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Strategies to Integrate Technological Innovations for Caribbean Small- and Medium-Sized Enterprises

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Walden University
2020

Abstract

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MBA, The University of the West Indies, 2007

BSc, The University of the West Indies, 1990

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Up to 59% of managers in small and medium sized enterprises (SMEs) fail to integrate technological innovation (TI) strategies. Restricted access to sophisticated technology, limited capital, and discontinuous collaborations between SMEs and government organizations hamper the successful integration of TI by managers of Caribbean SMEs. Managers of SMEs in the Caribbean region must exploit strategies for improved efficiencies in operational capacity, continuous development in business profits and growth, and surviving hyper-competition. Grounded by the theories of diffusion of innovation and adopter-based instrumentalist, the purpose of this qualitative multiple case study was to explore strategies that 4 operation managers of SMEs in the Caribbean region use to integrate TI into their business operations to increase business growth and profitability. Data were collected from semistructured interviews, operating reports, and technological plans. Data were analyzed using Yin's 5-step process of compiling, disassembling, reassembling, interpreting, and concluding. The 4 themes that emerged were (a) customization of technological innovation, (b) empowerment of adopter-based end-user, (c) government intervention, and (d) supplier-buyer networks. A key recommendation is defining a strategic plan that includes the customization of procured TI and its continuous improvement through monitoring and research. The implications for positive social change include the potential for operation managers of SMEs to improve business performance, enhance the work environment of production staff, and contribute to the economic health of regional communities.

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Dedication

I dedicate this study to my late father, Rawle, and my mother, Bernice. Their love, support, confidence in me, and guidance provided a solid foundation in my early years for a chance to succeed in life. I am grateful for the inspiration to achieve all that I could.

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Section 1: Foundation of the Study

Operation managers of small- and medium-sized enterprises (SMEs) need to employ technological innovation (TI) to tackle business challenges. One of the challenges faced by managers of SMEs in the global market environment is integrating TI into business operations (Farinha, Ferreira, Nunes, & Ratten, 2017). Managers of SMEs in the Caribbean region may also encounter other issues external to business operations but pertinent to the successful integration of TI. Restricted access to sophisticated technology (Hossain, 2015), limited capital (Barge-Gil & López, 2015), and discontinuous collaborations between SMEs and government organizations (da Silva Gabriel & Da Silva, 2017) hamper the successful integration of TI by managers of Caribbean SMEs. However, Valaei, Rezaei, and Ismail (2017) noted that managers of SMEs located in the Caribbean region must exploit strategies for improved efficiencies in operational capacity, continuous development in business profits and growth, and surviving hyper-competition. Strategies to integrate TI in SMEs may enable operation managers to enhance profit margins and improve the technical capacity, operating procedures, and human resource relations for efficiencies in workforce activities. In this study, I focused on strategies that operation managers used to integrate TI into business operations of SMEs in the Caribbean for enhanced profitability.

Background of the Problem

Researchers from as early as the 1890s commented on the various types of innovation applications employed by business managers to stimulate business activities

and improve profit margins (Mlecnik, 2016; Tarde, 1903; Tosti, 1897; Zoo, de Vries, & Lee, 2017). Managers seeking to improve territorial competitive advantage may exploit company innovativeness but encounter challenges when integrating innovation strategies into business operations (Farinha et al., 2017; Tidd & Thuriaux-Alemán, 2016). Failed integration of TI is a dilemma experienced in the Latin America and Caribbean (LAC) region that researchers inextricably linked to poor competitive advantage in the global market and weak sustainable development at a national level (Farinha et al., 2017; Roofe & Stone Roofe, 2016; Tidd & Thuriaux-Alemán, 2016). Equipping operation managers with the necessary skills to successfully implement strategies to integrate TI would improve business profitability.

