revolution: Impact on tourism education. *Journal of Tourism and Gastronomy Studies*, 8(4):2417-2443.
- Coetzee, J., Neneh, B., Stemmet, K., Lamprecht, J., Motsitsi, C. and Sereeco, W. 2021. South African universities in a time of increasing disruption. *South African Journal of Economic and Management Sciences*, 24(1):1-12.
- Coker, D. C. 2022. A thematic analysis of the structure of delimitations in the dissertation. *Online Submission*, 17:141-159.
- Collins, A., Ali, S.A. and Yilmaz, S. 2024. AI-generated future: What awaits tourism and hospitality with AI-based deep learning technologies?. In *ENTER e-Tourism Conference*: 35-39. Cham: Springer Nature Switzerland.
- Collado-Agudo, J., Herrero-Crespo, Á. and San Martín-Gutiérrez, H. 2023. The adoption of a smart destination model by tourism companies: An ecosystem approach. *Journal of Destination Marketing & Management*, 28:1-12.
- Corne, A., Massot, V. and Merasli, S. 2023. The determinants of the adoption of blockchain technology in the tourism sector and metaverse perspectives. *Information Technology and Tourism*, 25:605-633.
- Costantino, L. and Rodzinka, J. 2022. The role of soft skills in employability in the financial industry. *Financial Internet Quarterly*, 18(1): 44-55.
- CHE (Council on Higher Education). 2020. The State of the Provision of Higher Education in South Africa. Pretoria: CHE
- Czerniewicz, L., Agherdien, N. and Badenhorst, J. 2020. A Wake-Up Call: Equity, Inequality and COVID-19 Emergency Remote Teaching. *Post Digital Science and Education*, 2: 946-967.
- Czyz, M. and Javed, M. 2025. Revolutionizing travel: The role of smart tourism technologies in enhancing tourist satisfaction and shaping sustainable destination images: Insights from Istanbul. *Geojournal of Tourism and Geosites*, 58(1):446-455.

- Dahmani, M. 2024. The impact of the fourth industrial revolution on business performance and sustainability: A literature review. *Theoretical Economics Letters*, 14:94-106.
- David, L.O., Nwulu, N.I., Aigbavboa, C.O. and Adepoju, O.O. 2022. Integrating fourth industrial revolution (4IR) technologies into the water, energy and food nexus for sustainable security: A bibliometric analysis. *Journal of Cleaner Production*, 363: 132522.
- Davis, F.D. 1989. Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIS Quarterly*, 13(3):319-340.
- DHET (Department of Higher Education and Training). 2013. White Paper for Post-School Education and Training. Pretoria: DHET.
- DHET. 2021. Report of the Ministerial Task Team on the Fourth Industrial Revolution. Pretoria: DHET.
- Department of Tourism. 2017. National Tourism Sector Strategy (NTSS) 2016–2026. Pretoria: Government Printer.
- Devers, K.J. and Frankel, R.M. 2000. Study design in qualitative research-2: Sampling and data collection strategies. *Education for Health*, 13(2):263-271.
- Dhaliwal, R.S. and Misra, P. 2020. Employability skills needed in hospitality industry: A scoping review. *Asian Journal of Education and Social Studies*, 10(1):18-34.
- Dimanche, F. and Lo, K. 2022. The elusive search for talent: Skill gaps in the Canadian luxury hotel sector. *Tourism and Hospitality*, 3:31-46.
- Ding, J. 2022. Social media utilisation in tourism industry: An updated review. *International Journal of Academic Research in Business and Social Sciences*, 12(5):84-96.
- Djunaid, A. 2023. The effect of service quality in enhancing consumer satisfaction. *Jurnal Penelitian Ilmu Manajemen*, 8(2):238-250.
- Du Plooy-Cilliers, F. 2021. Research paradigms and traditions. In: Du Plooy Cilliers, F., Davis, C. and Bezuidenhout, R. M. eds. *Research Matters*. 2nd ed. Claremont: Juta & Company Ltd, 322-336.

- Du Plooy-Cilliers, F. 2021. The research proposal. In: Du Plooy Cilliers, F., Davis, C. and Bezuidenhout, R. M. eds. *Research Matters*. 2nd ed. Claremont: Juta & Company Ltd, 21-43.
- Duru, E., Duatepe Paksu, A., Balkis, M., Duru, S. and Bakay, M. E. 2020. Examination of 21st-century competencies and skills of graduates from the perspective of sector representatives and academicians. *Journal of Qualitative Research in Education*, 8(4): 1-21.
- Egger, R. and Neuburger, L. 2022. Augmented, virtual and mixed reality in tourism. In: Xiang, Z., Fuchs, M., Gretzel, U., Höpken, W. (eds) *Handbook of e-Tourism*. Springer, Cham. Available:https://doi.org/10.1007/978-3-030-48652-5_19 (Accessed 13 July 2025).
- Elgeddawy, M. and Abouraia, M. 2024. Pragmatism as a research paradigm. In: *European Conference on Research Methodology for Business and Management Studies*, ECRM, 1 July 2024, Academic Conferences International Limited, 71-74.
- Enslin, C. 2021. Limitations, delimitations and recommendations. In: Du Plooy Cilliers, F., Davis, C. and Bezuidenhout, R. M. eds. *Research Matters*. 2nd ed. Claremont: Juta & Company Ltd, 313-321.
- Erkunt, H. 2023. Empowering the next generation: Integrating AI literacy into modern education. In: *SETSCI-Conference Proceedings*, Ankara, Türkiye, 29 December 2023, 15, 33-35.
- Farias-Gaytan, S., Aguaded, I. and Ramirez-Montoya, M.S. 2023. Digital transformation and digital literacy in the context of complexity within HEIs: a systematic literature review. *Humanities and Social Sciences Communications*, 10:1-11.
- Fernández Alcantud, A. and García Moreno, B. 2022. Smart tourism destinations: The backbone of tourism recovery. *Smart Tourism*, 3(2):1-9.
- Ferràs, X., Hitchen, E.L., Tarrats-Pons, E. and Arimany-Serrat, N. 2020. Smart tourism empowered by artificial intelligence: The case of Lanzarote. *Journal of Cases on Information Technology*, 22(1):1-13.
- Ferns, S., Dawson, V. and Howitt, C. 2019. A collaborative framework for enhancing graduate employability. *International Journal of Work-Integrated Learning*, 20(2):99-111.
- Ferràs, X., Hitchen, E.L., Tarrats-Pons, E. and Arimany-Serrat, N. 2020. Smart tourism empowered by artificial intelligence: The case of Lanzarote. *Journal of Cases on Information Technology*, 22(1):1-13.

- Finch, H. 2006. Comparison of the performance of varimax and promax rotations: Factor structure recovery for dichotomous items. *Journal of Educational Measurement*, 43(1):39-52.
- Franke, T.M., Ho, T. and Christie, C.A. 2012. The chi-square test: Often used and more often misinterpreted. *American Journal of Evaluation*, 33(3):448-458.
- Frick, J. 2023. Establishing effective business/ stakeholder networks to underpin regional digital strategies. *International Journal of Business and Management*, 18(4):63-68.
- Fuentes-Martínez, A. 2020. From a technology acceptance model to a practice acceptance model. *Ars Educandi*, 17(17): 61-66.
- Garanti, Z. 2023. Value co-creation in smart tourism destinations. *Worldwide Hospitality and Tourism Themes*, 15(5):468-475.
- Garcez, A. 2020. From a Technology Acceptance Model to a Practice Acceptance Model. *Ars Educandi*, 17(17):61-66.
- Garcez, A., Silva, R. and Franco, M. 2021. Digital transformation shaping structural pillars for academic entrepreneurship: A framework proposal and research agenda. *Education and Information Technologies*, 27(1):159-182.
- Ghaderi, Z., Beal, L., Hall, C.M., Zaman, M., Ahmad Rather, R. and Mat Som, A.P. 2024. Cybersecurity and smart tourist destinations resilience. *Tourism Recreation Research* :1-17.
- Gračan, D., Zadel, Z. and Pavlović, D. 2021. Visitor satisfaction management using mobile digital tools and services to create a smart destination concept. *Economic Review*, 72(2):185-198.
- Grepon, B., Margallo, J.C., Maserin, J. and Dompol, R. 2023. RUI: A web-based road updates information system using Google Maps API. *International Journal of Computing Sciences Research*, 7:2253-2271.
- Gretzel, U. 2021. Conceptualising the smart tourism mindset: Fostering Utopian thinking in smart tourism development. *Journal of Smart Tourism*, 1(1):3-8.
- Gretzel, U., Sigala, M., Xiang, Z. and Koo, C. 2015. Smart tourism: foundations and developments. *Electronic Markets*, 25(3):179-188.
- Gupta, S. and Sandhane, R. 2022. Use of sentiment analysis in social media campaign design and analysis. *Cardiometry*, 22:351-363.

- Hajoš, B. 2019. Croatian employers' perception of the knowledge, skills and competencies of pr students or graduates. *Journal of Innovative Business and Management*, 11(1):61-71.
- Hariyanti, N.K.D., Noviani, L., Khairani, E., Latief, Y. and Mustafa, F. 2024. Digital applications and the use of information technology in increasing the attractiveness of foreign tourist visits. *International Journal of Engineering, Science and Information Technology*, 4(3):55-59.
- Hauke, J. and Kossowski, T. 2011. Comparison of values of Pearson's and Spearman's correlation coefficients on the same sets of data. *Quaestiones Geographicae*, 30(2):87-93.
- Heinonen, K. and Strandvik, T. 2022. Viewpoint: applying pragmatism to stimulate service research and practice-a European perspective. *Journal of Services Marketing*, 36(4):467-475.
- Hendrawan, R. F. and Daryanto, D. 2019. Employability skills: Industry perspective and achievement of student employability skills. *Journal of Physics: Conference Series*, 1402(2):022049.
- Hennink, M. and Kaiser, B.N. 2022. Sample sizes for saturation in qualitative research: A systematic review of empirical tests. *Social Science and Medicine*, 292:1-10.
- Henriques, H.J.G., de Almeida, C.R. and Ramos, C.M.Q. 2024. The application of artificial intelligence in the tourism industry: A systematic literature review based on Prisma methodology. *Journal of Tourism, Sustainability and Well-Being*, 12(1):65-86.
- Hossan, D., Dato'Mansor, Z. and Jaharuddin, N.S. 2023. Research population and sampling in quantitative study. *International Journal of Business and Technopreneurship*, 13(3): 209-222.
- Huang, A., de la Mora Velasco, E. and Haney, A. 2024. Examining instructional technologies in hospitality and tourism education: A systematic review of literature. *Journal of Hospitality and Tourism Education*, 36(2):113-131.
- Huang, C. D., Backman, K. F., Backman, S. J., Chang, L. L. and Huang, Y. C. 2019. Exploring the implications of virtual reality technology in tourism marketing: An integrated research framework. *International Journal of Tourism Research*, 21(2):325-340.

