AN EMPIRICAL STUDY OF REAL-TIME INFORMATION-RECEIVING USING INDUSTRY 4.0 TECHNOLOGIES IN DOWNSTREAM OPERATIONS

Abstract

Industry 4.0 requires businesses to adopt the latest technology to be effective. However, previous studies have not addressed customer engagement (CE) and its direct benefit (buying) and indirect benefits (referring, influencing, and feedback) using modern technologies. This study analyses customer engagement in regard to real-time information-receiving (RTIR) in the downstream operations implemented through software-as-a-service technology. The data is collected from 533 customers of small businesses in the retail, food & beverages, and accommodation sectors. The study's empirical model was validated using the theory of information-sharing (ToIS). The outcomes specify that RTIR is the antecedent of CE. The results show the mediation effect of customer orientation on RTIR and CE relationship. The study also confirms that gender moderates three out of the four examined relationships between RTIR and CE. Subsequently, our outcomes offer a deeper understanding of RTIR and CE, imbedded in ToIS. This article exposes industry practitioners to RTIR and CE in terms of direct benefit and indirect benefits with modern technologies in downstream operations. This study provides a new theoretical framework using ToIS to advance RTIR in downstream operations through SaaS and CE.

Keywords: Real-time information-receiving, customer engagement, SaaS, industry 4.0

1. Introduction

Industry 4.0 drastically raises customer expectations (Müller et al., 2018) and enhances product and service quality (Frank et al., 2019) and organisational forms (Matt et al., 2015). The adaptation and

implementation of cloud-based applications, including software as a service (SaaS), is one aspect of industry 4.0. Software-as-a-Service (SaaS) is recognised as a technology capable of providing operational and financial benefits to firms, and it is rising as the dominant IT service delivery model (Oliveira et al., 2019). It provides the opportunity to the businesses to reach to optimise 'possible' level of relationships with stakeholders. In this perspective, industry 4.0 provides many prospects to customers as well, i.e. internet could increase their lifestyle. Therefore, businesses provide free SaaS app for customers whilst the service providers make application and data hosting available. Companies use SaaS technology in software or applications for CRM and CEM (customer relationship and experience management respectively), which customers can use for real-time information-receiving (RTIR). SaaS technology enables businesses to share information with customers in real-time to achieve transparency in operations and add value to their business models. It should provide efficiency and easiness in afford, access, and buy the new product (e.g. European Commission, 2016; Sung, 2018). Therefore, industry 4.0's capability of information sharing and transparency through SaaS is becoming part of the strategic planning of the businesses (Appio et al., 2019; Aceto et al., 2020).

Lambert and Cooper (2000) emphasised the significance of point-of-sale and "key" customer data for the improvement of supply chain management (Sener et al., 2019). Several studies called the customer perspective a value-adding one (Bhagwat and Sharma, 2007; Martinsons et al., 1999). Customer perspective turns intentions into actions. In this study, we gauge customer actions as a direct benefit (buying) and indirect benefits (referring, influencing, and feedback) of customer engagement (CE) (Pansari & Kumar, 2017), which is a key in downstream operations. Customers make buying decisions and use the product or service based on the information they receive and know, hence, the framing of RTIR, SaaS and CE in this study. A particular focus on retail, food & beverage, and accommodation businesses about their operations and processes is made because little studies examined such concept there. The Malaysian service sector consists of three groups, final services, intermediate services and government services. These three sectors are a major part of final services group. These sectors contribute 72.9 % in final services group and 33.1 % to the total service industry. This paper fills this intellectual gap and sheds light on CE using RTIR, through SaaS technology in downstream operations.

Several studies suggest that Industry 4.0 provides opportunities and threats for supply chain management (i.e. Ivanov et al., 2019; Manavalan & Jayakrishna, 2019; Xu et al., 2018). On the other hand, previous studies consider customer perspective for supply chain improvement and present it as an integrated part of supply chain management (Forslund, 2007; Mentzer et al., 2001; Rodríguez-Espíndola et al., 2018; Suh & Kim, 2018). Nevertheless, information flow is very relevant in industry 4.0 to drive actionable insights of business to revolutionise supply chains model. The information flow towards customers is critical, as providing online information is an essential element of customer service (Gunasekaran et al., 2001; Osei-Frimpong, Wilson & Lemke, 2018). Dell uses real-time information sharing to receive customers' orders online and give them information on component availability (Zhou & Benton Jr, 2007). Johnson and Ramaprasad (2000) argue that sharing information with customers fosters relationships with them and has the psychological effect of empowering, involving and satisfying them. Building from this literature, we conceptualise that RTIR is the antecedent of CE, and there is a scarcity of research on the RTIR-CE relationship.

Lasi et al. (2014) explained that Industry 4.0 suggests many options like using RTIR via RFID etc. which allow an advanced integration in various application systems. The extant literature describes how the adoption of RTIR in various business processes, e.g. gauging employees' attitudes (Constant et al., 1994), improving supply chain performance (Devaraj et al., 2007; Li et al., 2014; Wiengarten & Longoni, 2018), increasing productivity (Ari Samadhi & Hoang, 1995), controlling traffic (Shahrbabaki et al., 2018), and transforming businesses or industries (Ge et al., 2017). All previous themes are linked to the automation and data exchange of industry 4.0. In this study, RTIR is conceptualised as receiving of real-time customer feedback/ responses (through CRM or CEM apps) after the service has been provided. Nevertheless, there is a scarcity of studies which determine the possible effect of RTIR on operations and processes using SaaS technology in the service industry.

Increasingly, firm's are investing in industry 4.0 technologies to achieve efficiency in operations and processes, which eventually benefits customers and other stakeholders in downstream operations. However, the payoff from IT investments is not guaranteed (Devaraj et al., 2007). Literature suggests the lack of scientific study that clearly shows and institutes the influence of the new e-Business technology (Ghouri & Mani, 2019; Mukhopadhyay & Kekre, 2002). Further, literature shows mixed

results for the technological investment. On the one hand, it is argued that there are issues with IT investment, including higher expectations (Davila et al. 2003), traditional valuation analysis (Hitt & Brynjolfsson, 1996), weak procurement methods (Hulme, 1997), non-compliance of technology (strategic change) (Whittaker, 1999), negative effects of existing products/services (Stock and Zacharias, 2013), and management of information sharing . Contrarily, a strong persuasion exists for technological investments (Fawcett et al. 2007; Ho, 1996; Vanpoucke et al., 2017). Other studies postulated that businesses should adopt information systems (IS) to survive in a competitive business environment and achieve better performance (Aydiner et al., 2019; Maiga et al., 2015). Converging them from these literatures, we examine the implication of SaaS in Industry 4.0 perspective for RTIR.