Operation managers of Caribbean SMEs may possess an elementary level of TI knowledge and ineptly strategize the integration of TI restricting business growth and the operationalization of business functions (Lee, Kim, & Shin, 2017; Roofe & Stone Roofe, 2016). According to Azudin and Mansor (2018), SMEs located in developing regions, including the Caribbean, comprise 99% of the business sector and contribute 36% towards Gross Domestic Product (GDP). The profits generated by SMEs in the Caribbean impact the GDP of the region. However, research completed by Baller, Dutta, and Lanvin (2016) indicated that two of the largest Caribbean islands, (a) Jamaica and (b) Trinidad and Tobago, ranked 83rd and 67th out of 139 countries in the global Network Readiness Index (NRI). The NRI is an indicator of a country's readiness to seize technological opportunities in the digital revolution (Baller et al., 2016). Integrating TI into Caribbean

SME operations creates TI capacity and contribute to business growth, the creation of wealth, and increased economic performance (Anyanwu, 2015). Managers of SMEs that access and successfully integrate sophisticated TI could drive business profits and grow the local economy.

Problem Statement

Business growth and profitability stagnate when managers of SMEs fail to integrate emerging TI into business operations (Farinha et al., 2017). The results of the Productivity, Technology, and Innovation (PROTEqIN) survey completed by Compete Caribbean in 2014 revealed that managers from 59% of SMEs in the Caribbean were unsuccessful in integrating innovative activities in business operations (Crespi et al., 2017). The general business problem was that some managers of SMEs in the Caribbean encountered poor business growth and low-profit margins. The specific business problem was that some operation managers of SMEs lack strategies to integrate TI into business operations for improved business performance.

Purpose Statement

The purpose of this qualitative multiple case study was to explore strategies that some operation managers of SMEs used to integrate TI into their business operations to increase business growth and profitability. The targeted population comprised of operation managers from four SMEs in the Caribbean region who successfully implemented TI into their business operations. The findings of this study may advance positive social change by offering information that may lead operation managers to

integrate TI into business operations. The implications for positive social change include the potential to develop the capabilities of operation managers in SMEs. The integration of TI could promote efficiencies for employees, create products meeting customer demands, and limit business failures for leaders in SMEs. Managers of SMEs, who can increase profit margins and sustain the operations of SMEs, might be able to contribute to the circulation of wealth in the local communities.

Nature of the Study

The three research methods used by business researchers include qualitative, quantitative, and mixed methods (Hammarberg, Kirkman, & De Lacey, 2016; Lewis, 2015). Qualitative researchers use open-ended questions to discover what is occurring or have occurred by capturing the experiences of people in a naturalistic setting (Hammarberg et al., 2016). I selected the qualitative method to use open-ended questions to explore strategies that managers use to integrate TI in business operations. In contrast, quantitative researchers use closed-ended questions to test predetermined hypotheses in a controlled environment (Hammarberg et al., 2016). Mixed methods research combines the strength of quantitative empirical research and comprehensive qualitative understanding (Griensven, Moore, & Hall, 2014). I did not test hypotheses, which is part of the quantitative study or the quantitative portion of mixed methods study.

I considered four research designs that I could use for this qualitative research study: (a) mini-ethnography, (b) narrative, (c) phenomenological, and (d) case study. Mini-ethnography or focused ethnography is useful when given limited time and

restricted resources and involves the exploration of cultural norms (Fusch & Ness, 2017). I did not select a mini-ethnography design because I did not explore the cultural norms of business groups. Researchers use narrative design to explore the internalized processing of incidents by participants through their stories (Rooney, Lawlor, & Rohan, 2016). I did not select a narrative design because I did not explore the internalized processing of incidents by managers of SMEs. Phenomenological design involves the in-depth study participants make of their lived experiences in their personal and social worlds (Wagstaff & Williams, 2014). I did not select a phenomenological design because I did not explore the lived experiences of a group of research participants. Case study researchers investigate real-life contemporary events to understand complex social phenomena through multiple sources of data (Yin, 2017). I used a case study design to explore the issue of a real-life situation from data collected through multiple sources.

Research Question

What strategies do operation managers use to integrate technological innovation into business operations?

Interview Questions

The participants answered the following open-ended questions on strategies to integrate TI for business operations:

1. What strategies did you use to improve the integration of TI into your business operations?

2. What strategies did you find most useful when improving the integration of TI into your business operations?
3. How did you prepare the end-users when integrating TI into your business operations?
4. What strategies did you use to prepare end-users to improve the integration of TI into your business operations?
5. How did the end-users respond to the integration of TI into your business operations?
6. How did the government's policies and concessions influence the strategies you used to integrate TI into your business operations?
7. What additional information would you like to share about your company or the strategies you use to improve the integration of TI into your business operations?