- Imam, T. 2022. Venturing and managing disruptive digital innovations: financial management concept motivated propositions. *International Journal of Innovation Science*, 15(5): 733-755.
- Ionel, M. 2021. Accommodation service and its importance in the hospitality sector. *Ovidius University Annals, Economic Sciences Series*, 21(1):319-323.
- Jamal, H., Algeelani, N.A. and Al-Sammarraie, N. 2024. Safeguarding data privacy: strategies to counteract internal and external hacking threats. *Computer Science and Information Technologies*, 5(1):46-54.
- James, T.G., DeJonckheere, M. and Guetterman, T.C. 2024. Integrating transformative considerations and quantitative results through a participant selection joint display in explanatory sequential mixed methods studies. *Journal of Mixed Methods Research*, 18(1):14-30.
- Janchai, W. Siddoo, V. and Sawattawee, J. 2019. A systematic review of work-integrated learning for the digital economy. *International Journal of Work Integrated Learning*, 15(1):67-78.
- Javadi, Y. 2022. 7 Pillars of Digital Transformation Framework for Continuous Business Growth. *IBusiness*, 14(3):139-149.
- Jevtic, B., Beslac, M., Janjusic, D. and Jevtic, M. 2023. The effects of digital natives' expectations of tech hotel service quality on customer satisfaction. *International Journal for Quality Research*, 18(1):1-10.
- Jiang, R. and Zhang, X. 2024. Research on the connection between the curriculum design of tourism management and industry demand. *International Journal of Management Science Research*, 7(5):17-20.
- Joshi, A., Kale, S., Chandel, S. and Pal, D.K. 2015. Likert Scale: Explored and Explained. *British Journal of Applied Science & Technology*, 7(4):396-403.
- Jugessur, Y.S.M.F. 2022. Reliability and internal consistency of data: Significance of calculating Cronbach's alpha coefficient in educational research. *International Journal of Humanities and Social Science Invention*, 11(4): 9-14.
- Julianto, M. R. and Daniawan, B. 2022. E-commerce information system using Technology Acceptance Model approach. *Journal TAM (Technology Acceptance Model)*, 13(1):1.
- Juma, H. and Patel, G. 2022. Assessment reforms in the fourth industrial revolution: perspectives of higher education students. *Towards Excellence*, 14(4):94-100.

- Jung, J. 2019. The fourth industrial revolution, knowledge production and higher education in South Korea. *Journal of Higher Education Policy and Management*, 42(2):134-156.
- Kadir, B.A. 2020. Designing new ways of working in industry 4.0: Aligning humans, technology and organisation in the transition to Industry 4.0. PhD. Technical University of Denmark.
- Kamper, S.J. 2019. Reliability and validity: linking evidence to practice. *Journal of Orthopaedic and Sports Physical Therapy*, 49(4):286-287
- Kana, N. and Letaba, P. 2024. The reshaping of curriculum transformation to address the 21st-century skill sets and employment prospects during the fourth industrial revolution era: A case of the South Africa TVET colleges. *South African Journal of Higher Education*, 38(2):157-175.
- Karadayi-Usta, S. 2024. Cybersecurity risks analysis in the hospitality industry: A stakeholder perspective on sustainable service systems. *Systems*, 12(10):397-411.
- Keaney, T.A., Jones, T.M. and Mulder, R.A. 2024. An undergraduate classroom experiment illustrates an effect of observer bias on data collection in animal behaviour. *Animal Behaviour*, 212(1):175-182.
- Formunyam, G. 2020. Deterritorialising to Reterritorializing the Curriculum Discourse in African Higher Education in the Era of the Fourth Industrial Revolution. *International Journal of Higher Education*, 9(4):27-34.
- Keke, M.E. 2022. The use of digital marketing in information transport in social media: The example of Turkish companies. *Transportation Research Procedia*, 63:2579-2588.
- Kelly, L.M. and Cordeiro, M. 2020. Three principles of pragmatism for research on organisational processes. *Methodological Innovations*, 13(2):1-10.
- Khan, S.A., Khan, V. and Khan, M.A. 2023. Technology as a catalyst for tourism entrepreneurship: A critical insight. *International Journal of Social Sciences and Humanities Invention*, 10(4):7832-7838.
- Khupase, A., Malekar, V., Wankhade, D., Dhamale, T. and Sagane, S. 2024. The future of travel: Trends and predictions. *International Journal of Multidisciplinary Research*, 6(6):1-6.

- Kimeto, J. C. 2021. Tertiary tourism graduate employees and tourism employers' perceptions on tourism skills and competencies relevant for providing quality tourism services in Kenya. *Tourism Critiques: Practice and Theory*, 2(1):20-37.
- Kinyanjui, D.N. 2019. Assessing the need for and constraints to information and communication technology (ICT) integration in the teaching and learning of tourism at HEIs in Kenya. *Journal of Education, Society and Behavioural Science*, 31(2):1-11.
- Kitchen, E., Goh, E., Steriopoulos, E., Harkison, T., Drake, C., Robertson, M., Losekoot, E. and Waterston, L. 2024. Preparing tourism, hospitality and events graduates to be industry ready: extending the three-factor model of authentic learning. *Studies in Higher Education*, 1:1-19.
- Knani, M., Echchakoui, S. and Ladhari, R. 2022. Artificial intelligence in tourism and hospitality: Bibliometric analysis and research agenda. *International Journal of Hospitality Management*, 107:1-15.
- Kohler, K. and Bihari. B. (2013). Baseline status determination report – Accommodation stock in Durban.
Available:<https://zulu.org.za/corporate/wp-content/uploads/sites/4/2021/05/195.-Tourism-Master-Plan-Baseline-Study-Durban-Accommodation-Baseline-Status-2013.pdf> (Accessed 2 February 2025).
- Koonin, M. 2021. Validity and reliability. In: Du Plooy Cilliers, F., Davis, C. and Bezuidenhout, R. M. eds. *Research Matters*. 2nd ed. Claremont: Juta & Company Ltd, 287-299.
- Kreismann, D. and Talaular, T. 2020. Business ethics training in human resource development: A literature review. *Human Resource Development Review*, 20(1):68-105.
- Kubitskyi, S., Shorobur, I., Yevdokymova, N., Vlasiuk, T. and Shevchuk, L. 2023. Development of HEIs in the current conditions. *Brazilian Journal of Education, Technology and Society*, 16:119-128.
- Kukla, D. 2019. Marketisation of higher education in the face of changeability of the labour market. *Szkola-Zawód-Praca*, (17):53-62.
- Lan, M. 2023. Data and cloud computing-integrated tourism decision-making in smart logistics technologies. *International Journal of e-Collaboration*, 19(7):1-20.
- Lawley, D.N. and Maxwell. A.E. 1962. Factor analysis as a statistical method. *Journal of the Royal Statistical Society. Series D (The Statistician)*, 12(3):209-229.

- Ledi, K.K., Dumeda, R.B., Bandoma, S. and Ameza-Xemalordzo, E. 2024. Strategic thinking and innovation as panaceas for hotel performance in turbulent business environments. *Cogent Business and Management*, 11(1):1-17.
- Lefrid, M., Cavusoglu, M., Richardson, S. and Donnelly, C. 2023. Simulation-based Learning Acceptance Model: Expanding the Technology Acceptance Model (TAM) into Hospitality Education. *Journal of Hospitality and Tourism Education*, 36(4):333-347.
- Lewing, J. M. 2020. Partner and process: Conceptual considerations for continuous faculty development for service-learning and community engagement at supportive institutions. *International Journal of Research on Service-Learning and Community Engagement*, 8(1):1-12.
- Li, Y. 2024. Research on the innovative strategies of tourism management talents personnel training in colleges and universities under the background of smart tourism. *Journal of Higher Education Teaching*, 1(2):134-138.
- Li, Y. 2023. A study on the innovation path of human resource management in the context of digitalization. In *Digitalization and Management Innovation*:425-432. IOS Press.
- Li, D., Du, P. and He, H. 2022. Artificial intelligence-based sustainable development of smart heritage tourism. *Wireless Communications and Mobile Computing*, 2022(1):1-13.
- Li, H., Xi, J., Hsu, C.H., Yu, B.X. and Zheng, X.K. 2025. Generative artificial intelligence in tourism management: An integrative review and roadmap for future research. *Tourism Management*, 110:1-21.
- Likert, R. 1932. A Technique for the Measurement of Attitudes. *Archives of Psychology*, 22(140):1-55.
- Lim, W.M. Jasim, K.M. and Das, M. 2023. Augmented and virtual reality in hotels: Impact on tourist satisfaction and intention to stay and return. *International Journal of Hospitality Management*, 116:1-13.
- Lin, C.C., Huang, A.Y.Q. and Yang, S.J.H. 2023. A review of AI-driven conversational chatbots implementation methodologies and challenges (1999–2022). *Sustainability*, 15(5):4012- 4024.
- Liu, Y., Jiang, Z. and Chan, H.C. 2019. Touching products virtually: Facilitating consumer mental imagery with gesture control and visual presentation. *Journal of Management Information Systems*, 36(3):823-854.

- Loan, V. T. K. 2022. E-learning application according to the flipped classroom model towards approaching the fourth industrial revolution. *Universum: психология и образование*, 7(97):40-44.
- Lucks, K. 2022. Industry 4.0 from an entrepreneurial transformation and financing perspective. *Sci*, 4(4):47-70.
- Luo, M.N. 2020. Student response rate and its impact on quantitative evaluation of faculty teaching. *The Advocate*, 25(2):1-9.
- Lubinga, S., Maramura, T.C. and Masiya, T. 2023. The fourth industrial revolution adoption: Challenges in South African HEIs. *Journal of Culture and Values in Education*, 6(2):1-17.
- Ly, B. and Ly, R. 2024. Effect of social media in tourism (Case in Cambodia). *International Journal of Tourism and Hospitality Management*, 1(1):44-52.
- Ma, S. 2024. Enhancing tourists' satisfaction: Leveraging artificial intelligence in the tourism sector. *Pacific International Journal*, 7(3):89-98.
- Maarouf, H. 2019. Pragmatism as a supportive paradigm for the mixed research approach: conceptualising the ontological, epistemological and axiological stances of pragmatism. *International Business Research*, 12(9):1-12.
- Mandalia, S. 2023. Tourism education in the digital era: navigating innovation and transformation. In *International Conference on Social Science and Education (ICoESSE 2023)*: 509-530. Atlantis Press.
- Manos, A., Filipidou, D.E., Deliyannis, I., Pavlidis, N., Argyros, V. and Mazi, I. 2024. In *Personalized Travel Recommendations Using Wearable Data and AI: The INDIANA Platform*. Greece, December 4-5, 1-8.
- Margit, C.C. 2023. Unleashing the digital barrier: Obstacles and challenges of digital transformation amidst technological roadblocks. *Multidisciplin ris Tudom nyok*, 13(4):120-132.
- Marques, B. 2024. Tourism development: A capacity dynamic. *Smart Tourism*, 5(1):1-17.
- Marumo, P. and Mearns, K. 2021. Tourism Education and Industry Skills Requirements: A South African Perspective. *African Journal of Hospitality, Tourism and Leisure*, 10(4): 1115-1129.

