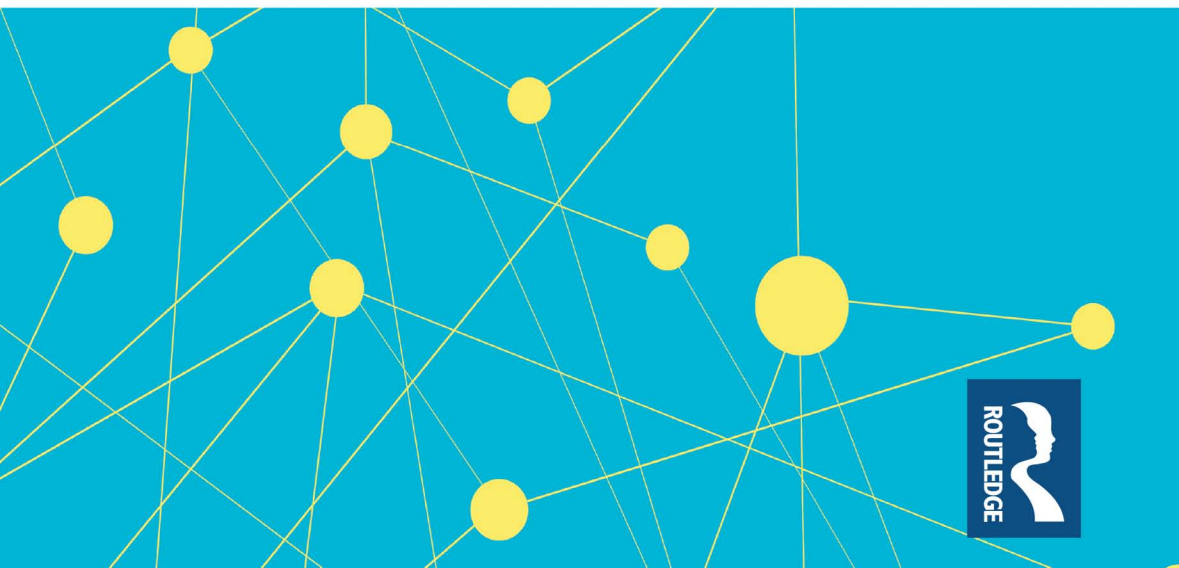


DIGITAL ASSISTANTS IN ONLINE RETAIL SHOPPING

ENHANCING CUSTOMER EXPERIENCE

Chetanya Singh, Manoj Kumar Dash
and Rajendra Sahu



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This book tackles a critical paradox in contemporary e-commerce: despite rapid proliferation of AI-powered digital assistants—from chatbots to voice-enabled shopping tools like Alexa and Siri—consumer adoption remains surprisingly low. Why do shoppers hesitate to trust these technologies, and what motivates those who embrace them? Through rigorous empirical research and innovative theoretical frameworks, this book addresses these pressing questions, offering insights into the psychological, social, and technological factors shaping consumer acceptance of AI-driven shopping assistance.

The book introduces the Acceptance of Digital Assistants in Online Shopping (ADAiOS) model, extending the Technology Acceptance Model (TAM) by integrating Social Presence Theory (SPT) and the Computers Are Social Actors (CASA) paradigm. Through systematic literature review, bibliometric analysis, and advanced multi-criteria decision-making techniques—including Gray-DEMATEL and Gray Influence Analysis (GINA)—the authors identify 12 key factors influencing consumer acceptance: usefulness, ease of use, performance, enjoyment, anthropomorphism, social presence, sociability, privacy concerns, technology anxiety, and trust. Drawing on empirical data from India's rapidly developing e-commerce market, it reveals that human-like attributes, social validation, and perceived presence are critical to acceptance, providing actionable strategies for designing trustworthy digital assistants.

This book will interest students, researchers, and academics in digital marketing, consumer behavior, e-commerce, artificial intelligence, human-computer interaction, and decision sciences. It will also serve industry practitioners, including marketing managers, digital strategists, e-commerce developers, UX designers, and policymakers seeking to optimize AI-powered retail technologies.