Conceptual Framework

The theories of diffusion of innovation (DOI) and adopter-based instrumentalist (ABI) formed the conceptual framework for this study. In 1962, Everett Rogers introduced the DOI theory by synthesizing Gabriel Tarde's (1890) concept of diffusion and Ryan and Gross' (1943) diffusion model framework (Rogers, 1995). Researchers use the DOI theory to explain how an idea, product, or process chosen by an individual, spreads across a population, gain momentum over time, and then adopted as part of a social system (Rogers, 2004). The DOI theory is the process of how organizations integrate TI into business processes over time.

In 1997, Surry and Farquhar presented the ABI theory to promote the social and human side of innovation diffusion, where the end-user is the primary force for change. The developer, or determinist, of innovation working together with the end-user, or instrumentalist, changes the product or process systematically for efficient utilization (Surry & Farquhar, 1997). The significance of technology acceptance by the adopter of innovation is that it influences a positive attitude towards technology change and is fundamental to the diffusion of TI (Doherty, Ramsey, Harrigan, & Ibbotson, 2016). The interaction between top-down management strategies and bottom-up end-user perceptions may assist in resolving conflicting views, cementing concurring opinions, and creating a culture of positive change for DOI.

Operational Definitions

The main operational definitions used in this study are as follows:

Diffusion: Diffusion is the process where innovation disperses through communication in a social system (Mlecnik, 2016).

Disruptive innovation: Disruption innovation is the implementation of bold and transformative approaches that contrast with incremental innovation processes (Anyanwu, 2015).

Foreign Direct Investment (FDI): FDI is a source of development finance that occurs when governments liberalize and deregulate markets (Henry, 2015).

Innovation: Innovation is the introduction of new ideas that encompass the advancement or improvement of products or processes through the application of available technologies (Chesbrough, 2017).

Inside-out open innovation: Inside-out open innovation is when businesses provide underutilized resources to outside businesses (Chesbrough, 2017).

Open innovation: Open innovation is the mobilization of information technology across business boundaries to enable innovation (Cui, Ye, Teo, Li, 2015).

Outside-in open innovation: Outside-in open innovation is when businesses allow external inputs and contributions to alter the internal business process (Chesbrough, 2017).

Small- and medium-sized enterprise (SME): SME is a company employing up to 249 employees (Mazzarol, Clark, & Reboud, 2014).

Sustained innovation: Sustained innovation is acquiring the necessary capabilities to allow for change or to meet challenges to maintain a competitive advantage aimed at the firm's survival (Van der Duin, Heger, & Schlesinger, 2014).

Technological innovation: Technological innovation is when research and engineering efforts contribute to developments in products and processes (Rua, França, & Fernández Ortiz, 2018).

Assumptions, Limitations, and Delimitations

Assumptions

Assumptions are conditions in a study that are accepted as true by the researcher, are not supported by research, and are critical for how peers understand the process for the outcome of the study (Amrein-Beardsley & Holloway, 2017). The primary assumption was that integrating TI resulted in improved goods and services, increased profits, and enhanced operational efficiency. The second assumption was that my biases would not influence my interpretation of the data. The third assumption was that the interviewees would provide truthful and accurate answers.

Limitations

Munthe-Kaas et al. (2018) noted that limitations referred to the specific weaknesses of the design of the study under review and may influence the trustworthiness of the study. I used purposive sampling to select four participants from four SMEs for this study. However, purposively selecting participants to the exclusion of others might have limited the emergence of themes related to the integration of TI. A second limitation of this study was that I use two data collection methods. I collected data through interviews and private company documents comprising of operating reports and technological plans; however, a third data source such as private meeting minutes might have enhanced methodological triangulation and improve the trustworthiness of the study.

Delimitations

Josiassen, Assaf, Woo, and Kock (2016) defined delimitations as boundaries determined by the researcher to control the range of the study. The scope of this study included SMEs located in Trinidad and Barbados and did not extend to the other Caribbean islands. However, Trinidad and Barbados represent the second and third most populated islands in the Caribbean region and include a high concentration of SMEs. Although all Caribbean islands share similar physical infrastructure and socioeconomic conditions, limiting the study to Trinidad and Barbados excluded the nuances of processes and challenges occurring at other locations. Another delimitation was that I included only personnel at the managerial level responsible for operational activities. I did not interview employees below the rank of management.