- Mazumdar, A., Karim, N. and Banerjee, S. 2025. What can machines teach us in our journey of reproducing human scientific creativity? <https://doi.org/10.31219/osf.io/ehnp7>
- Mchunu, N.T. 2025. Privacy concerns and information security in e-tourism: Business and information management perspective. The case for touring companies in South Africa. *Athens Journal of Tourism*, 12(1):39-60.
- Mellahi, K. and Harris, L. C. 2016. Response rates in business and management research: an overview of current practice and suggestions for future directions. *British Journal of Management*, 27(2):426-437.
- Mercader, C. and Gairín, J. 2020. University teachers' perception of barriers to the use of digital technologies: the importance of the academic discipline. *International Journal of Educational Technology in Higher Education*, 17(4):1-14.
- Merdović, B. and Jovanović, B. 2024. Understanding identity theft and fraud. *Kultura Polisa*, 21(2):17-43.
- Mhango, L., Bello, F.G., Dias, C.V. and Chirambo, G.C. 2025. Employability and survival strategies in tourism and the hospitality industry in an ever-changing technological world: Systematic review of the literature. *African Journal of Hospitality, Tourism and Leisure*, 14(1):25-35.
- Mhlanga, D. and Molo, T. 2020. COVID-19 and the Digital Transformation of Education: What Are We Learning? *Education and Information Technologies*, 25: 1-20.
- Mich, L. 2020. Artificial intelligence and machine learning. *Handbook of e-Tourism*:1-21.
- Mijwil, M., Unogwu, O.J., Filali, Y., Bala, I. and Al-Shahwani, H. 2023. Exploring the top five evolving threats in cybersecurity: An in-depth overview. *Mesopotamian Journal of Cybersecurity*, 2023:57-63.
- Misra, P. 2023. Skill sets for future hospitality jobs. *Journal of Economics, Management and Trade*, 29(7):98-103.
- Mlambo, S.S. and Ezeuduji, I.O. 2020. South Africa's KwaZulu-Natal tourism destination brand essence and competitiveness: tourists' perspectives. *GeoJournal of Tourism and Geosites*, 32(4):1195-1201.
- MN, K., Khalid, F. and Husnin, H. 2020. Preparing graduates with digital literacy skills toward fulfilling employability needs in 4IR era: A Review. *International Journal of Advanced Computer Science and Applications*, 11(6):307-316.

- Mirčetić, V. and Mihić, M. 2022. Developing smart tourism as a strategic approach to tourism challenges in the post-COVID era. In *Proceedings of XVII International Symposium SymOrg 2020-Business and Artificial Intelligence*,116-117.
- Mocanasu, D.R. 2020. Determining the sample size in qualitative research. *International Multidisciplinary Scientific Conference on the Dialogue between Sciences & Arts, Religion & Education*, 4(1):181-187.
- Mohdar, H.S.A. and Pawar, T.M. 2022. An overview of content analysis. *International Journal of Research and Analytical Reviews*,9(1):552-568.
- Momani, A.M., Alsakhnini, M. and Hanaysha, J.R. 2022. Emerging technologies and their impact on the future of the tourism and hospitality industry. *International Journal of Information Systems in the Service Sector*,14(1):1-16.
- Mongia, M. 2024. Building trust: Data governance and security in edge-cloud integration. *International Journal for Multidisciplinary Research*, 6(6):1-10.
- Msuha, B. and Mdendemi, T. 2019. Hypothesis testing for the association between categorical variables: empirical application of Chi-square test. *Mathematical Theory and Modelling*, 9(2):9-17.
- Muharam, I.N., Tussyadiah, I. and Kimbu, A. 2024. Unlocking the potential of blockchain-based sharing economy in hospitality and tourism: A systematic review. *International Journal of Hospitality Management*, 122:1-12.
- Muhie, Y.A. and Woldie, A.B. 2020. Integration of artificial intelligence technologies in teaching and learning in higher education. *Science and Technology*, 10(1):1-7.
- Mwithi, F.M. 2023. Indigenising Facebook language: Use of local languages in Facebook communication among a selected group of Kenyan internet users. *Edition Consortium Journal of Literature and Linguistic Studies*, 1(5):268-280.
- Myers, G. and Scarinci, J. 2022. Consumers' use of smartphone technology for travel and tourism in a COVID era: A scoping review. *Journal of Resilient Economies*, 2(1):169-180.
- Ndlovu, J. and Rogerson, C.M. 2023. Digitalisation and Tourism SMMEs in South Africa. *GeoJournal of Tourism and Geosites*, 47(3):1010-1020.

- Nguyen, H.H., Kailasam, T. and Kamble, Z. 2023. A scoping review of the hospitality industry and tertiary partnership to prepare work-ready graduates. *ASEAN Journal on Hospitality and Tourism*, 21(1):48-63.
- Nikolskaya, E.Y., Zakharova, E.V., Galkin, D.V., Kovaleva, N.I. and Panova, N.A. 2021. The impact of digital technologies on the transformation of the tourism and hospitality industry. *Geintec*, 11(4):623-632.
- Nithyanantham, V. 2020. Attitude and awareness towards information and communication technology of student-teachers. *International Journal of Psychosocial Rehabilitation*, 24(5):2585-2591.
- Nkwanyana, S. and Pelser, T. 2022. Rethinking Tourism Education in South Africa: Aligning Curricula with Industry 4.0. *Journal of Contemporary Management*, 19(1): 44-63.
- Noone, R. 2020. The everyday information experience of street-level wayfinding: A critical look. In *Proceedings of the Annual Conference of CAIS/Actes du congrès annuel de l'ACSI*. 8 November 2020, 1-5.
- Novera, C.N., Ahmed, Z., Kushol, R., Wanke, P. and Azad, M.A.K. 2022. Internet of things (IoT) in smart tourism.: A literature review. *Spanish Journal of Marketing*, 26(3):325-344.
- Nuong, M.D. and Ragavan, N.A. 2023. Digital future of the global hospitality industry and hospitality education: Review of related literature. *APJFES*, 2(2):71-100.
- Oh, E. 2020. How to prepare students for the 4th industrial revolution society. *Studies in Educational Management*, 7:17-27.
- O'Lemmon, M. 2024. The worst mistake 2.0? The digital revolution and the consequences of innovation. *AI & Society*, 39(3):1359-1368.
- Ochara, N. M. 2021. Governance mechanisms for fourth industrial revolution artifacts in HEIs: A systems perspective. *SSRN Electronic Journal*. 33-41. Available: <https://doi.org/10.2139/ssrn.3814133> (Accessed 2 November 2024).
- OECD. 2025. Using alternative data sources and tools to measure and monitor tourism, *OECD Tourism Papers*, No. 2025/11. Paris: OECD Publishing.
- Okhota, V. 2021. Innovative approaches to the formation of competitive tourism products (services): foreign and domestic experience. *Innovative Economy*, 1-2:108-113.

- Park, H. Lee, M. and Back, K.J. 2023. A critical review of technology-driven service innovation in hospitality and tourism: Current discussions and future research agendas. *International Journal of Contemporary Hospitality Management*, 35(12):4502-4534.
- Parry Thompson, R. 2023. Integrating education for sustainable development in learning development practice within a university's humanities and social sciences faculty. *Journal of Learning Development in Higher Education*, 29:1-6.
- Pascoe, G. 2021. Sampling. In: Du Plooy Cilliers, F., Davis, C. and Bezuidenhout, R. M. eds. *Research Matters*. 2nd ed. Claremont: Juta & Company Ltd, 145-165.
- Patel, M. and Patel, N. 2019. Exploring Research Methodology: Review Article. *International Journal of Research and Review*, 6(3):48-55.
- Peng, S. 2024. National governance and economic transformation in the digital economy. *Scientific Journal of Economics and Management Research*, 6(10):39-44.
- Penprase, B. E. 2018. The fourth industrial revolution and higher education. *Higher Education in the Era of the Fourth Industrial Revolution*, 10(1):978-981.
- Pervez, N., Mahmood, W., Akram, M. and Waqas, M. 2024. Analysing the alignment between university curriculum and job market requirements in Pakistan: Challenges and opportunities. *Indus Journal of Social Sciences*, 2(2):397-410.
- Phi, G.T. and Clausen, H.B. 2021. Fostering innovation competencies in tourism higher education via design-based and value-based learning. *Journal of Hospitality, Leisure, Sport & Tourism Education*, 29:1-9.
- Pillai, S.G., Haldorai, K., Seo, W.S. and Kim, W.G. 2021. COVID-19 and hospitality 5.0: Redefining hospitality operations. *International Journal of Hospitality Management*, 94:1-11.
- Polishchuk, E., Bujdosó, Z., El Archi, Y., Benbba, B., Zhu, K. and Dávid, L.D. 2023. The theoretical background of virtual reality and its implications for the tourism industry. *Sustainability*, 15(13):10534-10552.
- Pradini, G., Awaloeldin. D.T., Agustiani, F. and Kelly, A. 2024. 5G technology transformation in tourism. *International Journal of Economics, Management, Business and Social Science*, 4(1):429-432.
- Prastiawan, D. I., Aisjah, S. and Rofiaty, R. 2021. The effect of perceived usefulness, perceived ease of use and social influence on the use of mobile banking through the mediation of attitude toward use. *Asia Pacific Management and Business Application*, 9(3):243-260.

- Pribadi, T.I., Tahir, R. and Yuliawati, A.K. 2021. The challenges in developing smart tourism: A literature review. *InfoTekJar:Jurnal Nasional Informatika dan Teknologi Jaringan*, 5(2):254-258.
- Provenzano, D. and Baggio, R. 2020. E-tourism economics: Editorial for the special issue. *Tourism Economics*, 26(6):847-852.
- Punzi, E. 2024. Research Interviews as Interaction and Therapeutic Possibility: A Relational Psychoanalytic Approach. *Creative Commons*, 35:161-175.
- Radun, V. and Bartula, M. 2022. Applying technologies of the fourth industrial revolution - the future of ecotourism and tourism of protected areas. In *Tourism International Scientific Conference*, 7(1):630-647.
- Raj, S. and Sharma, S. 2023. Tourism education and career readiness: A case study of Himachal Pradesh government schools. *Journal of Tourism Education*, 3(2):85-92.
- Rakowski, N. 2022. Bridging the disconnect between academic institutions and employers in the 4th industrial revolution. *Canadian Journal of Career Development*, 21(1):109-117.
- Rashideh, W. 2020. Blockchain technology framework: Current and future perspectives for the tourism industry. *Tourism Management*, 80:1-13.
- Razack, F., Naicker, N. and Sucheran, R. 2025. Digital Literacy and Employability Skills in Hospitality and Tourism Education. *African Journal of Hospitality, Tourism and Leisure*, 14(2): 437-444.
- Reddy, P., Chaudhary, K. and Hussein, S. 2023. A digital literacy model to narrow the digital literacy skills gap. *Heliyon*, 9(4):1-16.
- Renfors, S. 2018. Internationalising higher tourism education: The case of curriculum design in the Central Baltic Area. *Journal of Teaching in Travel & Tourism*, 18(4):315-331.
- Richardson, J. T. E. 2005. Instruments for obtaining student feedback: A review of the literature. *Assessment & Evaluation in Higher Education*, 30(4):387-415.
- Rodrigues, V., Breda, Z. and Rodrigues, C. 2024. The implications of industry 4.0 for the tourism sector: A systematic literature review. *Heliyon*, 10(11):1-20.
- Rogerson, C.M. and Baum, T. 2020. COVID-19 and African Tourism Management: Problems and Prospects. *Development Southern Africa*, 37(5): 727-741.