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Acronyms and abbreviations

AI	Artificial Intelligence
ACC	Acceptance
ADAiOS	Acceptance of Digital Assistants in Online Shopping
AHP	Analytic Hierarchy Process
ANOVA	Analysis of Variance
ANT	Anthropomorphism
ANX	Anxiety
AR	Augmented Reality
ATT	Attitude
AVE	Average Variance Explained
CAGR	Compound Annual Growth Rate
CASA	Computers Are Social Actors
CB-SEM	Covariance-Based Structural Equation Modeling
C-commerce	Conversational Commerce
CFA	Confirmatory Factor Analysis
CFCS	Converting Fuzzy Values into Crisp Scores
COSE	Customer Online Shopping Experience
CR	Composite Reliability
CSF	Critical Success Factor
CSV	Comma-Separated Value
DA	Digital Assistant
DEMATEL	Decision-Making Trial and Evaluation Laboratory
DOI	Diffusion of Innovations
EAS	Ease of Use
E-commerce	Electronic Commerce
EDU	Education
EFA	Exploratory Factor Analysis
EFGD	Expert Focus Group Discussion
ENJ	Enjoyment
E-retail	Electronic Retail
E-WOM	Electronic Word-of-Mouth
FGD	Focus Group Discussion

FMRI	Functional Magnetic Resonance Imaging
FRP	Future Research Proposition
FSQCA	Fuzzy-Set Qualitative Comparative Analysis
GEN	Gender
GINA	Gray Influence Analysis
Grey DEMATEL	Gray Decision-Making Trial and Evaluation Laboratory
HCI	Human-Computer Interaction
HTMT	Heterotrait-Monotrait Ratio
INC	Income
ISM	Interpretive Structural Modeling
MCDM	Multiple-Criteria Decision-Making
M-commerce	Mobile Commerce
M-shopping	Mobile Shopping
NFI	Normed Fit Index
PER	Performance
PLS-SEM	Partial Least Squares Structural Equation Modeling
PRI	Privacy Risk
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
PwC	PricewaterhouseCoopers
RAP	Rapport
RO	Research Objective
RQ	Research Question
SEM	Structural Equation Modeling
SLR	Systematic Literature Review
SNI	Social Network Influence
SOC	Sociability
SOP	Social Presence
SPSS	Statistical Package for the Social Sciences
SPT	Social Presence Theory
SRMR	Standardized Root Mean Square Residual
TAM	Technology Acceptance Model
TOPSIS	Technique for Order Performance by Similarity to Ideal Solution
TRU	Trust
U&G	Uses and Gratifications
USF	Usefulness
UTAUT	Unified Theory of Acceptance and Use of Technology
VIKOR	Vlekriterijumsko KOmpromisno Rangiranje (multi-criteria optimization and compromise solution)
VR	Virtual Reality

1 Introduction to digital assistant acceptance in online shopping

Background

Electronic commerce (e-commerce) was introduced in the 1960s and has continued to grow since then (Tian & Stewart, 2011). Technological advances such as artificial intelligence (AI), internet penetration, prevalent smartphone use, and social media penetration have steered e-commerce growth (Chawla & Kumar, 2021). According to a SkyQuest (2023) report, "the global e-commerce market is estimated to reach $62,415 billion by 2030, growing at a compound annual growth rate (CAGR) of 11% from 2023 to 2030." A Statista survey (2026) estimates that the total number of global e-commerce customers will reach four billion by 2030. Online shopping is a form of e-commerce that allows customers to purchase products and services from retailers over the internet via websites and online stores, mobile applications, or social media platforms (Zhang et al., 2017). E-commerce has radically altered the global marketplace by offering consumer convenience, 24/7 accessibility, greater product and service variety, and more discounts and offers (Chawla & Kumar, 2021).

However, the impersonal nature of online shopping, that is, a lack of in-person assistance provided by sales agents, physical touch, and social interaction with other customers, hinders its growth (Holzwarth et al., 2006). Moreover, traditional customer service agents are inefficient in online shopping due to limited availability (Ping et al., 2019). To overcome these challenges, e-commerce businesses are actively deploying digital assistants (DAs). DAs are revolutionizing businesses' communication methods, and brands are actively adopting them to engage with consumers (Brill et al., 2019). They automate customer support and facilitate business-consumer conversations (Luo et al., 2019).