Significance of the Study

Contribution to Business Practice

The contributions to business practice include strategies used by operation managers of SMEs to integrate TI into business operations. The findings of this study might encourage operation managers of SMEs to integrate TI to benefit from increased business profitability, quality enhancement of products and services, operating business efficiencies, and counteracting economic complexities like competitiveness, weak infrastructure and financial constraints. Also, the findings of this study of successful strategies used to integrate TI might leverage the business practices of operation managers for better strategic competitive positioning for SMEs.

Implications for Social Change

The implications for positive social change include the potential to assist operation managers in mitigating obstacles that prevent the integration of TI in business operations. The findings from this study highlight possible strategies for integrating TI to enhance the operational procedures of innovation implementers. Depending on the different types of businesses and socioeconomic characteristics of the location of communities, operation managers might customize strategies highlighted in this study to integrate TI into operations. Scholars might apply the findings of this study for identifying indicators that would enhance the integration of TI in businesses and could increase business profitability. Improvement of financial business conditions might result in job preservation and increase employment opportunities, enhance the economic landscape in the long-run, and provide more social amenities for a meaningful community life of positive, dignified relationships.

A Review of the Professional and Academic Literature

In the professional and academic review of the literature, I provided a critical analysis of all main concepts related to strategies to integrate TI into business operations. Extensive searches of extant academic databases led to peer-reviewed journal articles, published company reports, and seminal books that provided a foundation for exploring strategies to integrate TI used by managers of SMEs. An analysis of the extant literature provided an understanding of the concepts and strategies that facilitate the integration of TI in business operations.

My literature review commenced with a review of the DOI theory, followed by an assessment of the ABI theory, which served as the conceptual lenses of this study. I also reviewed open innovation (OI) and its linkage to DOI theory and the framework of innovation openness (FIO) to assess the readiness of organizations to innovate. A critical review of the available literature provided strategies to integrate TI by operation managers of SMEs. The literature review also included other studies pertaining to strategies relating to the integration of TI and the conceptual theories selected.

While I obtained research materials through the Walden Library for economic regions globally, I used the archives of the University of the West Indies to gather scholarly work specific to Caribbean businesses. The online research databases available through the Walden Library included Academic Search Complete, Business Source Complete, ABI/INFORM Complete, LexisNexis Academic, SAGE Complete, ScienceDirect, and ProQuest Central. Other online research databases I reviewed included Google Scholar, JSTOR, and Questia. I also accessed academic literature from the Researchgate website. The literature review section included 89 or 93% peer-reviewed sources, 78 or 87% of these articles published between 2015 to 2019.

Application to the Business Problem

The purpose of this qualitative multiple case study was to explore strategies that some operation managers of SMEs used to integrate TI into their business operations to increase business growth and profitability. The theories in the conceptual framework that I used for this study included Rogers' (1962) DOI theory and Surry and Farquhar's

(1997) ABI theory. DOI is a business innovation-decision process diffused through the social network at rates of adoption and used to address the challenges encountered when integrating innovation into a social system (Rogers, 1995; Surry & Farquhar, 1997; Witell et al., 2015). The attitude and reaction of workers to the innovation introduced into the social system highlight the social and human side of innovation adoption and influence the success of innovation integration and referred to ABI theory (Surry & Farquhar, 1997). These theories are useful for understanding managers' approach to integrating TI throughout the organization and the end-user's perspective on this process. Two other conceptual theories I critically assessed in this study included OI and the FIO.

Diffusion of Innovation (DOI) Theory

The DOI theory, although propagated by Everett Rogers (1962), was conceptualized by Gabriel Tarde's (1890) concept of diffusion. In 1890, Gabriel Tarde initiated the concept of diffusion as well as the social theory of imitation and innovation, such that, societal practices created through imitation of one generation by subsequent generations diffused through the years (Howaldt & Schwarz, 2017). The conceptual thinking of Tarde (1890) motivated Ryan and Gross (1943) to advance the diffusion model framework through an experimental agricultural study in Iowa. During the period 1936 to 1939, a new hybrid corn variety diffused by farming salespersons to farm operators improved the yields per acre 600 times over (Ryan & Gross, 1943). Technological knowledge promoted by agents of diffusion influenced various business operators to integrate new technological strategies facilitating DOI over time.