- Roque, H. C. and Ramos, M. 2019. The importance of cultural training in the hospitality sector. *European Journal of Tourism, Hospitality and Recreation*, 9(2):58-67.
- Saayman, M. 2022. Tourism Skills for the Future: A South African Review. *South African Journal of Higher Education*, 36(4): 210-226.
- Sahin, Y.G. and Celikkan, U. 2020. Information technology asymmetry and gaps between HEIs and industry. *Journal of Information Technology Education. Research*, 19:339-365.
- Saneinia, S., Zhai, X., Zhou, R., Gholizadeh, A., Wu, R. and Zhu, S. 2024. Beyond virtual boundaries: the intersection of the metaverse technologies, tourism and lifelong learning in China's digital discourse. *Humanities and Social Sciences Communications*, 11(1):1287-1300.
- Santarsiero, F., Carlucci, D. and Schiuma, G. 2024. Driving digital transformation and business model innovation in tourism through innovation labs: An empirical study. *Journal of Engineering and Technology Management*, 74:1-14.
- Sarstedt, M. and Ringle, C.M. 2020. Structural equation models: From paths to networks (Westland 2019). *Psychometrika*, 85(3):841-844.
- Scherer, R., Siddiq, F. and Tondeur, J. 2019. The Technology Acceptance Model (TAM): A meta-analytic structural equation modelling approach to explaining teachers' adoption of digital technology in education. *Computers and Education*, 128:13-35.
- Schott, C. and Marshall, S. 2021. Virtual reality for experiential education: A user experience exploration. *Australasian Journal of Educational Technology*, 37(1):96-110.
- Sekaran, U. and Bougie, R. J. 2016. Research methods for business: a skill-building approach. 7th ed. West Sussex: John Wiley and Sons.
- Setiawan, R. A. and Oktaviani, P. 2021. Examining the Technology Acceptance Model in the adoption of narcotic precursor reporting system (Sippre). *Journal TAM (Technology Acceptance Model)*, 12(2):158-163.
- Sharma, P. 2023. Cybersecurity in focus: A comparative analysis of threats and risks in diverse industries. *International Journal of Engineering in Computer Science*, 5(2):33-37.
- Sharma, A.K. and Sharma, R. 2025. Smart tourism in the digital age: Overcoming barriers and unlocking new possibilities. *Revista de Gest~ao*:1-14. Available: <https://doi.org/10.1108/REGE-02-2025-0030> (Accepted 25 August 2025).

- Sharma, V. and Singh, A. 2024. Developing conceptual framework for life skills: The employability requisite in the hospitality industry. *International Journal of Scientific Research in Engineering and Management*, 8(10):1-11.
- Sheik, I. and Kader, A. 2022. Sustainable entrepreneurship strategies for SMME development in the fourth industrial revolution within KwaZulu-Natal, South Africa. *Technology Audit and Production Reserves*, 6(4):6-11.
- Shenkoya, T. and Kim, E. 2023. Sustainability in higher education: Digital transformation of the fourth industrial revolution and its impact on open knowledge. *Sustainability*, 15(3):24-73.
- Shestra, N. 2021. Factor analysis as a tool for survey analysis. *American Journal of Applied Mathematics and Statistics*, 9(1):4-11.
- Shi, J., Cai, L. A. and Wolfe, K. 2022. Advancing hospitality and tourism education and research through global crises. *Journal of Teaching in Travel & Tourism*, 22(3):199-204.
- SiteMinder. 2025. Cybersecurity in the hospitality industry. Available: <https://www.siteminder.com/r/cyber-security-hospitality-industry/> (Accessed 5 August 2025).
- Si-Tou, C.F. 2024. Intelligent technologies and applications in Smart Tourism-A systematic review. *Smart Tourism*, 5(1):2643-2666.
- Siddiqui, M. S., Syed, T. A., Nadeem, A., Nawaz, W. and Alkhodre, A. 2022. Permission and usage control for virtual tourism using blockchain-based smart contracts. *International Journal of Advanced Computer Science and Applications*, 13(11):11-26.
- Sigala, M. 2020. Tourism and COVID-19: Impacts and implications for advancing and resetting industry and research. *Journal of Business Research*, 117:312-321.
- Singh, S., Sharma, M. and Bangad, P.R. 2024. Technology-driven trends in hospitality: The rise of Smart hotels in the digital era. *ShodhKosh: Journal of Visual and Performing Arts*, 5(6):336-343.
- Singh, D. and Tilak, G. 2020. Implementation of education model 4.0: Developing industry 4.0 skills in graduate engineers for improving employability skills. *Humanities and Social Sciences Reviews*, 8(2):601-613.

- Sitepu, R.B., Eliyana, A., Raza, A. and Rosalina, M. 2020. The readiness of educational competency in higher education in connecting the era of industrial revolution 4.0. *SHS Web of Conferences*, 76:1-8.
- Skulmoski, G. J., Hartman, F. T. and Krahn, J. 2007. The Delphi method for graduate research. *Journal of Information Technology Education: Research*, 6(1):1-21.
- Sofiyah, F.R., Dilham, A., Lubis, A.S., Marpaung, J.L. and Lubis, D. 2024. The impact of artificial intelligence chatbot implementation on customer satisfaction in padangsidempuan: Study with Structural Equation Modelling Approach. *Mathematical Modelling of Engineering Problems*, 11(8):2127-2135.
- Stewart, R., Dayal, H., Langer, L. and van Rooyen, C. 2019. The evidence ecosystem in South Africa: growing resilience and institutionalisation of evidence use. *Palgrave Communications*, 5(1):1-12.
- Stylianou, C. and Pericleous, K. 2025. Reviewing the digital skills and readiness of hospitality and tourism graduates: A way of success. *Worldwide Hospitality and Tourism Themes*, 17(1):11-21.
- Subedi, M. 2023. Use of mixed methods in social sciences research. *Nepalese Journal of Development and Rural Studies*, 20(1):96-105.
- Sumitha, K., Kannan, P.N. and Garad, A. 2021. Competencies of quality professionals in the era of industry 4.0: A case study of electronics manufacturer from Malaysia. *International Journal of Quality & Reliability Management*, 38(3):839-871.
- Syafruddin, S., Syarif, E., Sukandar, E.R. and Kustiyyono, O. 2025. Bridging the skills gap: The role of vocational education in developing competent human resources for sustainable tourism. *The Journal of Academic Science*, 2(1):290-299.
- Tani, M. 2022. Same degree but different outcomes: an analysis of labour market outcomes for native and international PhD students in Australia. *Journal for Labour Market Research*, 56(1):24-51.
- Tarigan, M.I. and Tinambunan, A.P. 2022. The effect of social media-based promotion on tourism decision-making. *International Journal of Environmental, Sustainability and Social Science*, 3(2):504-511.
- Tenbergen, B., Krusche, S., Hanna, R. and Bano, M. 2023. Software engineering education and training: Industry demands, curriculum deficits and pedagogy direction. *IEEE Software*, 40(6):36-39.

- Thiart, K. 2025. 4IR and tourism. Creative and Technology Universitas Training Solutions. Available: <https://www.ctutrainig.ac.za/4ir-and-tourism> (Accessed 6 August 2025).
- Thorne, S. 2020. The great saturation debate: what the “s word” means and doesn’t mean in qualitative research reporting. *Canadian Journal of Nursing Research*, 52(1):3-5.
- Tian, Q. and Hebron, D.E. 2024. Skill sets for the hospitality sectors: A review. *International Journal for Multidisciplinary Research*, 6(5):1-9.
- Tolossa, D.N., Umema, F.F. and Gota, G.G. 2023. Social media and tourism: A systematic literature review. *A Global Journal of Interdisciplinary Studies*, 6(4):1-8.
- Tourism KwaZulu-Natal (TKZN) 2024. *Statistics Report 2022*. Durban: TKZN. Available: <https://zulu.org.za/corporate/wp-content/uploads/sites/4/2024/01/TKZN-Stats-Report-2022.pdf> (Accessed 1 September 2024).
- Treglia, E. and Tomassoni, R. 2019. The development of digital competences and emotional skills through the use of audio-visual technologies. *International Journal of Digital Literacy and Digital Competence*, 10(1):55-60.
- Tsiligiris, V. and Bowyer, D. 2021. Exploring the impact of 4IR on skills and personal qualities for future accountants: A proposed conceptual framework for university accounting education. *Accounting Education*, 30(6):621-649.
- Turpie, J., Letley, G., Weiss, J. and Schmidt, K. 2022. Accounting for ecosystem services and asset value: pilot accounts for KwaZulu-Natal, South Africa. *One Ecosystem*, 7:54-68.
- Tushabe, S.B. and Murimi, N.M. 2024. Bridging the skill gaps: Analysing the mismatch between hospitality education and industry needs in Uganda. *African Journal of Tourism and Hospitality Management*, 3(1):201-213.
- Tussyadiah, I.P. 2020. A review of research into automation in tourism: Launching the annals of tourism research curated collection on artificial intelligence and robotics in tourism. *Annals of Tourism Research*, 81:1-13.
- Tussyadiah, I.P., Wang, D., Jung, T.H. and Tom Dieck, M.C. 2018. Virtual reality, presence and attitude change: Empirical evidence from tourism. *Tourism Management*, 66:140-154.
- United States Agency for International Development (USAID). (2024). Pacific Islands, Digital Ecosystem Country Assessment (DECA). Washington, DC: USAID.