The use of AI-based conversational bots as online shopping assistants, either as alternatives to or complements of human frontline employees, is on the rise (Ruan, 2022). A Statista report (2025) concludes that there were more than 140 million DA users in the United States in 2022 who used smart devices and mobile phones to perform tasks and assist customers. There

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is a growing trend among online retailers of using intelligent DAs during service interactions to enhance customers' service experiences (Y. Xu et al., 2022). DAs enhance internal workflows and reduce expenses while offering on-demand customer service (Silva et al., 2023).

Conversational commerce (c-commerce), coined by Messina (2016), is described as "using natural language interfaces, such as voice and text-based DAs, to enable seamless, two-way interactions between businesses and consumers for services" (Van Eeuwen, 2017). Juniper Research projects c-commerce spending to rise from $41 billion in 2021 to $290 billion in 2025, representing an unparalleled CAGR of 58% (Barker, 2021). C-commerce is e-commerce enabled by AI-powered representations that enable conversing with customers (Han, 2021). According to a Research and Markets report (2023), the global c-commerce market is projected to rise from $1.740 trillion in 2023 to $4.915 trillion by 2028. The primary driver of this growth is the development of AI-driven DAs to deliver quick, precise customer service and personalized product recommendations.

The Indian e-commerce market is estimated to reach $350 billion by 2030, making it the second-largest worldwide market after the United States (IBEF, 2023). India possesses unique cultural nuances, such as linguistic diversity, "high touch" service expectations (i.e., human-driven, tailored customer support), and a need for assistance with digital platforms. These unique characteristics of the Indian market require DAs to be designed to support local languages and address cultural differences, thereby enhancing customer retention in the emerging economy (Kaur et al., 2026). Figure 1.1 shows the emergence of DA acceptance from various areas.