Tarde's (1890) view of the social system intersects Rogers' (1962) DOI theory, as both scholars considered the existence of human interrelationships. The social interaction of managers, line-reports, executive team, and external stakeholders operating in businesses observed by Rogers (1962) parallels the social interaction in social systems viewed by Tarde (1890). The concept of diffusion introduced by Tarde in 1890 related to the unconscious and involuntary reflection of the opinion of others, such as the imitation of others when persons converse in a common language or perform a task in a pre-described routine (Tarde, 1903). Although Rogers (1962) focused on formal and informal communication channels in DOI, Tarde's (1890) repetition of actions without spoken words may be relevant in contemporary business settings for the diffusion of actions or expectations related to TI. Socialization within a business environment facilitates the exchange of knowledge and ideas through formal or informal communication channels or visual observations.

DOI theory is a dynamic process and transcends the boundaries of location, time, and field of study. Everett Rogers (1962) developed the DOI theory to encompass the process of transferring innovation over time in business and social organizations, education, medicine, and other branches of learning (Rogers, 2004; Scott & McGuire, 2017). The generalization of the DOI theory to multiple disciplines by Rogers (1962) supports the use of the DOI lens for exploring how TI integrates through businesses and consumer markets. Soete (2019) highlighted the importance of building on existential knowledge on innovation, technology, and science for continuous transformative change.

In this study, I focused on integrating TI in businesses related to the manufacturing of consumer goods.

Researchers building on the diffusion of inventive methods theorized by Tarde (1890) promoted the concept of DOI. In 1942, Ryan and Gross included all elements of innovation to create a meta-theory DOI framework. However, in 1962, Rogers identified four main components of innovation that comprised the existing DOI theory (Rogers, 2004; Surry & Farquhar. 1997). These components include the innovation-decision process; individual innovativeness; rate of adoption; and perceived attributes (Rogers, 2004). Researchers adopt these components of DOI to focus on the systematic process of decisive action to innovate, predisposition of individuals to innovate, the rate of adoption, and consideration of how potential adopters perceive the innovation (Surry & Farquhar, 1997). Business models that include the four components of the DOI theory may allow for integrating TI into businesses.

Managers may employ the four components of DOI theory outlined by Rogers' (1962) as a template for TI integration into operations and final diffusion to the consumer market. However, there exist elements of business operations that the DOI theory may not adequately address. Surry and Farquhar (1997) noted the human element of the interrelationships of employees of organizations as not sufficiently highlighted by Rogers (1962) and posits the ABI theory. The managerial responsibility in the innovation-decision process is a dual assignment of assessing internal operations, staff interrelationships, and evaluating external TI resources (Damanpour, Sanchez-Henriquez,

& Chiu, 2018). As such, the technology introduced to organizations commonly originates external to the business as upstream TI or existing elsewhere within the industry. The concept of OI introduced by Chesbrough (2003) encompasses avenues of accessing TI externally.

Aydin and Parke (2018) mentioned that the technological infrastructure of firms might not permit the integration of sophisticated upstream TI. To this end, Michelino, Lamberti, Cammarano, and Caputo (2015) suggested assessing the innovation openness of companies to determine the technological absorptive capacity and inform managers on the likelihood of TI integration. The measure of FIO is a numerical ratio calculated on the cost and revenue inputs related to innovation activities (Michelino et al., 2015). Managers may use the empirical data of FIO ratios to ascertain the company's technological infrastructure before introducing and diffusing TI within the organization.

Discussions on the concept of social innovation by Gabriel Tarde (1890), Emile Durkheim (1893), Joseph Schumpeter (1930), and Max Weber (1968) revealed that the diffusion of social innovation could lead to social transformation and sustainable practices within technological fields. Although traced to the 19th century, the usage of social innovation for collaborating elements of civil society policies and developing human resources evinced in the 20th century (Ayob, Teasdale & Fagan, 2016). Social innovation may also ignite the creative aspects of all innovation. Howaldt and Schwarz (2017) noted Tarde's (1890) concept of imitations and inventions as the foundation of all social practices and persons invent unconsciously by performing unborrowed or new

actions. The diffusion of social innovation and the development of the capabilities of human resources influence the integration of TI.