- Valdez-De-Leon, O. 2019. How to Develop a Digital Ecosystem – a Practical Framework. *Technology Innovation Management Review*, 9(8):43-54.
- Vasconcelos, S. and Balula, A. 2019. Do you speak digital? – A literature review on language and digital competences in tourism education. *Tourism in Southern and Eastern Europe*, 5:729-737.
- Vasista, K. 2022. Augmented reality vs. virtual reality. *Central Asian Journal of Mathematical Theory and Computer Sciences*, 3(3):1-4.
- Verma, A., Shukla, V.K. and Sharma, R. 2021. Convergence of IoT in the tourism industry: A pragmatic analysis. *Journal of Physics: Conference Series*, 1714:1-25.
- Vignaroli, L., Gramaglia, M., Fuentes, M., Casella, A., Odarchenko, R., Natale, L., Altman, B. and D’Andria, F. 2020, December. The touristic sector in the 5G technology era: The 5G-TOURS project approach. In *2020 IEEE Globecom Workshops (GC Wkshps)* (1-6). IEEE.
- Vinh, N., Hung, Q. and Hien, L. 2023. Prioritising key success factors of the internet of things application in tourism enterprise. *International Journal of Professional Business Review*, 8(5):1-15.
- Vivek, R. and Nanthagopan, Y. 2021. Review and comparison of multi-method and mixed method application in research studies. *European Journal of Management Issues*, 29(4):200-208.
- Volchek, K. and Brysch, A. 2023. Metaverse and tourism: From a new niche to a transformation. In *ENTER22 e-tourism conference*: 300-311. Cham: Springer Nature Switzerland.
- Walhidayah, I. 2024. Digital transformation and innovation in tourism events. *Information Technology Tourism*, 26:373-375.
- Wang, X., 2024. Use of proper sampling techniques to research studies. *Applied and Computational Engineering*, 57(1):141-145.
- Warner, P. 2010. Quantifying association in ordinal data. *Journal of Family Planning and Reproductive Health Care*, 36(2):83-85.
- Wibisono, R.D. and Lale, J. 2024. The impact of social media on tourist destination choices: A quantitative analysis. *OPSearch: American Journal of Open Research*, 3(6):141-146.

- Wirdarti, E., Erkamim, M. and Wartono, A. 2024. Big data in tourism destinations: A systematic literature review. *Indonesian Journal of Machine Learning and Computer Science*, 4(3):719-724.
- Xiao, H. 2022. Analysis of the combination of the regional natural environment and local characteristics of the tourism industry under the perspective of synergistic development. *Journal of Environmental and Public Health*, 2024:1-10.
- Xu, D., Yang, H., Rizoiu, M.A. and Xu, G. 2022. Being Automated or Not? Risk Identification of Occupations with Graph Neural Networks. In *International Conference on Advanced Data Mining and Applications*:520-534. Cham: Springer Nature Switzerland.
- Yallop, A. and Seraphin, H. 2020. Big data and analytics in tourism and hospitality: Opportunities and risks. *Journal of Tourism Futures*, 6(3):257-262.
- Yang, X., Xing, H., Ji, X. and Wang, Z. 2021. Smart localization of thunderstorm charge for human 4IR applications. *Mobile Information Systems*, 2021:1-15.
- Yaska, M. and Nuhu, B. M. 2024. Assessment of measures of central tendency and dispersion using likert-type scale. *African Journal of Advances in Science and Technology Research*, 16(1):33-45.
- Yung, R. and Khoo-Lattimore, C. 2019. New realities: a systematic literature review on virtual reality and augmented reality in tourism research. *Current Issues in Tourism*, 22(17):2056-2081.
- Yaşar, E. 2022. The effect of employer brand on workplace selection in the hospitality industry. *Journal of Tourism Theory and Research*, 8(2):29-36.
- Zaifri, M., Khalloufi, H., Kaghat, F.Z., Azough, A. and Zidani, K.A. 2023. From earlier exploration to advanced applications: bibliometric and systematic review of augmented reality in the tourism industry (2002–2022). *Multimodal Technologies and Interaction*, 7(64):1-24.
- Zhang, L. and Jung, E.H. 2022. The more engaging, the more enjoyable? Age matters in predicting perceived enjoyment with different Facebook activities. *Frontiers in Psychology*, 13:1-13.
- Zhang, Y., Sotiriadis, M. and Shen, S. 2022. Investigating the impact of smart tourism technologies on tourists' experiences. *Sustainability*, 14:1-21.

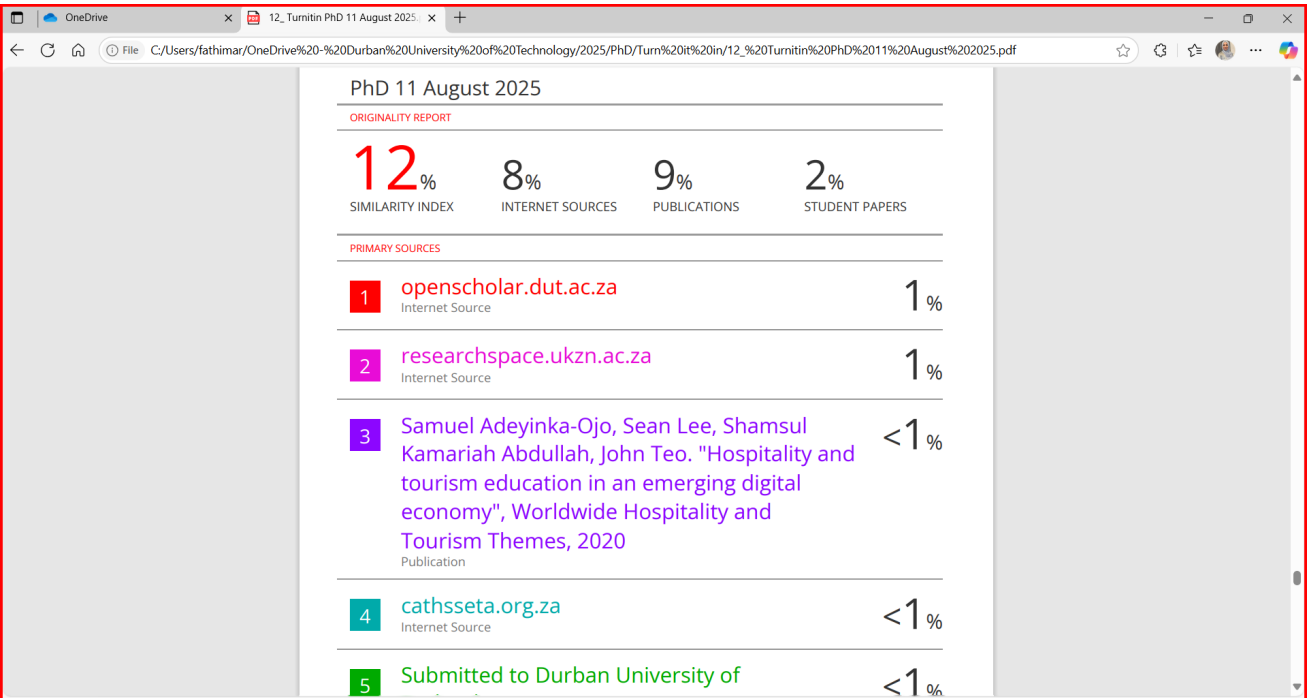
- Zhao, Y., Pinto, L. and Lai, C. 2019. Technology acceptance model (TAM) and social media usage: An empirical study on Facebook. *Journal of Enterprise Information Management*, 32(1):118-132.
- Zsifkovits, H., Woschank, M. and Pacher, C. 2021. A case study: Industry 4.0 and human factors in SMEs. *Industry*, 4:233-261.
- Zulkifli, Z., Ambiyar, A., Syahril, S., Giatman, M., Mulyono, H., Saputra, A. and Weriza, J. 2024. Development of flipped classroom combined case team-based project learning to improve students' academic achievements in higher education. *TEM Journal*, 13(4): 3495-3504.

ANNEXURES

Annexure A: Research Project Plan

Activity	Timeframe
Literature review/Theoretical framework	April 2023 – Ongoing
Write-up Chapters 1-3	
Design of questionnaire	August - September 2023
Pilot questionnaire	February 2024
Revisions to the questionnaire	February 2024
Data Collection (Quantitative)	April - June 2024
Analysis of data from the questionnaires	July - August 2024
Data Collection (Qualitative)	October - December 2024
Analysis of data from semi-structured interviews	January - February 2025
Research Methodology /Findings write-up Chapters 4-7	March - June 2025
Recommendations/Main findings write-up	July 2025
Chapter 8 Submission	August 2025

Annexure B: Turnitin Report Cover Page



Annexure C: Letter of Information and Consent and Indemnity Form



LETTER OF INFORMATION

Title of the Research Study: Towards a Transformative Higher Education Curriculum Model in Smart Tourism within Fourth Industrial Revolution for Accommodation Establishments in KwaZulu-Natal

Principal Investigator/s/researcher: F Razack, PhD Candidate in Business and Information Management

Co-Investigator/s/supervisor/s: Prof N. Naicker (PhD), Dr R. Sucheran (PhD)

Dear Research Participant

Good day. I trust that you are well. Thank you for showing an interest in the above study. My name is Fathima Razack and I am a PhD student at the Durban University of Technology (DUT) in the Department of Information and Corporate Management. I am currently undertaking a study on investigating the nature and extent of the usage of Smart Tourism and 4IR applications at accommodation establishments based in Kwa-Zulu Natal (KZN) and determining the 4IR skills and training needs of employees in the industry. I would like to invite you to participate in the research.

Brief Introduction and Purpose of the Study

The fourth industrial revolution (4IR) has caused technology to permeate all sectors of the economy, including the tourism industry. Graduates from universities offering tourism

programmes need to be equipped with 4IR skills. This study investigates the nature and extent of Smart Tourism and 4IR applications at accommodation establishments based in Kwa-Zulu Natal (KZN) and determines their 4IR skills and training needs. Further, the study will ascertain the extent to which Smart Tourism and 4IR applications are included in the existing higher education curriculum at universities in KZN and the industry perspectives of graduates' skills in this field. The output of the study will be a transformative model/framework for the inclusion of 4IR into the tourism curriculum at HEIs.

By completing this survey, you will help the researcher assess the nature and extent of the usage of Smart Tourism and 4IR applications at accommodation establishments based in KZN, determining the 4IR skills and training needs of the industry and evaluating the graduates' skills in 4IR and Smart Tourism.

Outline of the Procedures:

Staff working at accommodation establishments in KZN will be invited to participate in an online survey questionnaire to ascertain their usage of Smart Tourism and 4IR applications, as well as their perspectives of employees' skills in this field. You are required to take roughly 10 to 15 minutes to honestly respond to each of the questionnaire's questions. In order to access the survey questionnaire, you will receive a link via email. After the online survey questionnaire with chosen participants, this study will conduct follow-up interviews. You may be contacted and requested to participate in the interview.

Risks or Discomforts to the Participant:

There are no potential known risks, discomfort, or disrespect to this study.

Reason/s why the Participant May Be Withdrawn from the Study:

You may decide to withdraw from this study at any time without any negative or adverse consequences by advising the researcher that s/he no longer wishes to participate. No reasons will be required from participants who wish to withdraw.

Benefits:

The study aims to design a Transformative Higher Education Curriculum Model in Smart Tourism within the Fourth Industrial Revolution. The study will produce at least two publications in internationally accredited journals.