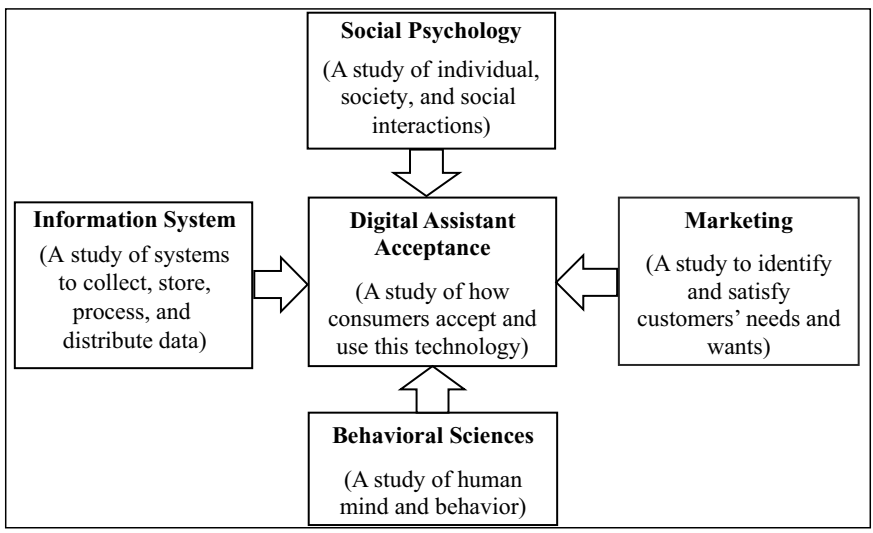

Figure 1.1 Emergence of digital assistant acceptance from various areas

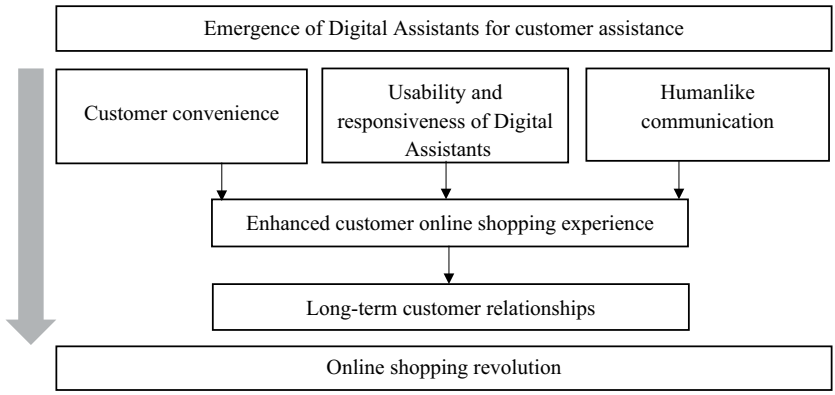

Figure 1.2 Digital assistant acceptance and the online shopping revolution

As shown in Figure 1.1, the concept of DA acceptance has emerged from multiple scientific disciplines and processes, including social psychology, marketing, behavioral sciences, and information systems. Social psychology studies people's thinking, emotions, and actions as they are influenced by the coexistence of others, both real and virtual (Snyder & Stukas, 1999). The American Marketing Association defines marketing as the process of exploring consumer needs and wants and creating, promoting, and delivering value to achieve customer satisfaction. Behavioral science is the study of people's behaviors, integrating psychology (i.e., the study of human thought and behavior (Skinner, 1995)), sociology (i.e., relating an individual with society (Hegtvedt & Turner, 1989)), and anthropology (i.e., the study of what it is to be a human (Levi-Strauss, 1966)). An information system is a seamless integration of individuals, activities, information, and technology to gather, analyze, and share insights. Figure 1.2 shows the DA acceptance-driven online shopping revolution.

Businesses are deploying DAs on online shopping platforms to offer customer assistance. This is due to the continuous availability, functional utility, and responsiveness of DAs. Also, AI-powered DAs enable human-like interaction with consumers. These advantages of DAs enhance customer online shopping experience and help build long-term relationships with them. This way, DAs have revolutionized the online shopping landscape. However, specific problems with DAs' acceptance in online shopping should be addressed to increase their adoption. The following section explains these problems, with a focus on the need for the study.

Issues and challenges of digital assistant acceptance in online shopping

An InMoment (2018) study states that 75% of consumers value in-person experiences and feel like "someone is watching them" while talking to DA,

which leads to an adverse reaction toward their use. A PricewaterhouseCoopers (PwC) survey indicates that only 10% of consumers use DAs for advanced tasks such as shopping (McCaffrey et al., 2018). The main reasons for less acceptance of DAs for shopping are limited knowledge of features, a lack of trust, and hesitation due to complexity (McCaffrey et al., 2018). Massive collection and analysis of user information to serve customers increases the potential for risks and security vulnerabilities (Rabassa et al., 2022). These practices may violate consumer privacy and make consumers vulnerable to marketing manipulation, cyberattacks, and fraud (Thaichon et al., 2022).

DAs often fail to humanize the online shopping experience because of "uncanny valley" effects (Mori, 2000), which suggest that imperfectly human-like AI can trigger a sense of eeriness or discomfort in users (Ratajczyk et al., 2026). Present DAs display an "AI empathy gap," in which interactions between humans and DAs feel standardized in comparison to human representatives (Howcroft & Blake, 2025). DA designers' concerns have shifted from implementing functional DAs to fostering genuine, relevant conversations by replicating human-like intelligence, social skills, and empathy (Khan et al., 2025). **Therefore, it is essential to understand the drivers and barriers to DAs' acceptance in online shopping to guide DA design strategies and enhance their use.** This book seeks to answer the broad questions listed in the next section.

Research questions

The following research questions (RQs) emerge based on the previous discussion on the need to study DA acceptance in online shopping:

- **RQ1.** What are the research trends of DA acceptance in online shopping?
- **RQ2.** What are the factors influencing DA acceptance in online shopping?
- **RQ3.** What is a model to explain DA acceptance in online shopping?
- **RQ4.** Do demographic characteristics impact DA acceptance in online shopping?
- **RQ5.** What is the prioritization of factors of DA acceptance in online shopping?
- **RQ6.** What are the cause-and-effect relations between factors of DA acceptance in online shopping?
- **RQ7.** What are the influences of the DA acceptance factors in online shopping?
- **RQ8.** What are the strategies for enhancing DA acceptance in online shopping?