RTIR was elucidated in numerous other studies. Many studies suggested that real-time information sharing enables improved performance: efficient decision-making (Oliveira & Handfield, 2019), better and efficient product ordering (He et al., 2018), improved procurement practices (Alsetoohy and Ayoun, 2018). Hostler et al. (2005) and Backhouse and Dhillon (1996) found mixed and negative effects on information technology systems. Despite this developing tendency of the RTIR topic, it has received little theoretical and empirical attention. Hence, this study gauges the interaction between RTIR, customer orientation (CO), and CE. Additionally, it explores the impact of gender as a moderator between RTIR and CE.

In the light of the foregoing, we try to advance the theoretical and empirical knowledge of supply chain RTIR from industry 4.0 perspective and answer the following research question: Whether or not cloud services in industry 4.0 could provide transparency and suggest a new model for businesses. The need to ask this question is threefold: first, preceding literature lacks a discussion of CE with regard to RTIR, and there is no evidence to show that RTIR in the service industry would add value in customers' minds. This study result enriches the ongoing theory-development efforts in these domains. Second, previous studies have not substantially attentive on the concept of RTIR in service industry; therefore, the present study enhances and fills this gap. Third, it is uncertain since the extensive implementation of SaaS in businesses whether RTIR would impact or be an antecedent of CE, or whether CO mediates this relationship. This research develops a theoretical framework using the theory

of information-sharing (ToIS), thus advances the understanding of downstream operations RTIR and CE with SaaS technology.

The other parts of the paper are: Part 2 discusses the related theories, review of literature and hypotheses. Part 3 elucidates the methodology, research design, and results of the reliability and validity tests. Part 4 presents the investigated constructs and the path-modelling results. Part 5 provides a discussion on theretical, and practical implications of the study. Finally, part 6 shares the main limitations, and future research directions.

2. Supporting Theories and Hypotheses

2.1 Theoretical foundation

Fawcett et al. (2009) emphasised how connective business networks (through information sharing) achieve the expected business performance. Constant et al. (1994) extended social exchange theory with ToIS and suggest 'organisational culture and policies as well as personal factors can influence people's attitudes about information-sharing' (Constant et al., 1994, p. 401). Information-sharing often leads to improved performance in operations (Prajogo & Olhager, 2012; Vaccaro, Parente, & Veloso, 2010). Jarvenpaa and Staples (2000) defined the purpose of ToIS as to apprehend the factors that reinforce or curb the information-sharing in technologically progressive and advanced organisations. Additionally, this theory also emphasises communication and information exchanges with strangers or potential customers. The present study highlights customers' perceptions about the information they receive through mobile apps from a particular business. It also provides insight into SaaS implementation and its benefits for business. Recent literature suggests that acquiring and sharing data throughout the supply chain is part of industry 4.0 (European Commission, 2016; Zhang & Chen, 2020). Bharadwaj et al. (2013) and North et al. (2018) explained that data acquisition and sharing of business information is only possible due to the top management commitment and exceptional technological expansions and progression, especially in mobiles. Information sharing always accords with the self-interest of businesses; nevertheless, customers think differently on the basis of information received on products and services (Chennamaneni et al., 2012; Constant et al., 1994).

The more an individual trust and believes that information shared by businesses is informative, correct, and trustworthy, the more they behave trustfully and confidently (Constant et al., 1994; Li & Lin, 2006). Constant et al. (1994) further elaborated on tangible information (like written documents or computer programs) as 'information as product', which has different effects on behaviour. This theory scrutinises the purpose and benefits of receiving information, and raises a question about information: "What is in it for me;" in response, this study provides answers from both the perspectives of both customers (What customer benefits are hidden in information receiving? Does it help them to make better decisions about products or services?) and businesses (Does real-time information sharing add value in the process of delivery of the product/service in downstream operations?). However, comprehension and knowledge of information-sharing values is still limited. This research explores customers' perceptions and perspectives of what they could attain and gain from receiving real-time knowledge from businesses in the downstream operations.

2.2. Real-time information receiving, customer engagement, and customer orientation

RTIR is a diversified concept which could be beneficial in different ways in service industries. Customers can become partners through interactive and knowledge-sharing technologies (Woodside & LaPlaca, 2014). Yi & Gong (2013) believed that information sharing intensify customer behaviour. Similarly, Frazzon et al. (2018) believed that the latest technological developments had enabled the entities to share real-time information. Many industries are involved in real-time information sharing with their customers (Cai et al., 2016; Lindau et al., 1994; Sahin & Robinson, 2002). Processing information in an organised and structured way curtails the uncertainty and assists the decision-makers in interpreting the information with specific standards and uniformity (i.e. Daft and Lengel 1986; Steinhoff et al., 2019). Such uniformity and standard, effectively processes the information into customer mind. According to Craighead et al. (2007), when individuals have a clear view of events, it can influence their attitudes and behaviours positively or negatively. This positivity or negativity influence on customer attitudes in turn designs the behaviour. Handfield et al. (2015) argued that timely and trusted information leads to agility and improved performance as they use.

Literature suggests that real-time information urges impulse behaviour towards related things. Instant information sharing is more likely to be spontaneous and automatic without prior consultation and evaluation (Reuter & Spielhofer, 2017; Wang et al., 2015). The result is cognitive and affective forces guiding individuals' attitude, and behaviour that is typically elicited at a specific time and place (Rook, 1987). Customer confidence or trust is also enhanced when they realise that the data they are receiving on their app is true and trustworthy; leading to purchase, loyalty, or satisfaction. This may also stimulate the potential customer to react instantaneously. Such type of tactic provides businesses with an opportunity to make unexpected positive behaviour (i.e. recommend the offering to others) as well. We posit that RTIR about operations and processes with customers enables businesses to maintain their particular standards, quality, and other performance indicators.

The benefit of sharing information varies depending on what type of information is shared and how (Locke, 2011). Van Doorn et al. (2010) suggested that CE enhances within a dynamic and interactive business environment and that such an environment is a strategic imperative for improving business performance. They further elaborated that CE is a behavioural construct that not only linked to purchase behaviour but beyond. The reasoning is based on the fact that engaged customers like to be in touch with the brand in viral marketing activity by making referrals and recommendations (Brodie et al., 2011; Van Doorn et al., 2010). Vargo and Lusch (2004) described CE as the non-transactional behaviour, such as replying/ commenting on a business Facebook page or recommending a service to a friend. In CE, the customer becomes an informal member and value creator in the business value chain. This type of role is initiated by a business' efforts for customers, amongst which is RTIR (Welker et al., 2008).

In present study, we conceptualised the term CE in the context of relationship marketing (Pansari & Kumar, 2017) which has direct implication on downstream operations. Pansari and Kumar (2017) conceptualised the CE construct in terms of direct and indirect benefits. The direct benefit is customer buying – making purchases as a result of marketing activities. The indirect benefits are theorised as having three aspects: a) customer referring, b) customer influencing, and c) customer feedback/knowledge. Customer referring means that customer(s) helps businesses by attracting other customers who would not be interested and attracted otherwise through business marketing efforts

(Kumar et al., 2010b). Customer influencing refers to customers affecting others' activities within their social media network (Kumar, 2013). Customer feedback denotes current customers' active involvement in improving a company's products/services by providing feedback or suggestions (Kumar & Bhagwat, 2010; Pansari & Kumar, 2017). These relationships using RTIR are still unclear in the literature. Several studies depict how customers giving and receiving feedback in real time can enhance CE (Beckers et al., 2018). Building from this, we propose that RTIR about customer feedback and ratings on apps enable businesses to enhance CE in downstream operations, so we hypothesise:

H1a: *Real-time information sharing has a positive relationship with direct benefit (buying) of customer engagement*.