Remuneration:

There will be no incentives for this study. Participation will be completely voluntary.

Costs of the Study:

As a participant, you will not be liable for any costs for this study, nor will you receive any monetary compensation or any other remuneration.

Confidentiality:

Although the respondents' email accounts will be used to circulate the questionnaire, the identities of participants will be kept confidential during the data analysis phase as well as in the reporting phase of the study. The participant's responses cannot be linked back to him/ her, as their details are not stored on the system.

Storage of all electronic and hard copies, including tape recordings:

Data will be stored in a safe space only accessible to the supervisor, co-supervisor and researcher. The data will be stored for five years. Thereafter, the print will be shared and the online copies will be deleted.

Persons to contact in the Event of Any Problems or Queries:

Participants are kindly advised to contact the researcher on 084 510 8813, my supervisor 031 3735588 or the Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Director: Research and Postgraduate Support Dr V Govender on 031 373 2558 or researchdirector@dut.ac.za.

General:

Participants are assured that participation is voluntary for this study. An information letter will be emailed to each participant, after which a consent form will need to be read, signed and submitted to the researcher prior to participation.



CONSENT

Full Title of the Study: Towards a transformative higher education curriculum model in Smart Tourism within Fourth Industrial Revolution for Accommodation Establishments in KwaZulu-Natal

Names of Researcher/s: Fathima Razack

Statement of Agreement to Participate in the Research Study:

- ☐ I hereby confirm that I have been informed by the researcher, Fathima Razack about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number:
- ☐ I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- ☐ I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- ☐ In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- ☐ I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- ☐ I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- ☐ I understand that significant new findings developed during the course of this research, which may relate to my participation, will be made available to me.

_____	_____	_____	_____
Full Name of Participant	Date	Time	Signature

I, Fathima Razack, herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____	_____	_____
Full Name of Researcher	Date	Signature

_____	_____	_____
Full Name of Witness (If applicable)	Date	Signature

_____	_____	_____
Full Name of Legal Guardian (If applicable)	Date	Signature

Annexure D: Institutional Ethical Clearance



11 March 2024

Ms F Razack
31 Blackpool Road
Oceanview
Bluff
4052

Dear Ms Razack

Towards a transformative higher education curriculum model in Smart Tourism within Fourth Industrial Revolution for Accommodation Establishments in KwaZulu Natal

Ethics Clearance Number: IREC 239/23

The DUT-Institutional Research Ethics Committee acknowledges receipt of your final data collection tool for review.

We are pleased to inform you that the data collection tool has been approved. Kindly ensure that participants used for the pilot study are not part of the main study.

In addition, the DUT-IREC acknowledges receipt of your gatekeeper permission letter.

Please note that **FULL APPROVAL** is granted to your research proposal. You may proceed with data collection.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the DUT-IREC according to the DUT-IREC SOP's.

Please note that any deviations from the approved proposal require the approval of the DUT-IREC as outlined in the DUT-IREC SOP's.

It is compulsory for a student or researcher to apply for recertification on an annual basis. The failure to do so will result in withdrawal of ethics clearance. It is the responsibility of the researcher and the supervisor to apply for recertification.

Please note that you are required to submit a Notification of Completion of Study form together with an abstract to the DUT-IREC office on completion of your study.

Yours Sincerely

Prof J K Adam
Chairperson: DUT-IREC

Annexure E: Letter to the Gatekeeper



19 February 2024

Request for Permission to Conduct Research

Dear Ms Kim Johnson

My name is Fathima Razack, a Doctor of Philosophy in Business and Information Management student at the Durban University of Technology. The research I wish to conduct for my Doctoral thesis is towards a transformative higher education curriculum model in Smart Tourism within Fourth Industrial Revolution for Accommodation Establishments in KwaZulu Natal.

I am hereby seeking your consent to administer an online survey questionnaire to, and conduct interviews with, staff employed at accommodation establishments based in KwaZulu Natal as per your database. The interviews will be conducted after administering the survey questionnaire, with a sub-population of managerial participants.

Participation in this study will help the researcher assess the nature and extent of the usage of smart tourism and 4IR applications at accommodation establishments based in KZN, determine the 4IR skills and training needs of the industry, and evaluate the graduates' skills in 4IR and Smart Tourism.

I have provided you with a copy of my proposal which includes copies of the data collection tools and consent and/or assent forms to be used in the research process, as well as a copy of the approval letter which I received from the DUT-Institutional Research Ethics Committee (DUT-IREC).

If you require any further information, please do not hesitate to contact me on 084 510 8813 or email me at fathimar@dut.ac.za; my supervisor Prof N. Naicker on 031 373 5588 or email: naickern@dut.ac.za; or my co-supervisor Dr R. Sucheran at 031 373 5509, email: reshma@dut.ac.za.

Thank you for your time and consideration in this matter.

Yours sincerely,

[Fathima Razack]
Durban University of Technology

Annexure F: FEDHASA Approval to Conduct the Study



P.O. Box 37165, Overport, 4067
Tel: +27 (0)31 563 0480
Email: fedhasakzn@fedhasa.co.za
VAT / REG 4830212884/ CO. REG 2003/019/161/08

Ms Fathima Razack
31 Blackpool Road
Oceanview
Durban
4052

Dear Fathima Razack

PERMISSION TO CONDUCT RESEARCH IN THE ACCOMODATION ESTABLISHMENTS IN KWAZULU NATAL

Your application to conduct research entitled:

**“Towards a transformative higher education curriculum model in Smart Tourism within
Fourth Industrial Revolution for Accommodation Establishments in KwaZulu Natal “**

in the KwaZulu-Natal accommodation establishments has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning conducting the online surveys and interviews.
2. Staff members partaking in the research study are not identifiable in any way from the results of the research.
3. A copy of this letter is submitted to each establishment prior to the research being conducted.
4. The period of investigation is limited to the period from 01 March 2024 to 01 March 2025.
5. Should you wish to extend the period of your survey at the accommodation establishments, please contact FEDHASA EAST COAST.
6. Please note that your research and interviews will be limited to accommodation establishments based in KwaZulu Natal.
7. Upon completion of the research, a brief summary of the findings, recommendations or a full report/dissertation/thesis must be submitted to Fedhasa East Coast.

Mr Jaya Naidoo
General Manager
FEDHASA EAST COAST

Annexure G: Ethics Certificate



Zertifikat Certificat

Certificado Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Fathima Razack

a complété avec succès - has successfully completed

Introduction to Research Ethics

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2023/08/30
CID : j4AFCMi088



Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

APPROVED BY



Programmes de formation continue (2 crédits)
Continuing Education Programs (2 credits)

Foederatio
Pharmaceutica
Helveticae

FPH
Programmes de formation
postgraduée et continue

Programmes de formation continue
Continuing Education Programs

Ce programme est soutenu par - This program is supported by :

European and Developing Countries Clinical Trials Partnership (EDCTP) (www.edctp.org) - Swiss National Science Foundation (www.snf.ch) - Canadian Institutes of Health Research (<http://www.cihr-irsc.gc.ca/e/2891.html>) - Swiss Academy of Medical Science (SAMS/ASSM/SAMW) (www.samw.ch) - Commission for Research Partnerships with Developing Countries (www.kfpe.ch)

[REV : 20220217]

Annexure H: Mini Delphi Questionnaire for the Proposed Multi-Dimensional Conceptual Model

Aim and Objectives

The study aims to develop a transformative higher education curriculum model in Smart Tourism within the 4IR to ensure that higher education is aligned with the technological developments in the tourism industry.

Following the research aim, the following research objectives (ROs) were established:

- [RO1]:** *Investigate the nature and extent of the usage of Smart Tourism and 4IR applications at accommodation establishments based in KwaZulu-Natal (KZN).*
- [RO2]:** *Determine the 4IR skills and training needed to be employable at accommodation establishments based in KZN.*
- [RO3]:** *Ascertain the extent to which Smart Tourism and 4IR applications are included in the existing higher education curriculum at universities in KZN.*
- [RO4]:** *Explore the perception of industry stakeholders from accommodation establishments towards the 4IR competencies and skills of tourism graduates from universities in KZN.*
- [RO5]:** *Formulate a model for a transformative higher education framework for the inclusion of 4IR into the tourism curriculum.*

Kindly provide your expert opinion on the proposed Multi-Dimensional Conceptual Model and its intended use in this study by answering the questions below:

1. Is the proposed Multi-Dimensional Conceptual Model in your professional assessment reflective of the study constructs and does it provide realistic opportunities for integrating 4IR skills into tourism curricula and their significance in the transformation of tourism education curriculum?
2. What additional concepts can be suggested for integrating 4IR skills into tourism curricula?
3. Comment on the concepts and constructs that have been omitted from the Multi-Dimensional Conceptual Model. Do you think that the researcher was justified in leaving those items out in terms of the aim and objectives of this study.

Annexure I: Survey Questionnaire

Survey questionnaire for industry stakeholders based at accommodation establishments

Title of the Research Study: Towards a Transformative Higher Education Curriculum Model in Smart Tourism within the Fourth Industrial Revolution for Accommodation Establishments in KwaZulu-Natal

The fourth industrial revolution (4IR) has caused technology to penetrate all sectors of the economy, including the tourism industry. Graduates from universities offering tourism programmes need to be equipped with 4IR skills. This study focuses on investigating the nature and extent of the usage of Smart Tourism and 4IR applications at accommodation establishments and determining their 4IR skills and training needs. This study aims to explore the development and promotion of a transformative higher education curriculum model in Smart Tourism within the Fourth Industrial Revolution. Furthermore, the study seeks to explore the industry perspectives of employee skills in this field in the KwaZulu-Natal province, South Africa.

It will take approximately 10 to 15 minutes to complete the questionnaire. Please answer all questions as completely as possible and where necessary, indicate your option by placing a cross (X) in the box provided. This survey is anonymous and your responses will be treated confidentially.

SECTION A: BIOGRAPHICAL INFORMATION

Place a cross (X) in the corresponding box. There is only **ONE** cross needed for each question.

1. Please indicate your gender.

Gender	(X)	
Male		1
Female		2
Other		3

2. Please select the category applicable to your age.

Age	(X)	
18-24		1
25-34		2
35-44		3

45-54		4
55 and above		5

3. How many years of experience do you have of working in an accommodation establishment?

Years of experience	(X)	
Under 5 years		1
6 to 10 years		2
11 to 15 years		3
16 to 20 years		4
Over 20 years		5

4. What is your highest qualification in tourism?

Highest qualification in tourism	(X)	
Higher Certificate		1
Diploma		2
National Diploma		3
Bachelor's Degree		4
Honours Degree		5
Master's Degree		6
PhD		7
No Tourism related qualification		8

5. Indicate which role you currently work in?

Current	(X)	
Front Office or Reception		1
Housekeeping		2
Management		3
Food and beverage		4
Accounts and finance		5

Human resources		6
Event planning		7
Marketing		8
Purchasing		9
Information Technology		10
Maintenance		11
Other		12

SECTION B:

1. USAGE OF SMART TOURISM AND 4IR APPLICATIONS IN ACCOMMODATION ESTABLISHMENTS: Awareness and Adoption of Smart Tourism and 4IR Application

Please read the following statements and indicate your level of agreement or disagreement. Put a cross in the corresponding box. There is only **ONE** cross needed for each statement.