Findings from the literature survey and knowledge gap analysis

The findings from the literature survey and research gaps are as follows:

- There is no systematic review of the literature or a bibliometric study on DA acceptance in online shopping. There is less consumer acceptance of

DAs in online shopping, and the possible causes have not been comprehensively researched (Ewers et al., 2020). A structured analysis of literature on consumer acceptance of DAs in online shopping is lacking (Han, 2021). A systematic literature review (SLR) and a bibliometric analysis of DA acceptance in online shopping are needed to identify prominent subareas and expand the existing literature (Alsharhan et al., 2023).

- There are a few works on the identification of DA acceptance factors in online shopping. Past studies have examined a few factors influencing customer acceptance of DAs in online shopping (Gursoy et al., 2019). There is little research on human-computer interaction factors related to DA acceptance (Pizzi et al., 2021). Most past studies have focused on functional factors of DAs, such as "usefulness" and "ease of use" (Klein & Martinez, 2022). Few models have included privacy as a factor negatively affecting DA usage (Rabassa et al., 2022). Studies indicate that empathy, as depicted by DA, increases consumer acceptance (Coker & Thakur, 2024). Knob et al. (2024) propose designing DAs that express emotions to enhance consumer interactions and make conversations more real and enjoyable. Hence, it is valuable to identify all potential factors of DA acceptance in online shopping.
- There is limited knowledge of the relationship between DA acceptance factors and consumer trust, attitudes, and acceptance in online shopping. Trust is an essential factor in consumer acceptance of an emerging technology (Choung, 2022). A few studies model Indian customers' acceptance of DAs in online shopping (N. Kumar & Singh, 2022). There are restricted surveys on DAs for customer service (Silva et al., 2023). Hence, a comprehensive model of consumer trust, attitudes, and acceptance of DAs in online shopping needs to be tested, incorporating variables from social science disciplines.
- There is scant research examining the moderating effects of demographic characteristics on DA acceptance in online shopping. Customer acceptance of service technology varies across demographic groups, including gender, age, and prior technology experience (Lu et al., 2019). However, the moderating effect of customer demographic characteristics such as "gender, age, income, and educational qualifications" is not examined in models of consumer intention to use DAs (Ashfaq et al., 2020). To formulate strategies tailored to each demographic segment with high acceptance rates, it is vital to understand how demographics affect DA acceptance in online shopping.
- There is a scarcity of work analyzing the causal interrelationships between factors of DA acceptance in online shopping. Work on critical success factors is needed to successfully deploy DAs in online shopping (V. Kumar & Ayodeji, 2021). The decision-making trial and evaluation laboratory (DEMATEL) is a multi-criteria decision-making (MCDM) method for analyzing cause-and-effect relations in complex systems (Si et al., 2018). However, past studies on DA acceptance have either used multivariate techniques such as structural equation modeling (SEM) (Kasilingam,

2020) or employed experimental designs (Zhu et al., 2022). None have employed DEMATEL to evaluate the causes and effects. Gray set theory, introduced by Julong (1989), is used to address the imprecision of human judgments in solving complex decision-making problems. The combined gray-DEMATEL approach is used across different industries to assess cause-and-effect factors (Ozcan & Tuysuz, 2016; Ritika et al., 2022). This book employs gray-DEMATEL to analyze the cause-and-effect factors of DA acceptance in online shopping.

- Insufficient knowledge exists about the influential factors of DA acceptance in online shopping from a strategic perspective. Knowledge of the influential factors affecting consumer adoption of an innovation is important for developing strategies to ensure its long-term usage (C.-Y. Chen et al., 2018). Gray influence analysis (GINA) is a novel, expert-survey-based method for examining the influence relations among factors in a system (Rajesh, 2023). Using gray system theory to identify the most influential factors of DA acceptance in online shopping is an entirely novel line of research. The book identifies the most influential factors of DA acceptance using the GINA method and proposes strategies for managers and policymakers.

Research objectives

Based on the knowledge gaps highlighted in the previous section, the book fulfills the following research objectives (ROs):

- **RO1.** To systematically review the knowledge on DA acceptance in online shopping and identify the key topics.
- **RO2.** To identify the factors of DA acceptance in online shopping.
- **RO3.** To develop a structural model of DA acceptance in online shopping and find the moderating effects of demographic characteristics.
- **RO4.** To analyze the cause and effect of DA acceptance factors in online shopping.
- **RO5.** To explore the influence of DA acceptance factors in online shopping.
- **RO6.** To develop strategies for DA acceptance in online shopping.