Diffusion of social innovation. One of the challenges to diffusion of TI includes the diffusion of social practices or innovations required for the development of human capital. Howaldt and Schwarz (2017) noted that the advancement of TI and economic innovation may face social challenges at a regional and national level. Social innovation may close the gap between the complexities of integrating the rapid global expansion of technological knowledge and the perception by employees of the social environment (Yang & Sung, 2016). Integrating TI through communication channels following social innovation measures may bring about the success of DOI.

Adopter-Based Instrumentalist (ABI) Theory

Although Rogers (1962) listed the importance of the end-user's disposition to innovate and diffuse innovation through the social network, he does not focus on the importance of the adopter's viewpoint. The limited assessment of the adopter's perspective in Rogers' (1962) DOI theory compelled Surry and Farquhar (1997) to develop the ABI theory. The fundamentals of the ABI theory highlight the adopter as the primary force for change and not merely a worker performing tasks to integrate change, inferring that the social context influences the design of all innovation (Surry & Farquhar, 1997). Beyond the technical aspect of innovation, the human elements of attitude, personality, and culture influence the acceptance or rejection of strategies to integrate TI and rate higher than technological superiority in the DOI process.

The researchers Tarde (1890) and Ryan and Gross (1942) originally developed the DOI theory for use in a social context. However, social importance took a lesser role to TI until the late twentieth century. While the adoption of innovation represents a technically-sided view of integrating technology into business operations, the workers act as a medium to diffuse technology throughout the social environment of organizations and to the external customer (Surry & Farquhar, 1997). The bottom-up approach takes into account the complexities of the social networking nature of technologies, and merging the bottom-up and top-down methods may achieve benefits (Singh & Hardaker, 2017). The focus on social networking in a social context upholds the view of Tarde (1890) by attributing some importance to social factors in the diffusion of TI. In this regard, the ABI theory does not distract from the significance of top-down executive strategies for integrating TI, but allows for a balanced evaluation of strategic measures to achieve DOI.

Open Innovation (OI) Theory

In 2003, Henry Chesbrough introduced the concept of OI theory to denote innovation created external to business operations but agreed that Schumpeter's (1930) growth theory, which focuses on internal resources, had a transformational effect on business operations. Over the years, innovation remains a driving force to improve business profitability. However, a close examination of the effect of innovation strategies on businesses signaled a need for effectively managing the innovation process.

The source of innovation may determine the type of innovation introduced to a firm. Souto (2015) observed that non-technological innovation is usually created through internal business knowledge and experienced in service-type industries, whereas TI may originate internal or external to business operations. Chesbrough (2003) described OI as outside-in and inside-out to demarcate the TI flow from one business to another. Chesbrough (2017) noted that enhanced business processes may require innovative methods from external sources to augment the limited technical knowledge in-house. Business operations tend to improve through the introduction of TI, whether developed internally or sourced externally to the company.

The primary requirement for introducing innovation into businesses is the entrepreneurial motivation regardless if sourced internally or outside the business process (Souto, 2015). One of the factors influencing the business managers' decision on the type of innovation adopted is the business profile. Hossain (2015) determined that the appropriateness of TI depended on the company size, while Malaki (2013) considered the level of economic development where the company is domiciled, and Farinha et al. (2017) viewed the company's technical sophistication. However, da Silva Gabriel and Da Silva (2017) advised that the success of any innovation strategy depended on the existence of communication channels to diffuse strategy messages among individuals. Innovation methods that are driven by particular business characteristics and, if appropriately managed, may result in improved production efficiency.

Framework of Innovation Openness

Michelino et al. (2015) introduced the measurement FIO and provided a numerically calculated ratio to measure the degree of openness of a firm's innovative process. The FIO ratio is an empirical calculation that establishes a company's absorptive capacity to innovate or adopt OI strategies as well as pinpoint business areas to enhance innovation openness (Bessant & Trifilova, 2017; Michelino et al., 2015). Managers of SMEs in Caribbean economies might successfully integrate TI if the assessment of FIO occurs before the application of the principles of DOI, OI, and ABI theories.

Measuring innovation openness. A company's degree of openness to innovation indicates its absorptive capacity to include technology changes (Michelino et al., 2015). The dynamic process of continuously evaluating production output, assessing the FIO, and introducing OI provides a cyclic pattern for business growth. The consequence of this appraisal aids managers of SMEs in determining future investments in innovations, divestments, or changes in the corporate structure.