Rating: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Statement		1	2	3	4	5
1.1	I am familiar with the concept of Smart Tourism.					
1.2	I am aware of the Fourth Industrial Revolution (4IR).					
1.3	I know how 4IR impacts the tourism industry.					

Please read the statement below and indicate how often you have made use of Smart Tourism applications or 4IR technologies in the workplace. Put a cross in the corresponding box. There is only **ONE** cross needed for each statement.

Rating: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Statement		1	2	3	4	5
1.4	I have personally used 4IR technologies or Smart Tourism applications for example Chatbots, GoogleMaps etc. in the workplace.					

2. USAGE OF SMART TOURISM AND 4IR APPLICATIONS IN ACCOMMODATION ESTABLISHMENTS: Types of Smart Tourism and 4IR Applications

From the Smart Tourism and 4IR applications mentioned below, please indicate the extent of you using these technologies in the workplace. Put a cross in the corresponding box. There is only **ONE** cross needed for each statement.

Rating: 1= Not at all, 2= Rarely, 3= Occasionally, 4= Frequently, 5 = Extensively

Statement		1	2	3	4	5
2.1 Mobile applications (apps) for destination information and navigation						
	Google Maps					
	Apple Maps					
	TripAdvisor					
	Roadtrippers					
2.2 Personalised recommendation based on user preferences and behaviour						
	Social media adverts					
	Facebook					
	Pinterest					
	Airbnb					
	LinkedIn					
	YouTube					
	Spotify					
	Netflix					
	Amazon					
2.3 Smart rooms (IoT-enabled) for enhanced guest experience						
	Keyless entry					
	Automated Climate Control					
	Personalised Lighting					

	Virtual Concierge					
2.4 Facial recognition, security and personalised services						
	Customer identification					
	Employee authentication					
	Keyless entry					
2.5 AI-driven chatbots for customer support and questions						
	Hotels.com Virtual Assistant					
	Marriott's Chatbot					
	Whistle Messaging					
	Accor's All-Around Chatbot					
	Any other AI-driven chatbot					
2.6 Big data analytics to analyse and make decisions on tourism trends						
	AI based analytics					
	Real time analytics dashboards					
2.7 Secure transactions or identity verification using Blockchain-based solutions						
	Digital identity for travel documents					
	Smart contracts for automating bookings					

3. USAGE OF SMART TOURISM AND 4IR APPLICATIONS IN ACCOMMODATION ESTABLISHMENTS: Benefits and challenges of Smart Tourism and 4IR applications

Please rate the following statements based on your experience. Mark the appropriate box with a cross. Only **ONE** cross per statement is required.

Rating: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Statement		1	2	3	4	5
3.1	Smart Tourism and applications of the Fourth Industrial Revolution (4IR) raise the overall quality of the tourist experience.					

3.2	These technologies boost the accommodation establishment's operational effectiveness.					
3.3	These technologies improve strategic efficiency with the Accommodation sector.					
3.4	Concerns about data security and privacy prevent these technologies from being widely adopted.					
3.5	The cost associated with putting these technologies into use and keeping them up to date is a challenge.					
3.6	Learning to use Smart Tourism and 4IR applications can be quite challenging.					

SECTION C:

1. ASSESSING 4IR SKILLS AND TRAINING NEEDS FOR EMPLOYABILITY IN ACCOMMODATION ESTABLISHMENTS IN KWAZULU-NATAL: 4IR Skills assessment

How important would you consider each of the following for new graduates to find a job in the tourism industry?

Mark the appropriate box with a cross. Only one cross per statement is required.

Rating: 1 = Not important at all, 2 = Slightly Important, 3 = Moderately Important, 4 = Very Important, 5 = Extremely Important.

Statement		1	2	3	4	5
Digital Literacy and Technology Skills						
1.1	Using basic computer applications (word processing, spreadsheets, etc.).					
1.2	Using mobile apps for tourism-related activities.					
1.3	Using social media for marketing and communication purposes.					
1.4	Mastery of virtual reality (VR) and augmented reality (AR) technologies for enhancing tourism experiences.					

Data Analysis and Interpretation					
1.5	Examining and interpreting data related to tourism to gain business insights.				
1.6	Using data visualisation tools (e.g. Tableau, Infogram, Google Data Studio, Power BI) to represent tourism trends and patterns.				
Artificial Intelligence (AI) and Automation					
1.7	Familiarity with chatbots and AI-powered customer service in tourism.				
1.8	Comprehension of how AI can improve tourism offerings being tailor made				
Cybersecurity					
1.9	Knowledge of cybersecurity risks and best practices for data protection in the tourism industry.				
Remote Collaboration					
1.10	Experience with remote collaboration tools (e.g., video conferencing, project management software).				

2. ASSESSING 4IR SKILLS AND TRAINING NEEDS FOR EMPLOYABILITY IN ACCOMMODATION ESTABLISHMENTS IN KWAZULU-NATAL:

Training needs

2.1 How important are the following 4IR skills for your current position?

Mark the appropriate box with a cross. Only **ONE** cross per statement is required.

Rating: 1 = Skill is not required, 2 = Slightly Important, 3 = Moderately Important, 4 = Very Important, 5 = Extremely Important.

4IR Skills important to your current position		1	2	3	4	5
2.1.1	Digital Literacy					
2.1.2	Data Analysis					
2.1.3	Artificial Intelligence Integration					
2.1.4	Virtual Reality and Augmented Reality					

2.1.5	Cybersecurity Awareness					
2.1.6	Remote collaboration					

2.2 Which 4IR skill listed below do you consider to be the most essential for the future of the tourism industry in KZN?

Mark the appropriate box with a cross. Only **ONE** cross per statement is required.

Rating: 1 = Not Important at all, 2 = Slightly Important, 3 = Moderately Important, 4 = Very Important, 5 = Extremely Important.

4IR Skills most essential for the tourism industry		1	2	3	4	5
2.2.1	Digital Literacy					
2.2.2	Data Analysis					
2.2.3	Artificial Intelligence Integration					
2.2.4	Virtual Reality and Augmented Reality					
2.2.5	Cybersecurity Awareness					
2.2.6	Remote Collaboration					

SECTION D:

1. EXPLORING THE PERCEPTION OF GENERAL STAFF ON THE 4IR COMPETENCIES AND SKILLS OF TOURISM GRADUATES: Perception of Graduates Smart Tourism and 4IR Skills

1.1 Please rate the level of competence that graduates possess in the following **Smart Tourism Skills**. Mark the appropriate box with a cross. Only one cross per question is required.

Rating: 1 = Poor, 2 = Fair, 3 = Average, 4 = Good, 5 = Excellent

Smart Tourism Skills		1	2	3	4	5
1.1.1	Digital Marketing and Social Media Management					
1.1.2	Data Analytics and Insights					
1.1.3	Customer Relationship Management (CRM) Systems					
1.1.4	Mobile App Management					

1.1.5	Use of Internet of Things in Guest Services					
-------	---	--	--	--	--	--

1.2 Please rate the level of competence that graduates possess in the following **4IR Skills**. Mark the appropriate box with a cross. Only one cross per question is required.

Rating: 1 = Poor, 2 = Fair, 3 = Average, 4 = Good, 5 = Excellent

4IR Skills		1	2	3	4	5
1.2.1	Artificial Intelligence					
1.2.2	Augmented Reality and Virtual Reality					
1.2.3	Cybersecurity					
1.2.4	Blockchain Technology					

1.3 To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?

Graduate current skill set	(X)	
Not at all prepared		1
Somewhat unprepared		2
Neutral		3
Somewhat prepared		4
Very well prepared		5

Thank you for filling out the survey! Your contribution is greatly appreciated for this research. If you have any questions, please do not hesitate to reach out to the researcher at: fathimar@dut.ac.za

Annexure J: Interview Schedule

Towards a transformative higher education curriculum model in Smart Tourism within Fourth Industrial Revolution for Accommodation Establishments in KwaZulu-Natal Interview Schedule for managers based at accommodation establishments

Researcher Information: Fathima Razack, PhD Candidate, Durban University of Technology

Introduction: Dear, [Participant's Name]. Thank you for participating in this study. My name is Fathima Razack and I'm conducting this interview as part of my PhD research.

Purpose of the Interview: The purpose of the interview is to investigate the nature and extent of the usage of Smart Tourism and 4IR applications at accommodation establishments based in KwaZulu-Natal (KZN) and determine the 4IR skills and training needs of the tourism industry. The researcher would also like feedback on questions relating to the inclusion of Smart Tourism and 4IR applications in the existing higher education curriculum at universities in KZN and your perspectives on graduates' skills in this field.

Informed Consent: I want to reassure you that your answers will be kept private and that your identity will be secured before we get started. Your participation in this interview, which will be recorded for accuracy, is completely optional. Please feel free to ask if you have any queries or concerns.

Demographic Information:

Can you please provide some basic demographic information?

Age:

Job title:

Work experience:

Qualifications and experience:

Interview Questions

1. In your opinion, which 4IR skills have you found that graduates entering your workplace lacks?

2. Which other 4IR-related technologies or trends do you think will have an impact on the KZN Accommodation sector? Substantiate your answer in terms of positive and negative impacts.
3. Do you think it would be beneficial to incorporate Smart Tourism and 4IR into the tourism curriculum?
4. What role do you see 4IR and Smart Tourism playing in higher education over the next five years?
5. What role do you see 4IR playing in the tourism industry over the next five years?
6. Which specific 4IR competencies and skills are most important for tourism graduates to succeed in accommodation establishments? Substantiate your answer.
7. Are there any specific challenges you face in order to develop or improve your 4IR skills for your position in the tourism industry?
8. Are there any specific challenges that your staff face in order to develop or improve their 4IR skills in the tourism industry?
9. In what ways, in your opinion, should the current university curriculum be changed to better meet the 4IR requirements of the tourism industry?
10. Can you provide examples of how employees who possessed high 4IR competencies benefited your business or the sector as a whole?
11. How familiar are you with the concept of Smart Tourism?
12. What types of Smart Tourism and 4IR applications are currently used in your establishment?
13. How has the use of AI-driven chatbots impacted customer support in your establishment?
14. How do you perceive the importance of cybersecurity skills in the tourism industry?
15. What measures have you taken to address data security and privacy concerns in your establishment?