Phases of the book

We have broadly divided this book into four phases to fulfill the six ROs. Figure 1.3 presents the book's flowchart. In the first phase, we conducted an exploratory study to understand DA acceptance in online shopping thoroughly. We systematically reviewed the literature on DA acceptance in online shopping and identified research topics through an SLR and a bibliometric analysis. Next, we conducted an expert focus group discussion (EFGD) to finalize the DA acceptance factors. Then we proposed a hypothetical model of the selected factors (independent variables), consumer trust and attitude

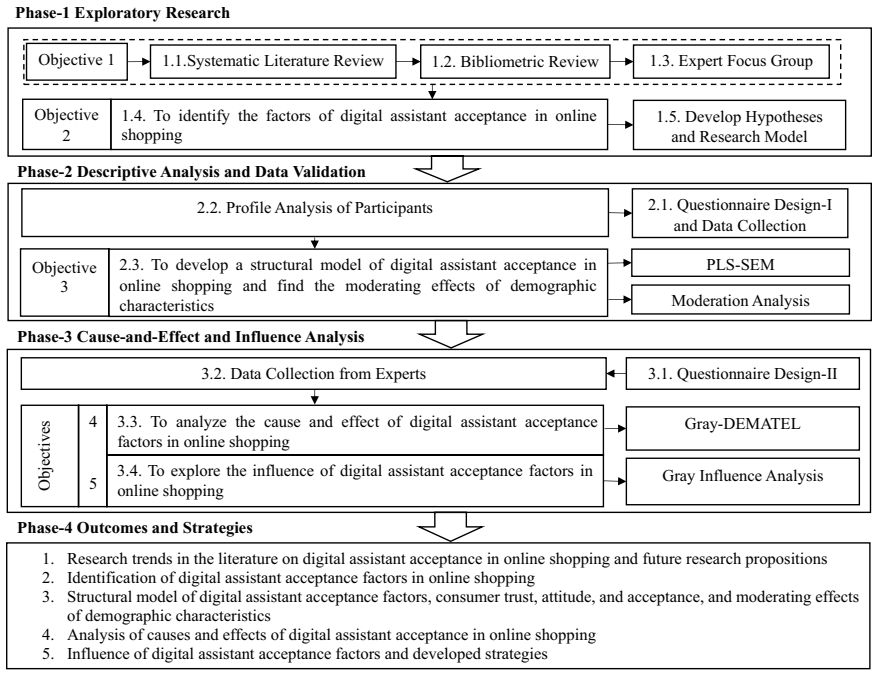

Figure 1.3 Flowchart of book phases

(mediating variables), acceptance (dependent variable), and demographic characteristics (moderating variables). In the second phase, we descriptively analyzed the respondents' profiles and validated the proposed hypothetical structural framework. To this end, we developed a structured questionnaire and collected data from frequent online shoppers and DA users. We employed a partial least squares structural equation modeling (PLS-SEM) technique and moderation analysis to estimate the proposed structural relationships. In the third phase, we analyzed the causes, effects, and influence of the factors. To this end, we designed another survey questionnaire and collected data from academic and industry experts. We employed a gray-DEMATEL and GINA approach for the analyses. In the fourth phase, we discussed the research outcomes and developed strategies for managers and policymakers.

Organization of the book

The four phases are covered in the seven book chapters, including the first chapter. A brief overview of these chapters is discussed here:

Chapter 1 introduces the acceptance of DAs in online shopping. It discusses the issues and challenges of DA acceptance in online shopping. It

formulates the ROs based on the findings. This chapter formulates RQs and ROs based on the insights from the knowledge gaps. It then discusses the book's phases and organization, as well as the study's novelty.

Chapter 2 reviews the literature on DA acceptance in online shopping. It is divided into three main sections: (a) an SLR, covering influential aspects of the literature, yearly publications, top journals, and countries; (b) a bibliometric overview, including network maps based on author co-authorship, keyword co-occurrence, institution citations, and document bibliographic coupling, clusters, and future research propositions; and (c) a critical review, including factor citations and application of MCDM methods. Lastly, this chapter presents the key insights from the systematic review of published research and identifies the knowledge gaps.