Michelino et al. (2015) referred to the FIO as a four-dimensional phenomenon that defines innovation outbound and inbound processes and economic and financial transactions. See Figure 1 for a diagrammatic representation of the input factors for the measurement framework. Analysis of financial and economic source data provides a comprehensive measure of the company's status to incorporate innovative strategies. To this end, ratios depict an empirical score for interpreting a company's innovation openness at a particular time.

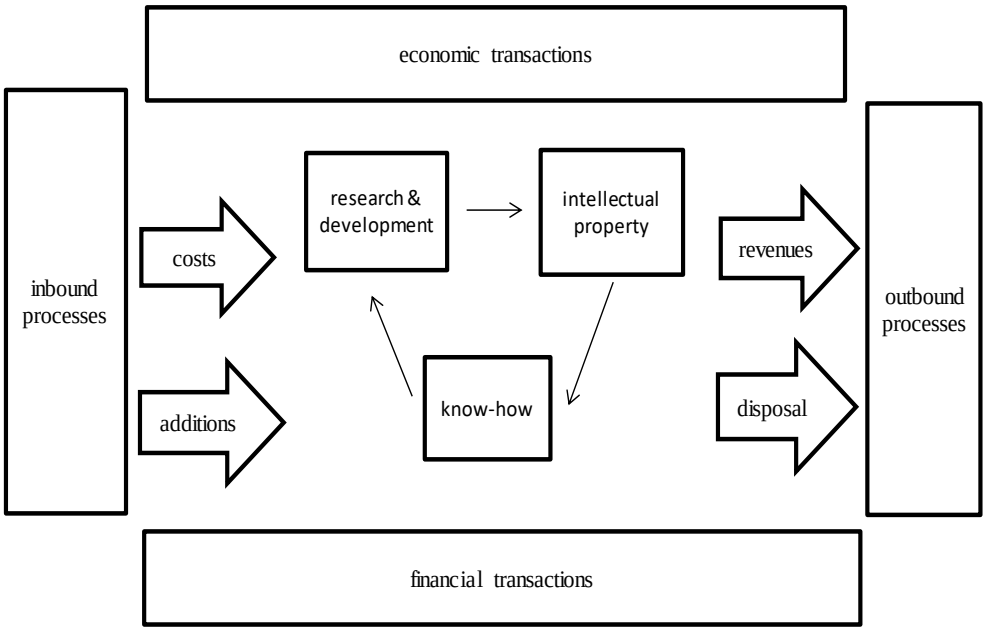

Figure 1. The framework of innovation openness (Michelino, Lamberti, Cammarano, & Caputo, 2015). Adapted from "Measuring Open Innovation in the Bio-Pharmaceutical Industry," by F. Michelino, E. Lamberti, A. Cammarano, & M. Caputo, 2015, *Creativity & Innovation Management*, *24* (1), p. 8. Copyright 2015 by John Wildey & Sons Limited. Reprinted with permission.

The methodology for measuring the FIO includes the financial and economic transactions carried out by businesses. Michelino et al. (2015) considered the cost and revenue components of the inbound and outbound processes associated with the economic transactions of research and development (R&D) and intellectual property (IP). The additions to and disposals of R&D, IP, and know-how quantify the financial transactions (Michelino et al., 2015). The ratios derived from the components of processes and transactions inform the calculation of the innovation openness ratio: the higher the ratio, the greater the propensity to integrate TI (see Tables 1 and 2).

Table 1

Measures of Open Innovation

	Economic transactions		Financial transactions		
	R&D	IP	R&D	IP	Know-how
Inbound processes	Costs from: - collaborative development - outsourcing of R&D services	Costs from: in-licensing	Additions to development costs	Additions of: -licenses -patents -trademarks -technology	Additions of goodwill
Outbound processes	Revenues from: -collaborative development - R&D services on behalf of third parties - R&D grants	Revenues from: out-licensing	Disposals of development costs	Disposals of: -licenses -patents -trademarks -technology	Disposals of goodwill

Note. R&D = Research and Development; IP = Intellectual Property. Adapted from "Measuring Open Innovation in the Bio-Pharmaceutical Industry," by F. Michelino, E. Lamberti, A. Cammarano, & M. Caputo, 2015, *Creativity & Innovation Management, 24*, p. 10. Copyright 2015 by John Wildey & Sons Limited. Reprinted with permission.