H1b: *Real-time information sharing has a positive relationship with indirect benefits (H1b1: referring, H1b2: influencing, H1b3: feedback) of customer engagement*.

Customer focus and customer-driven practices are top priority of businesses (Esbenshade et al., 2016; Zeppetella et al., 2017). Two main studies of CO are Kohli and Jaworski's (1990) and Narver and Slater's (1990) in literature: While, Kohli and Jaworski defined it as organisation-wide generation and dissemination of, and responsiveness to market intelligence, Narver and Slater stated it as the organisational culture that most effectively and efficiently creates the necessary behaviours for the creation of superior value for buyers and, thus, continuous superior performance for the business. Deshpandé et al. (1993) recommended that profit is a reward for CO. Majaro (1993) stressed that businesses need to concentrate more on customer orientation rather than profit orientation.

Hence, real-time information receiving perhaps would enhance CO. RTIR about customer feedback/ratings provides the receiver with a picture of the business and its operations. If the business shares real-time information with customers and that information is matching with customer preferences or requirements, it would add value in service delivery and also fulfil the customers' desire for more personalised, customised, and closer relationships with service providers (Berry, 1995; Parasuraman et al., 1991). These activities, and organisational thinking strengthen the customer orientation, resulting in better relationships. Thus, we hypothesise the following:

H2: *Real-time information sharing has a positive relationship with customer orientation.*

Uncles et al. (2003) posited that the customer-focused/ driven approach enhances customer purchase behaviour. Customer preferred or matching information or offering could evolve the customer behaviour and provide an opportunity to make unexpected positive behaviour (i.e. sale). Kumar et al. (2010a) explained that a customer orientation approach enables customers to be involved in referring to the product/ service. Similarly, Hartline et al. (2000) suggested that a customer-focused approach creates a degree of impact through the customers' influence on social media. Individuals can influence others' activities within their (interactive) social network, through direct or indirect activities, for particular businesses (Trusov et al., 2009). When a customer finds that a business is customer-driven and focused, they also want to be involved in this process. Therefore, we propose the association between CO and CE:

H3a: *Customer orientation has a positive relationship with direct benefit (buying) of customer engagement*.

H3b: *Customer orientation has a positive relationship with indirect benefits (H3b1: referring, H3b2: influencing, H3b3: feedback) of customer engagement.*

Table 1 depicting the important details of studies and findings to show the knowledge gap. As summarised above, that customer driven offering/ services could involve the customer in buying, referring, influencing, and feedback/ knowledge when they receive latest and updated information on their device. Therefore, RTIR in downstream operations is associated with CE, and that CO is associated with both RTIR and CE. Hence, we propose that CO plays a mediating role between RTIR and CE, and hypothesise as follows:

H4a: *Customer orientation positively mediates the relationship between real-time information-receiving and the direct benefit (buying) of customer engagement.*

H4b: *Customer orientation positively mediates the relationship between real-time information-receiving and the indirect benefits (H4b1: referring, H4b2: influencing, H4b3: feedback) of customer engagement*.

Table 1. Details of studies linking industry 4.0 and customer engagement

Study	Country	Sample type/ industry	Study type	Sample count	Variables	Finding
Beckers et al., (2018)	North-America, Europe, Asia	Secondary Data	Quantitative	88	Customer Engagement Initiative, Type of Initiative, Social Media, Competitive Intensity, Advertising Intensity, Customer Satisfaction, Corporate Reputation, Market Turbulence, Abnormal Stock Return	The companies' customer engagement initiatives, on average, decrease market value, which is likely because the shareholders are sensitive to the risk of these initiatives backfiring. Nevertheless, initiatives that stimulate word-of-mouth are viewed less negatively than initiatives that solicit customer feedback, as are initiatives that are supported by social media. Companies that operate in a competitive environment or do not advertise much can create value by stimulating customer engagement, while companies with a strong corporate reputation are likely to not benefit from it.
Cai et al., (2016)	China	Machinery And Equipment Manufacturing, Construction,	Quantitative	208	Supply Chain Collaboration, Organizational Responsiveness, Information Technology Capability	Supply chain collaboration positively affects organisational responsiveness. Both outside-in and spanning IT capability positively moderates this relationship.

		Electronic And Optical Product Manufacturing, Financial And Insurance Services, Wholesale And Retail Trade				
Frazzon et al. (2018)	-	-	Simulation Model, MIP Model	-	MIP, Genetic Algorithm, Real World System, Simulation Model	There is significant reduction in the number of late orders, substantiating that proper scheduling approaches combined with information visibility allow for operational improvements in manufacturing supply chains.
Handfield et al. (2015)	United Kingdom	Manufacturing Businesses	Quantitative	151	Internal Stakeholder Alignment, System Orientation, External Supply Base Alignment, Supplier	This study suggested that synergistic effects derived through strong internal lines of communication combined with external supply relationships based on defined metrics and processes.

					Agility, Performance Improvement	
Lindau et al., (1994)	Sweden	Departments of body shop of car plant	Simulation Study, Case Study	4	Lead-time, Work-in-Process, Output	The performance of a car-body shop is affected when real-time information about progress in sub-systems is available to the scheduler.
Rook (1987)	United States	College Classrooms and Off-Campus Field Setting	Qualitative	133	”Consumers’ Impulse Buying Behavior	The research identifies: (1) the subjective experiences that distinguish the onset of the buying impulse, (2) how consumers cope with their impulsive urges to buy, and (3) the types of negative consequences they incur as a result of their impulsive buying.
Sahin & Robinson (2002)	-	Research Articles	Qualitative	-	Information Sharing, System Coordination	Only through a clear understanding of the economics of channel integration can help the industry move forward with the development and implementation of new information-technology-based supply chain strategies.

Steinhoff et al., (2019)	-	Secondary Data, Research Articles	Qualitative	-	Seamless Relationships, Networked Relationships, Omnichannel Relationships, Personalized Relationships, Anthropomorph-ized Relationships	Online relationships encompass relational exchanges between the customer and company that are mediated by Internet technology and take place in a non–face-to-face (i.e., human-to-technology interactions) setting.
Van Doorn et al., (2010)	-	-	Qualitative	-	Customer-Based, Firm-Based, Context-Based, Customer Engagement Behavior, Customers, Firms, Others	Customer engagement behaviour could affect initiative by firm information usage and technological use.
Yi & Gong (2013)	-	Undergraduate Students	Quantitative	-	Customer Participation Behavior, Customer Citizenship Behavior	This study also shows that customer participation behaviour and customer citizenship behaviour exhibit different patterns of antecedents and consequences.