Chapter 3 identifies the factors of DA acceptance in online shopping. It discusses the conceptual background of the following technology acceptance theories and models: the Technology Acceptance Model (TAM), the Social Presence Theory (SPT), and the Computers Are Social Actors (CASA) paradigm. This chapter identifies the study's factors through a two-stage process: literature review and EFGD. Lastly, this chapter develops hypotheses and proposes a model to evaluate the relationships between the factors, consumer trust, attitude, and acceptance and finds the moderating effects of demographic characteristics.

Chapter 4 develops a structural model of DA acceptance in online shopping and finds the moderating effects of demographic characteristics. The chapter's methodology includes developing the questionnaire and collecting data from consumers. This chapter first analyzes the respondents' profiles and then employs the PLS-SEM technique to estimate the model relationships. The empirical analysis includes reliability and validity estimation, model fit evaluation, hypothesis testing, and moderating analyses of consumer demographic characteristics.

Chapter 5 analyzes the cause and effect of DA acceptance factors in online shopping. This chapter employs the gray-DEMATEL method. It provides an overview of the gray-DEMATEL and the method justification. This chapter discusses the estimation procedure of the proposed method. We designed a questionnaire to collect data from the experts on the interrelationships between the elements. This chapter presents the findings of the analyses, including rankings of the factors, the causes and effects, and a digraph of the causal relationships.

Chapter 6 explores the influence of DA acceptance factors in online shopping. To this end, this chapter employs the GINA method. This chapter provides an overview of the GINA and the method justification. It discusses the estimation procedure of the proposed approach. This chapter presents the most influential factors and compares the results with those of gray-DEMATEL.

Chapter 7 presents this book's conclusions, implications, and opportunities for future studies. It summarizes the results of all the analyses. This

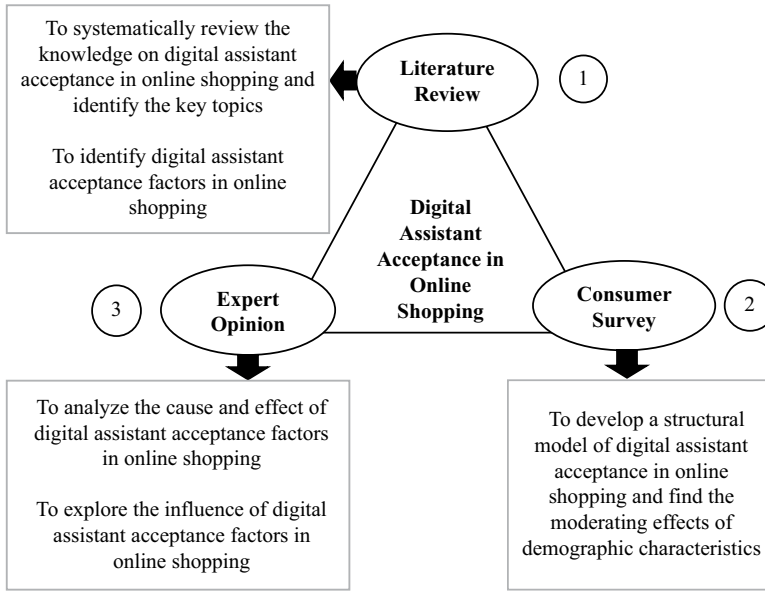

Figure 1.4 Triangular approach to the book

chapter gives the book's theoretical contributions and practical implications, including the strategies for DA acceptance in online shopping. It concludes with the book's limitations and further scope for study.

This book is novel, as it identifies and validates the DA acceptance model in online shopping. Figure 1.4 shows the triangular approach to the book.

As shown in Figure 1.4, first, this book systematically reviews the extant literature and identifies the factors from the literature review and EFGD. Second, this book provides a consumer survey to develop a structural model and find the moderating effects of demographic characteristics. Third, this book provides expert opinions to analyze the causes, effects, and influences of the factors in a gray environment. The next chapter addresses the SLR, bibliometric analysis, and a future research framework for DA acceptance in online shopping.

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Conclusions, contributions, strategies, and future directions

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