Annexure K: Alignment of the Research

TITLE: Towards a Transformative Higher Education Curriculum Model in Smart Tourism within the Fourth Industrial Revolution for Accommodation Establishments in KwaZulu-Natal			
AIM: This study aims to develop a Transformative Higher Education Curriculum Model in Smart Tourism within the Fourth Industrial Revolution to ensure that higher education is aligned with the technological developments in the tourism industry.			
Research Objectives	Theoretical Frameworks	Data Collection Methods/Data Sources	Data Analysis/Results
[RO 1]: <i>Investigate the nature and extent of the usage of Smart tourism and 4IR applications at accommodation establishments based in KwaZulu-Natal.</i>	<i>TAM, Innovative Technologies Framework for Hospitality and Tourism Curriculum Development, Multi-Dimensional Conceptual Model</i> <i>Chapter Three</i>	Literature Review <i>Chapter Two</i> Online Survey/Face-to-face Survey Questionnaire <i>Annexure I Chapter Four, Chapter Five</i> Semi-Structured Interviews <i>Annexure J Chapter Four, Chapter Six</i>	Descriptive and inferential statistics using SPSS <i>Chapter Five</i> Coding scheme, thematic analysis and word frequency using NVivo <i>Chapter Six</i>
[RO 2]: <i>Determine the 4IR skills and training needs to be employable at accommodation establishments based in KwaZulu-Natal.</i>	<i>TAM, Innovative Technologies Framework for Hospitality and Tourism Curriculum Development,</i>	Literature Review <i>Chapter Two</i> Online Survey/Face-to-	Descriptive and inferential statistics using SPSS <i>Chapter Five</i> Coding scheme, thematic analysis and word frequency using NVivo <i>Chapter Six</i>

	Multi-Dimensional Conceptual Model Chapter Three	face Survey Questionnaire Annexure I Chapter Four, Chapter Five Semi-Structured Interviews Annexure J Chapter Four, Chapter Six	
[RO 3]: <i>Ascertain the extent to which Smart Tourism and 4IR applications are included in the existing higher education curriculum at universities in KwaZulu-Natal.</i>	TAM, Innovative Technologies Framework for Hospitality and Tourism Curriculum Development, Multi-Dimensional Conceptual Model Chapter Three	Literature Review Chapter Two Online Survey/Face-to-face Survey Questionnaire Annexure I Chapter Four, Chapter Five Semi-Structured Interviews Annexure J Chapter Four, Chapter Six Document Analysis Chapter Six	Descriptive and inferential statistics using SPSS Chapter Five Coding scheme, thematic analysis and word frequency using NVivo Chapter Six
[RO 4]: <i>Explore the perception of industry stakeholders from accommodation establishments towards the 4IR competencies and skills of tourism graduates from universities in KwaZulu-Natal.</i>	TAM Innovative Technologies Framework for Hospitality and Tourism	Literature Review Chapter Two Online Survey/Face-to-	Descriptive and inferential statistics using SPSS Chapter Five

	<i>Curriculum Development, Multi-Dimensional Conceptual Model</i> <i>Chapter Three</i>	Face Questionnaire <i>Chapter Four, Annexure I</i> Semi-Structured Interviews <i>Chapter Four, Annexure J</i>	Coding scheme, thematic analysis and word frequency using NVivo <i>Chapter Six</i>
[RO 5]: <i>Formulate a model for a Transformative Higher Education Framework for the inclusion of 4IR into the tourism curriculum.</i>	<i>TAM, Innovative Technologies Framework for Hospitality and Tourism Curriculum Development, Multi-Dimensional Conceptual Model</i> <i>Chapter Three</i>	Triangulation, Model Development, Technology Readiness Index Mobile App <i>Chapter Seven</i>	Descriptive and inferential statistics using SPSS <i>Chapter Five</i> Coding scheme, thematic analysis and word frequency using NVivo <i>Chapter Six</i>
Consolidation of Research Conclusions of the study, Recommendations of the study, Implications of the study, Limitations and Future Research <i>Chapter Eight</i>			

Annexure L: Certificate of Language Editing

LANGUAGE EDITING REPORT:

Student Name: Fathima Razack

Student Number: 19653464

To whom it may concern

This report confirms that the thesis (PhD.) titled **“Towards a Transformative Higher Education Curriculum Model in Smart Tourism within the Fourth Industrial Revolution for Accommodation Establishments in KwaZulu-Natal”** submitted by Fathima Razack **of the Faculty of Accounting and Informatics, Department of Information and Corporate Management, Post Graduate Studies, Durban University of Technology**, has been edited for language. The editing process was undertaken to ensure that the thesis was free from such English language errors as (but not limited to) those of clarity, coherence, grammar, punctuation, spelling, style and syntax. Neither the research contents nor the researcher’s intention was altered in any way.

Should you have any questions or comments, please do not hesitate to contact me.

Sincerely

Dr V Moodley

Cell: 0829390752

E-mail: vadivelumoodley@gmail.com

18th August 2025

Annexure M: Cross Tabulation for Table 5.14

Table 5.14: Cross Tabulation: “I am familiar with the concept of Smart Tourism” vs “Age”

			Age (years)					Total
			18 - 24	25 - 34	35 - 44	45 - 54	≥ 55	
I am familiar with the concept of Smart Tourism.	Strongly Disagree	Count	3	5	18	11	9	46
		% within Age (years)	10,0%	6,6%	16,4%	22,0%	32,1%	15,6%
	Disagree	Count	3	9	5	6	5	28
		% within Age (years)	10,0%	11,8%	4,5%	12,0%	17,9%	9,5%
	Neutral	Count	10	31	25	9	0	75
		% within Age (years)	33,3%	40,8%	22,7%	18,0%	0,0%	25,5%
	Agree	Count	9	23	35	16	4	87
		% within Age (years)	30,0%	30,3%	31,8%	32,0%	14,3%	29,6%
	Strongly Agree	Count	5	8	27	8	10	58
		% within Age (years)	16,7%	10,5%	24,5%	16,0%	35,7%	19,7%
Total		Count	30	76	110	50	28	294
		% within Age (years)	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)	Monte Carlo Sig. (2-sided)		
				Significance	99.9% Confidence Interval	
					Lower Bound	Upper Bound
Pearson Chi-Square	43,911 ^a	16	0,000	<0.001 ^b	0,000	0,001

Annexure N: Cross Tabulation for Table 5.15

Table 5.15: Cross Tabulation: “Perception of Graduate Preparedness” vs “Gender”

			Gender		Total
			Male	Female	
To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	Not at all prepared	Count	8	15	23
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	34,8%	65,2%	100,0 %
		% within Gender	6,6%	8,8%	7,8%
		% of Total	2,7%	5,1%	7,8%
	Somewhat unprepared	Count	28	37	65
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	43,1%	56,9%	100,0 %
		% within Gender	23,0%	21,6%	22,2%
		% of Total	9,6%	12,6%	22,2%
	Neutral	Count	36	53	89
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	40,4%	59,6%	100,0 %
		% within Gender	29,5%	31,0%	30,4%
		% of Total	12,3%	18,1%	30,4%
	Somewhat prepared	Count	27	50	77
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	35,1%	64,9%	100,0 %
		% within Gender	22,1%	29,2%	26,3%
		% of Total	9,2%	17,1%	26,3%
	Very well prepared	Count	23	16	39
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	59,0%	41,0%	100,0 %
		% within Gender	18,9%	9,4%	13,3%
		% of Total	7,8%	5,5%	13,3%
Total		Count	122	171	293
		% within To what extent do you believe recent graduates are well-prepared for	41,6%	58,4%	100,0 %

	employment in the Accommodation sector with their current skill set?			
	% within Gender	100,0 %	100,0 %	100,0 %
	% of Total	41,6%	58,4%	100,0 %

Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)	Monte Carlo Sig. (2-sided)		
				Significance	99.9% Confidence Interval	
					Lower Bound	Upper Bound
Pearson Chi-Square	6,744 ^a	4	0,150	0,145 ^b	0,133	0,156

Annexure O: Cross Tabulation for Table 5.16

Table 5.16: Cross Tabulation: “Examining and Interpreting Data related to Tourism to Gain Business Insights” vs “ Highest Qualification in Tourism”

			What is your highest qualification in tourism?							Total
			Higher Certificate	Diploma	National Diploma	Bachelor’s Degree	Honours Degree	Master’s Degree	No Tourism related qualification	
Examining and interpreting data related to tourism to gain business insights.	Not important at all	Count	13	3	3	2	1	0	9	31
		% within What is your highest qualification in tourism?	22,4%	7,3%	6,8%	7,4%	11,1%	0,0%	8,7%	10,5%
	Slightly Important	Count	9	4	0	3	0	0	7	23
		% within What is your highest qualification in tourism?	15,5%	9,8%	0,0%	11,1%	0,0%	0,0%	6,7%	7,8%
	Moderately Important	Count	10	10	5	6	2	4	26	63
		% within What is your highest qualification in tourism?	17,2%	24,4%	11,4%	22,2%	22,2%	36,4%	25,0%	21,4%
	Very Important	Count	12	18	18	6	3	4	43	104
		% within What is your highest qualification in tourism?	20,7%	43,9%	40,9%	22,2%	33,3%	36,4%	41,3%	35,4%
	Extremely Important	Count	14	6	18	10	3	3	19	73
		% within What is your highest qualification in tourism?	24,1%	14,6%	40,9%	37,0%	33,3%	27,3%	18,3%	24,8%
Total		Count	58	41	44	27	9	11	104	294

	% within What is your highest qualification in tourism?	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
--	---	--------	--------	--------	--------	--------	--------	--------	--------

Annexure P: Cross Tabulation for Table 5.17

Table 5.17: Cross Tabulation: “Perception of Graduate Preparedness” vs “Digital Literacy”

			To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?					Total
			Not at all prepared	Somewhat unprepared	Neutral	Somewhat prepared	Very well prepared	
Digital Literacy	Skill is not required	Count	11	1	9	1	5	27
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	47,8%	1,6%	10,2%	1,3%	12,8%	9,3%
	Slightly Important	Count	1	1	4	1	3	10
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	4,3%	1,6%	4,5%	1,3%	7,7%	3,4%
	Moderately Important	Count	1	5	11	11	6	34
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	4,3%	7,8%	12,5%	14,5%	15,4%	11,7%
	Very Important	Count	0	20	31	23	7	81
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	0,0%	31,3%	35,2%	30,3%	17,9%	27,9%
	Extremely Important	Count	10	37	33	40	18	138
		% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	43,5%	57,8%	37,5%	52,6%	46,2%	47,6%
Total		Count	23	64	88	76	39	290

	% within To what extent do you believe recent graduates are well-prepared for employment in the Accommodation sector with their current skill set?	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
--	--	--------	--------	--------	--------	--------	--------

Chi-Square Test

	Value	df	Asymptotic Significance (2- sided)	Monte Carlo Sig. (2-sided)		
				Significance	99.9% Confidence Interval	
					Lower Bound	Upper Bound
Pearson Chi-Square	67,216 ^a	16	0,000	<0.001 ^b	0,000	0,001