2.3. *Gender as moderator*

Gender is the most frequent demographic variable used in a survey based research, especially with regard to products and services (Cruz-Cárdenas et al., 2019; Putrevu, 2001). Eagly and Wood (1993) projected that women are expected to be communal and men to be agentic. Tannen (1990) posited that females are more deeply connected to the internet as compared to males. They often observe computer-mediated communication as a reason to raise questions and gain understanding, whereas males were more likely to use it to get and give information. Consistently, other studies also depicted that males had more positive attitudes towards internet technologies than females (Ono & Zavodny, 2003; Wang et al., 2017). Therefore, we can suppose that the cognitive and perspective gender differences affect information searchers' likings, preferences, and abilities to navigate and search the information on the internet effectively. Previous literature suggest that females lag behind the males in the degree to which they are blended/ experienced with, and motivated by technology (Kim et al., 2007; Schumacher & Morahan-Martin, 2001). Lin et al. (2017) explained how the perception of privacy risk, enjoyment, and reputation, besides community identification, all in relation to gender, have complex influences on users' social network site continuance decisions. Hence, we hypothesise the moderating role of gender in the relationship between RTIR in downstream and CE:

H5a: *Gender moderates the relationship between real-time information-receiving and the direct benefit (buying) of customer engagement*.

H5b: *Gender moderates the relationship between real-time information-receiving and the indirect benefits (H5b1: referring, H5b2: influencing, H5b3: feedback) of customer engagement*.

2.4 *Control variables*

The present study reflects two control variables: education and age. These variables stay unchanged and constant throughout the study to avert the influence over to independent variable. Some studies show educational differences in adaptation to technology and information sharing (Capon &

Burke 1980; Pereira et al., 2017). Age creates a disparity in adaptation to technology and information sharing (Christofides et al., 2012; Sarmento et al., 2015). Hence, education and age are two reliably measured variables in earlier studies on aspects of information receiving. Figure 1 represents the hypothesised model of the study.

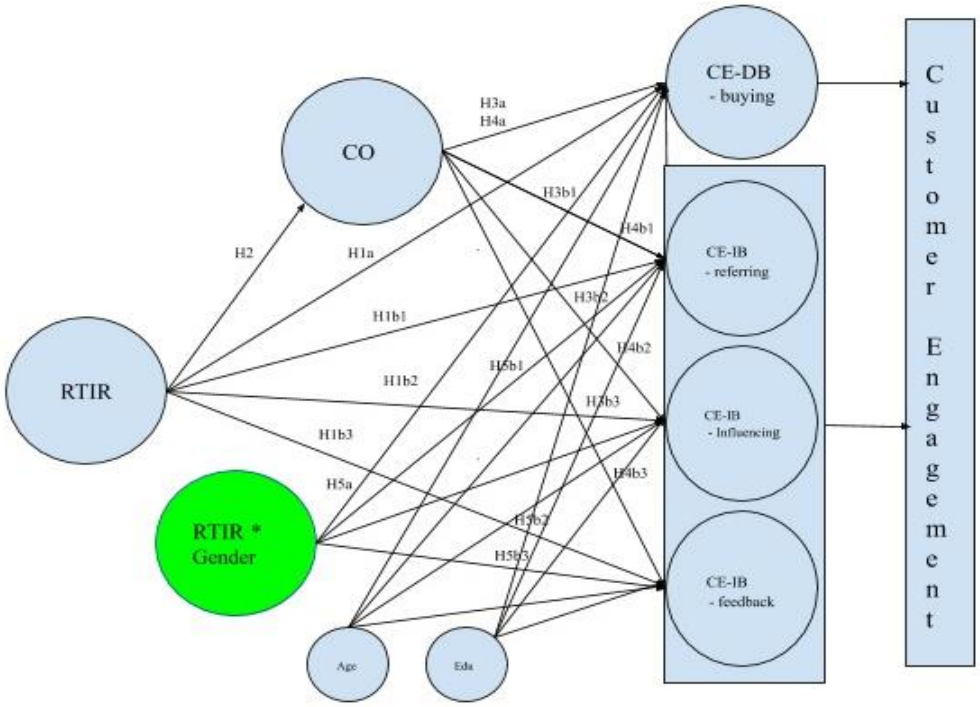

Figure 1. Hypothesised model

(RTIR: real time information receiving; CO: customer orientation; CE-DB: Customer engagement-direct benefits; CE-IB: customer engagement -indirect benefit)

3. Methodology

3.1 Operationalising constructs

The flow chart of the methodology presented in figure 2. The issue of content validity was addressed with the help of two professors, three scholars and industry representatives to determine whether the empirical work would speak to the intellectual distress of investigation (Zeller & Carmines, 1980). All constructs were adopted from published research work, which articulated each construct's features and attributes (Appendix 1). To investigate the effect of all constructs, we use Likert scale (strongly disagree = 1 – strongly agree = 5), while a CE direct benefit (very low = 1 – very high = 5).

The study model specifies the following direct relationships: RTIR → CO, CO → Buy, RTIR → Buy, CO → Ref, RTIR → Ref, CO → Inf, RTIR → Inf, CO → Fb, and RTIR → Fb. Moreover, it also depicts mediation relationships: RTIR → CO → Buy, RTIR → CO → Ref, RTIR → CO → Inf, and RTIR → CO → Fb, and the moderating effects of Gender * RTIR → Buy, Gender * RTIR → Ref, Gender * RTIR → Inf, and Gender * RTIR → Fb. We employed ADANCO 2.0.1 software to use partial least squares (PLS) method to find the results. Chin (1998) considers PLS method more suitable for analysis when the theory is at primary and early development phase, and present study intends to reveal customers' perceptions and perspectives on real-time data receiving in retail, food & beverage, and accommodation industries, which is at an early stage of the research. The other reason to adopt the PLS method is that it shows the significance of construct(s) relationship(s) and demonstrate on how well the model of the study perform (i.e. Hair et al., 2016). Additionally, it also provides R^2 value and suitable for prediction-based research (i.e. Wei et al., 2019).

The RTIR and CO (mediator) were conceptualised with three items each. The RTIR items, respectively, concerned the customer opinion about whether RTIR has potential advantages, could help in decision making and is a possible useful option. The CO items concerned with customers' opinion on their long-term commitment to businesses, customer value creation by businesses, and market research activities by businesses to determine their needs. The CE construct consists of two sub-variables: i) direct benefit and ii) indirect benefits. The direct benefit sub-variable was entailed in the customer's intent to buy a particular service brand, which was measured using three items. The items measuring direct benefit showed the customers' opinion about their likelihood, probability, and intensity of willingness to purchase the same service. The indirect benefit sub-variable consists of three parts: i) referring, ii) influencing, and iii) feedback/knowledge intention of the customer. The referring was assessed using three items, about positive word of mouth and recommendation to people (on one's own initiative or when asked) of the service brand. The influencing was considered using three items about social media sharing: sharing an opinion or information after receiving a service, sharing interesting information, and sharing positive reviews about the service brand. The feedback/knowledge was gauged using three items, concerning the intention to share feedback about the current situation to employees and managers, and feedback for improvement. Table 2 presents the demographic

characteristics of the customer sample in terms of gender, education, and age. Education and age were the control variables used to ensure robustness.

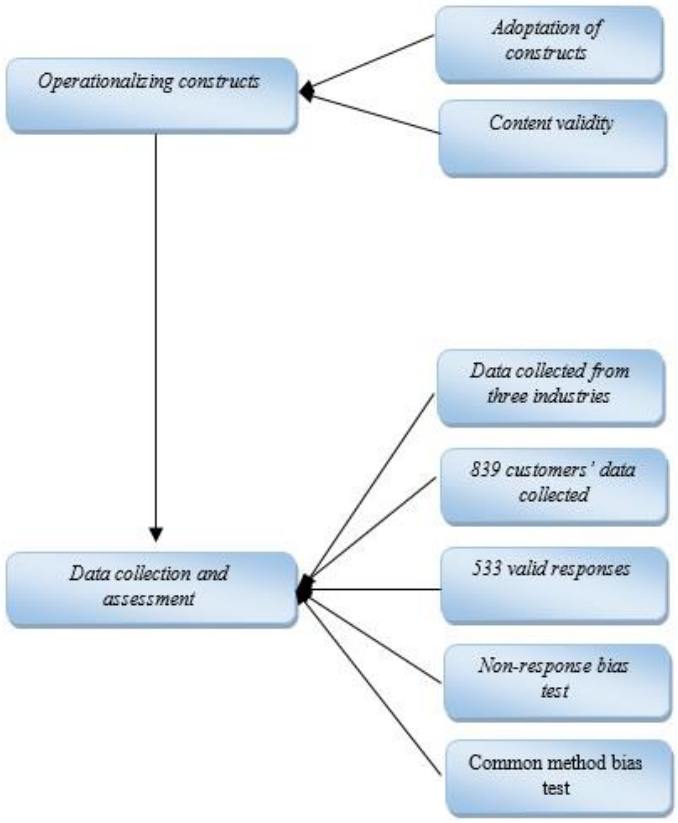

Figure 2. Flow chart of the methodology

3.2 Data collection and assessment

The sample contains customers of retail, food & beverage, and accommodation sectors, i.e. TESCO, McDonald's, Impiana KLCC and First World hotel. Our respondents were individuals, and we approach them in different convenience and speciality stores, food outlets, and people who use to travel domestic/international and use hotel services. The Malaysian government is concentrating on the implementation of industry 4.0 concepts, and they proposed the SMEWG Strategic Plan for 2017-2020. Therefore, this study provides the idea that at what extent businesses are ready to adopt new industry

4.0 ideas. The data from the Department of Statistics Malaysia was used as a sample frame. We used the convenience sampling technique based on the availability of the customers in the outlet/ premises at the time of data collection. The sample was collected from 839 customers in a field survey, and 533 were found to be valid for final analysis. Of the responses received, 306 were excluded, in which 43 questionnaires were not returned by participants, and the remaining 263 were incomplete or incorrectly answered. The first author of the study led the survey, with the cooperation extended by academia and sub-industry business personnel. The knowledge and literacy level of the most of the respondents were high, and well-aware of the benefits of SaaS, as they had at least one app of a famous food chain. We also asked two questions to make sure that they understood 'what a SaaS or its app is' (Do you have any app related to any brand which provides a product or service?; Do you understand the advantages of receiving information regarding business operations on this kind of app?). We also provided information on RTIR in the form of figures and text attached to the questionnaire. We provided the customers with the options of filling in the questionnaire on- or offline. If they agreed to respond, we allowed them ample time to fill it out on the spot, otherwise, we provided them with the link to the online questionnaire. The questionnaire consists of an item about the opinion of the customer on RTIR and its impact on customer engagement in the presence of customer orientation and gender as mediator and moderator, respectively.

One of its key priorities of Malaysian government is to consolidate the SMEs' competitiveness and innovation by enhancing their participation in the Internet world and digital economy through electronic commerce and reducing the technological gap (SMECORP, 2017). In this context, this study sheds light on the customer aspect of SaaS adoption to share real-time information. Of Malaysia's SMEs, 87.9 % belong to the service sector (Ghouri & Mani, 2019). The data was acquired from retail, food & beverage, and accommodation sub-sectors operating in Malaysia, which were chosen because i) there are no widely-appreciated RTIR implications in these sectors and ii) these sub-sectors contribute 18 % to the service sector, or 72.9 % to the final service category and 33.1 % to the overall service industry (Ministry of Finance Malaysia, 2017).

The data consists of responses from customers who were using the products/services in retail, food & beverage, or accommodation, of specific brands. The data collection took 32 days to complete.

We adopted two methods for purifications of data and results. First, the independent t-test was used to check the non-response bias. Armstrong & Overton (1977) suggests to compare the first 20 and last 20 respondents on all variables to check the non-response bias. The t-test results confirmed no meaningful variance between the early and late respondents. Second, the marker variable approach was applied to finding the common method bias. We incorporated a variable unrelated to the current study (self-awareness) in a correlational investigation of the study model as the marker variable (Lindell & Whitney, 2001; Lowry & Gaskin, 2014). The correlational values to the marker variable were small (MV -> CE-DB =.017), and (MV -> CE-DB =.031) to moderate (MV -> RTIR = .58); thus, it also confirmed the low common methods bias.

Table 2. Customer sample characteristics

Category		Numbers	%
Gender	Male	262	49.16
	Female	271	51.84
Education level	Never attended school	0	0
	Attended school	8	0.15
	Diploma	182	34.15
	Degree	235	44.09
	Masters	108	20.26
Age	18-28	148	27.77
	28–38	159	29.83
	38–48	169	31.71
	48+	57	10.69

4. Data Analysis and Results

4.1 Validity and reliability

All reflective items were retained and cleanly loaded on their intended constructs. Then, we run the construct validity test to understand whether each construct was measured appropriately (Bagozzi et al., 1991; Happell et al., 2015). We employed convergent validity (average variance extracted - AVE) and discriminant validity (Heterotrait-Monotrait ratio of correlation – HTMT) to test the validity of constructs (Gefen et al., 2000; Henseler et al., 2015). We also used Jöreskog's rho to test

the reliability of the constructs (Henseler et al., 2014; Nunnally & Bernstein, 1994). The HTMT should be at most 0.85, the AVE at least 0.5, and Jöreskog's rho at least 0.7. Table 3 exhibits the information of the sources, loadings, Jöreskog's rho and AVE test results, and the HTMT results are illustrated in Table 3. All results of validity and reliability were significantly appropriate and attain the minimum threshold level (Dijkstra & Henseler, 2015; Hair et al., 2010; Henseler et al., 2016). Table 5 clarifies the mean, standard deviation, and correlation between each construct.

Table 3. AVE and reliability results and evaluation of the measurement model

Construct	Source	Item Coding	Loading	Jöreskog's rho (ρ_c)	AVE
Perceived Benefits of RTIS (PBRTIS)	Benlian and Hess (2011); Gewald and Dibbern (2009)				
		RTIR1	0.819	0.867	0.712
		RTIR2	0.927		
		RTIR3	0.901		
Customer Orientation (CO)	Webb et al., (2000).				
		CO1	0.872	0.899	0.714
		CO2	0.828		
		CO3	0.836		
Customer Engagement – Buying (Direct Benefit)	Dodds et al., (1991)				
		CEB1	0.928	0.909	0.733
		CEB2	0.897		
		CEB3	0.798		
Customer Engagement – Referring (Indirect Benefit	Johnson et al., (2003); Knemeyer et al., (2003) Zeithaml et al., (1996);				
		CER1	0.809	0.872	0.774
		CER2	0.914		
		CER3	0.884		
Customer Engagement – Influencing (Indirect Benefit)	Chu and Kim (2011)				
		CEI1	0.807	0.866	0.801
		CEI2	0.758		
		CEI3	0.837		
Customer Engagement – Feedback (Indirect Benefit)	Söderlund (1998)				
		CEF1	0.924	0.910	0.827
		CEF2	0.917		
		CEF3	.0907		

Table 4. Heterotrait-monotrait ratio of correlation results

Construct	RTIR	CO	Buy	Ref	Infl	Fb	Gender * RTIR
Real-Time Information-Sharing (RTIR)							
Customer Orientation	0.5901						
Buying	0.6508	0.7789					
Referring	0.7030	0.6962	0.7354				
Influencing	0.7849	0.3300	0.2532	0.2934			
Feedback	0.7002	0.7005	0.7772	0.7765	0.2847		
Gender * RTIR	0.4785	0.1901	0.6693	0.7587	0.2735	0.6972	

Table 5. Descriptive statistics and correlation matrix of underlying constructs

Construct	Mean	SD	RTIR	CO	Buy	Ref	Inf	Fb
Real-time Information-Receiving (RTIR)	3.12	1.21	1					
Customer Orientation (CO)	3.41	1.87	0.4142	1				
Buying (Buy)	3.55	1.92	0.5647	0.5951	1			
Referring (Ref)	3.11	1.33	0.4992	0.6784	0.7905	1		
Influencing (Inf)	3.01	1.68	0.5635	0.6044	0.7500	0.7644	1	
Feedback (Fb)	3.09	2.11	0.6303	0.2423	0.0632	0.0604	0.0926	1
Gender * RTIR	3.68	1.59	0.2465	0.0834	0.5967	0.5111	0.5552	0.0608

Note: All correlations are significant at $p < 0.05$.

4.2 Results

We run path analysis with a bootstrap option to examine the theorised model.We examined the explanatory power of study's structural model, the amount of variance explained by the independent variable over the dependent variable, and its paths' magnitude and strength (Ghouri & Mani, 2019; Hair et al., 2019). Figure 3 represents the saturated model outcomes, and Table 6 demonstrates the Cohen's f^2 (effect size) and each relationship's direct and indirect effect(s).

Hypothesis 1a (RTIR → buying of CE): $\beta = 0.257$ with t-value > 1.96, (Cohen et al., 2013; Hair et al., 2010). Additionally, hypotheses 1b1, 1b2, and 1b3 suggest that RTIR → indirect benefits of CE – referring, influencing, and feedback: $\beta = 0.478$, 0.262, and 0.566 with t-value > 1.96, respectively. Hypothesis 2 (RTIR → enhance CE): $\beta = 0.414$ t-value > 1.96. Hypothesis 3a (CO → direct benefit -

buying of CE): β = 0.447 with t-value > 1.96. Furthermore, hypotheses 3b1, 3b2, and 3b3 suggest that the CO → indirect benefits of CE – referring, influencing, and feedback: β = 0.577, 0.458, and 0.278 with t-value > 1.96, respectively.

Hypothesis 4a (RTIR → CO → direct benefit - buying of CE) with a medium effect size: β = 0.442, and Cohen's f^2 = 0.577 (Cohen, 1992), with t-value > 1.96. The result indicates that RTIR remains significant for CE direct benefit (buying) after including CO as a mediator, with β = 0.185 (indirect effect) and β = 0.442 (total effect). However, the RTIR value of 0.418 and its effect on CE direct benefit (buying) is explained through the CO mediator. Thus, result confirms the partial mediation relationship (Hair et al., 2013). Hypothesis 4b1 (RTIR → CO → indirect benefit - referring of CE) with a small effect size: β = 0.619 and Cohen's f^2 = 0.259, with t-value > 1.96. The result shows that the RTIR remains significant for CE indirect benefit (referring) after including CO as a mediator, with β = 0.140 (indirect effect) and β = 0.619 (total effect). However, the RTIR value of 0.226 and its effect on CE indirect benefit (referring) is explained through the CO mediator. Thus, result endorses the partial mediation relationship. Hypothesis 4b2 (RTIR → CO → indirect benefit - influencing of CE) with a small effect size: β = 0.452 and Cohen's f^2 = 0.266, with t-value > 1.96. The result shows that RTIR remains significant for CE indirect benefit (influencing) after including CO as a mediator, with β = 0.190 (indirect effect) and β = 0.452 (total effect). However, the RTIR value of 0.420 and its effect on CE indirect benefit (influencing) is explained through the CO mediator. Thus, result establishes the partial mediation relationship. Hypothesis 4b3 (RTIR → CO → indirect benefit - feedback of CE) with a large effect size: β = 0.677 and Cohen's f^2 = 0.861, with t-value > 1.96. This result shows that RTIR remains significant for CE indirect benefit (feedback) after including CO as a mediator, with β = 0.210 (indirect effect) and β = 0.677 (total effect). However, the RTIR value of 0.310 and its effect on CE indirect benefit (feedback) is explained through the CO mediator. Thus, result confirms the partial mediation relationship here as well.

Hypothesis 5a (RTIR → gender → direct benefit - buying of CE) with an approximately large effect size: β = 0.496 and Cohen's f^2 = 0.789, with t-value > 1.96. The result indicates that gender strengthens the relationship of RTIR with CE direct benefit (buying). Thus, result confirms the moderating relationship (Hair et al., 2013) Hypothesis 5b1 (RTIR → gender → indirect benefit -

referring of CE) with no effect size: $\beta = 0.025$, and Cohen's $f^2 = 0.080$, with t-value < 1.96. The result indicates that gender does not strengthen the relationship of RTIR with CE indirect benefit (referring). Thus, result not establishes the moderating relationship. Hypothesis 5b2 (RTIR → gender → indirect benefit - influencing of CE) with small effect size: $\beta = 0.452$ and Cohen's $f^2 = 0.592$, with t-value > 1.96. This result shows that gender strengthens the relationship of RTIR with CE indirect benefit (influencing). Thus, result proves the moderating relationship. Hypothesis 5b3 (RTIR → gender → indirect benefit - feedback of CE) with small effect size: $\beta = 0.262$ and Cohen's $f^2 = 0.266$, with t-value > 1.96. The result suggests that gender strengthens the relationship of RTIR with CE indirect benefit (feedback). The results are stronger for males in comparison with females. Thus, result verifies the moderating relationship. All three moderated results are illustrated in Figures 4a-c. The note to Figure 2 provides the fit indices, with R^2 values ranging from 16.5 % to 70.0 %; this supports the final model (Hosmer et al., 2013).

Table 6. Effect size, direct and indirect effects of the measurement model

Effect	Cohen's f^2	Direct Effect			Indirect Effect			Total Effect		
		β	Mean	*t*-	β	Mean	*t*-	β	Mean	*t*-
RTIR -> CO	0.207	0.414	0.421	3.954	-	-	-	0.414	0.421	3.954
CO -> Buy	0.565	0.447	0.443	5.117	-	-	-	0.447	0.443	5.117
CO -> Ref	0.886	0.577	0.576	6.257	-	-	-	0.577	0.576	6.257
CO -> Inf	0.535	0.458	0.455	5.477	-	-	-	0.458	0.455	5.477
CO -> Fb	0.210	0.278	0.275	1.979	-	-	-	0.278	0.275	1.979
RTIR -> Buy	0.577	0.257	0.264	3.070	0.185	0.188	3.949	0.442	0.453	5.318
RTIR -> Ref	0.259	0.478	0.506	1.965	0.139	0.197	4.121	0.618	0.703	6.816
RTIR -> Inf	0.266	0.262	0.268	3.157	0.189	0.198	4.165	0.452	0.466	5.177
RTIR -> Fb	0.861	0.466	0.468	6.632	0.210	0.213	2.489	0.677	0.681	6.459
Gender * RTIR ->	0.289	0.199	0.208	2.083	-	-	-	0.199	0.208	2.083
Gender * RTIR -> Ref	0.080	0.024	0.028	0.038	-	-	-	0.024	0.028	0.038
Gender * RTIR -> Inf	0.274	0.208	0.219	2.071	-	-	-	0.208	0.219	2.071
Gender * RTIR -> Fb	0.219	0.216	0.218	1.983	-	-	-	0.216	0.218	1.983

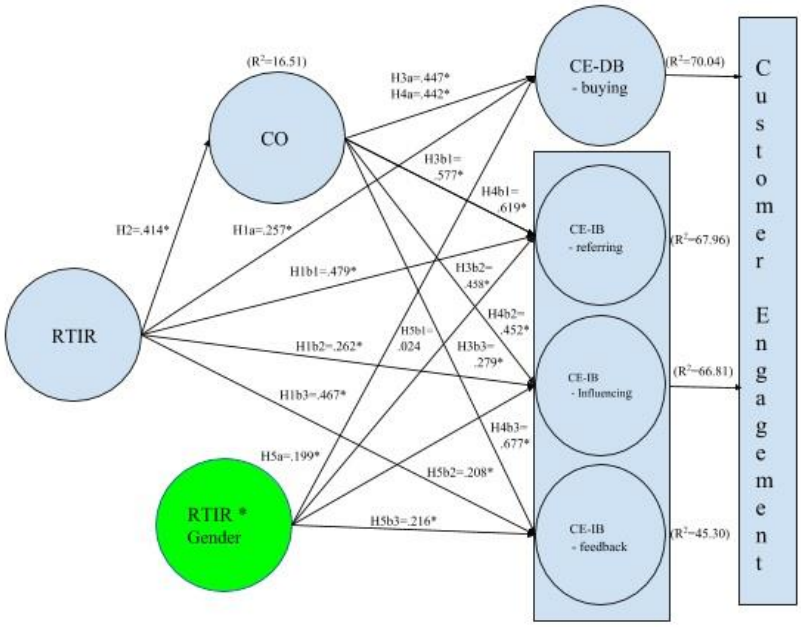

Figure 3. Structural results for hypotheses testing, R^2 values, and fit indices

Note: a) n = 533; saturated model SRMR = 0.0718, *dULS = 1.135 < **HI99 = 1.648; Estimated model SRMR = 0.0751, dULS = 1.217 < HI99 = 1.981

b): R^2 with age and education in relationship with CE-DB buying = 76.22, CE-IB referring = 62.98, CE-IB influencing = 67.21, and CI-IB feedback = 53.31

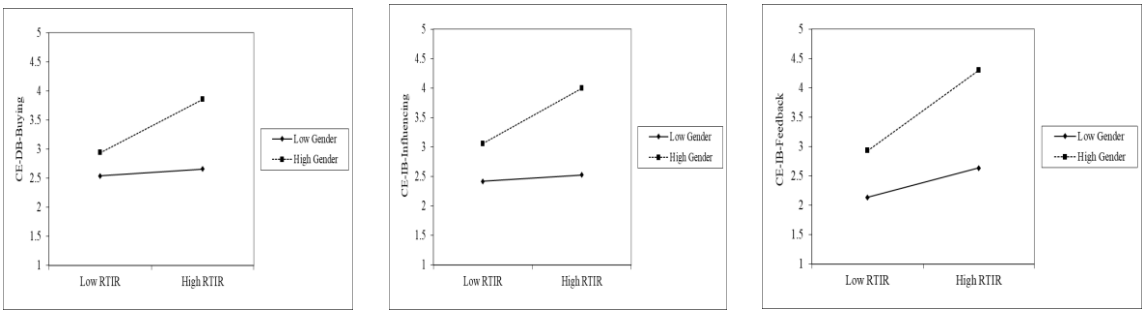

Figure 4. Two-way interaction effects for standardized variables: (3a) Gender * RTIR → direct benefit (buying) customer engagement; (3b) Gender * RTIR → indirect benefit (influencing) customer engagement; (3c) Gender * RTIR → indirect benefit (feedback) customer engagement. Low Gender = Female, High Gender = Male.

* The unweighted least squares discrepancy that quantifies how strongly the empirical correlation matrix differs from the model-implied correlation matrix. The lower the dULS, the better the theoretical model's fit (Henseler, 2017).

** ADANCO 2.0.1 uses bootstrapping to provide the 95%-percentile ("HI95") and the 99%-percentile ("HI99") for the dULS if the theoretical model was true. If the dULS exceeds these values, it is unlikely that the model is true (Henseler, 2017).

5. Discussion and Conclusion

5.1 Implications to theory

SaaS has potential to add value in business operations, and it is one of the tools to process information to attract/retain customers and achieve sustainability in the industry 4.0 era; however, It's implementation was found to be nascent in all service sectors. The present study's prime objective was to discover the relationship between RTIR, CO, and CE from customers' perspectives in downstream operations. We found that RTIR was positively related to CO and CE's direct and indirect benefits, whilst CO itself was also positively associated with CE and its direct and indirect benefits. Moreover, CO was shown to have a partial mediating role between RTIR and CE's direct and indirect benefits, and gender was shown to moderate between RTIR and CE's direct and indirect benefits, except for referring. These relationship results support our underpinning theories and theoretical framework with its hypotheses (RTIR).

This study contributes to the discussion on the significance of RTIR. First, this paper provides important insight into the underpinning theory of ToIS. It suggests that the relationship among RTIR, CO, and CE from customers' perspectives, that how information receiving in downstream operations helps the firm's to not only plan but create value to the customers in the downstream operations. Several studies outline customers' stances on information sharing by businesses and engagement with brands (Brodie et al., 2011; Dziekan & Kottenhoff, 2007; Harmeling et al., 2017; Hollebeek et al., 2018; Pansari & Kumar, 2017; Regan et al., 2011; Ulmer et al., 2017); however, few construct measure customers' perceptions about RTIR, which is linked to ToIS. To address this, we empirically examined direct and indirect benefits of CE's, if they started receiving real-time information about business

operations and processes in downstream. Second, this study provides insights into how small businesses might enhance their contribution to digital economy and consumption through electronic business in industry 4.0. Such initiatives could also reduce the technological gap in Industry 4.0 implementation of the SMEWG Strategic Plan for 2017-2020. Precisely, we stressed on the consideration and understanding of the perspectives of customers – of retail trade, food & beverages, and accommodation businesses –about real-time information receiving. Third, the present study enriches the literature on RTIR by providing specific, deeper insights about CE's direct and indirect benefits, CO implementation as a mediator, and gender as a moderator.

Extant previous literature, i.e. Constant et al. (1994) and Jarvenpaa & Staples (2001), and more recent (Feller et al., 2017; Hayes et al., 2016; Liu et al., 2016) have underlined ToIS, but ignored to focus on the impact of RTIR on CE. Our study advances this literature incrementally, by showing that RTIR in downstream enriches direct and indirect benefits of CE from the Industry 4.0 perspective, thereby benefiting downstream operations. In this study, it is also evident that real-time- information sharing improves the business performance in perspective of buying, referrals, influencing, and feedback intention. Hence, we find the answers of a critical question of ToIS: "Why should I share information, and what is in it for me?" and present research findings that extends ToIS theory through the importance of customer orientation aspect on information exchanges with potential customers in downstream operations.

5.2 Managerial Implications

This study advances the RTIR understanding for practitioners. First, it focuses on the implementation of RTIR (Büyüközkan & Göçer, 2018), that not only bridges a theoretical gap (Büyüközkan & Göçer, 2018; Sahin & Robinson, 2002), but also shares possible benefits. Second, it suggests a new framework to explain the relationship between the use of RTIR and both CO and CE. Third, it reveals gender dependency on customers' intention to buy, refer, influence and give feedback. The male is more involved due to their more positive attitude to give and get the information. Fourth, we connect CE with operations literature by empirically testing direct and indirect benefits against RTIR. The study outcomes share the proof that RTIR is an antecedent of CE. Sawhney et al. (2005) hinted about a similar relationship in the perspective of product innovation. Lastly, present research

offers significant understandings into the inherent procedure through which RTIR impacts CE's direct and indirect benefits by conforming CO's intervention.

Present study findings have imperative implications for managers. Businesses could educate customers using SaaS technology, ultimately enhancing buying behaviour. Our findings show customers want to see real-time information on their mobile apps. Sharing information on customer behaviour/feedback on these apps would attract new or potential customers, and existing customers can also help to entice new ones through referrals and social media activities. We found customers are willing to share more feedback once they understand the openness of a business's operations and processes. Thus, businesses could leverage investment in new technologies (i.e., SaaS) to facilitate the customer into buying, referring, influencing, and feedback. Gender (male) plays a major part in broadening customers' understanding on information receiving aspect. With RTIR, customers can witness and verify how a particular business's operation and supply chain address their needs and expectations. This RTIR would initiate competition between businesses. Once customers start preferring specific service over others due to received information on the mobile app, the other businesses might be drawn to adopt the same technology. Moreover, they would also try to enhance their production, quality, delivery time etc. to share to attract customers.

6. Limitations and Future Directions

The present study findings and related implications should be considered in light of three important limitations. First, since the data was collected from general customers' about the application of RTIR through SaaS technology, researchers in future, may explore individual or comparative studies, with a similar model, on a generational basis, especially on Millennials and Generation Z. Second, this study only focused on two service industry sub-sectors; future research could be conducted on other service sectors, i.e. public and private educational institutions, utility institutions, and health institutions etc. We assume that adopted items or constructs may perform contrarily in other sectors. Moreover, the identical method could be used in other industry and government services in other geographical zone. Although this study's results consist of customers' intentions, however, CEOs' or managers' responses regarding RTIR adaptation in supply chain could be different and important. Finally, future studies can

adopt proposed framework with other independent and dependent variables, such as goal directed shopping, brand engagement, and customer inspiration.

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Appendix A: The brief description of items

Construct	*Source*	*Item Description*
Perceived Benefits of RTIS (PBRTIS)	Benlian and Hess (2011); Gewald and Dibbern (2009)	A real-time information-receiving application could provide many advantages. A real-time information-receiving application could be a useful instrument for increasing decision making excellence. Overall, I consider real-time information-receiving application is a possible useful option.
Customer Orientation (CO)	Webb et al., (2000).	*After implementation of real-time information-receiving system…* …This service brand/ provider effectively utilises its human and, product and service systems to gain long-term customer commitment. This service brand/ provider will consistently offers products and services that create customer value. This service brand/ provider will engages in market research activities to determine customer needs.
Customer Engagement – Buying (Direct Benefit)	Dodds et al., (1991)	*After implementation of real-time information-receiving system…* …The likelihood of purchasing this service brand is: The probability that I would consider buying this service brand is:: …My willingness to buy this service brand is:
Customer Engagement – Referring (Indirect Benefit	Johnson et al., (2003); Knemeyer et al., (2003) Zeithaml et al., (1996);	*After implementation of real-time information-receiving system…*

		…I will say positive things about this service brand/ provider to persons in my environment. I would not have a problem giving referrals to my surrounding people (offline and online) about this service brand/ provider. If anyone will ask me for the names of the service brand/ provider, I would be happy to provide the name of this service brand/ provider.
Customer Engagement – Influencing (Indirect Benefit)	Chu and Kim (2011)	*After implementation of real-time information-receiving system…* When I will receive service brand/ provider related information or opinion from a friend, I will pass it along to my other contacts on the social network site(s). On the social network site(s), I will like to pass along interesting information about this service brand/ provider from one group of my contacts on my 'friends' list to another. I will tend to pass along my contacts' positive reviews of this service brand/ provider to other contacts on the social network site(s).
Customer Engagement – Feedback (Indirect Benefit)	Söderlund, (1998)	*After implementation of real-time information-receiving system…* …I will tell service brand/ provider representatives exactly what I think if a certain situation occurs regarding this service. I will demand to speak with manager in charge if a certain situation occurs regarding the service. I will likely to share the feedback related to service for improvement.