Strategies Used to Integrate Technological Innovations

The concept of DOI entails decision-making at three levels: (a) strategic business management, (b) the implementers within the organization, and (c) the consumers. Rogers (2004) illustrated the sway decision-making plays at influencing the diffusion of TI from the conception of TI to organizations to consumers. However, Aydin and Parker (2018) noted that the end-users of the consumer market create a continuous demand for new sophisticated TI. The views of Rogers (2004) and Aydin and Parker (2018) indicated that the DOI process is dynamic and an interrelated flow of decisions that facilitate the

provision and acceptance of new ideas or technology. The DOI concept explains the decision-making role of the key stakeholders influencing the integration of TI into businesses.

Table 2

The Basic Ratios of Open Innovation

	Economic transactions	Financial transactions
Inbound processes	Costs ratio = (costs from OI) / (total R&D and IP costs)	Additions ratio = (additions from OI) / (total intangibles)
Outbound processes	Revenues ratio = (revenues from OI) / (total revenues)	Disposals ratio = (disposals from OI) / (total intangibles)
Openness ratio =	$[(\text{costs ratio}^2 + \text{revenues ratio}^2 + \text{additions ratio}^2 + \text{disposals ratio}^2)/4]^{1/2}$	

Note. OI = Open Innovation; R&D = Research and Development; IP = Intellectual Property. Adapted from "Measuring Open Innovation in the Bio-Pharmaceutical Industry," by F. Michelino, E. Lamberti, A. Cammarano, & M. Caputo, 2015, *Creativity & Innovation Management, 24*, p. 11. Copyright 2015 by John Wildey & Sons Limited. Reprinted with permission.

Innovation-decision process. The introduction of innovation strategies into business operations follows the systematic review of prevailing TI and assessment of the requirements of the business. The innovation-decision process may commence with an assessment of the internal technological status to ascertain the degree and type of innovation required to change business operations (Damanpour et al., 2018). Selecting the appropriate TI to integrate into business operations involves consideration of innovations employed in similar businesses, targeted end-users, local environment, and

individuals involved in the process (Moullin, Sabater-Hernández, Fernandez-Llimos, & Benrimoj, 2015). Although Moullin et al. (2015) and Surry & Farquhar (1997) identified knowledge and decision-making skills to execute innovation-decision, Moullin et al. (2015) emphasized persuading the end-users and including the implementers in the TI decision process. Damanpour et al. (2018) and Moullin et al. (2015) stressed that internal management and the perception and buy-in of end-users and implementers might be more important than the implementation of TI. In this regard, managers do not necessarily discount the importance of Chesbrough's (2003) OI concept but prioritize the TI implementation processes within the confines of the organization.

There are challenges associated with the innovation-decision process. Business owners establishing the appropriate strategy to integrate TI may face issues with deciphering the variations in terminology, classification of concepts, order of process steps or stages, and reviewing the different types of available innovation options (Moullin et al., 2015). However, technologists versed in DOI theory could liaise with external upstream suppliers, management, and employees and improve technological knowledge at all organizational levels (Moullin et al., 2015; Surry & Farquhar, 1997). The innovation-decision process is a strategic management process as it involves high-level, systematic consideration of internal business factors and availability of external TI resources forcing management to anticipate and contingently plan for challenges in the integration of TI. Delineating TI through the innovation-decision process is the primary component in the DOI theory.

The responsibility of strategic innovation-decisions within most SMEs commonly lies with the executive heads. Arzubiaga, Kotlar, De Massis, Maseda, and Iturralde, (2018) noted the delicate balance of innovation, entrepreneurship, family-ties, and altruism factoring into the innovation-decision process of directors and then directing the activities to implement TI. Arzubiaga et al. (2018) and Zattoni, Gnan, and Huse (2015) supported the involvement of directors in sourcing and implementing TI but also placed importance on technological knowledge, experience, access to research and networking to transform entrepreneurship to innovative activities. A study by Zattoni et al. (2015) revealed that the strategic involvement of directors increased the financial performance of the firm. The innovation-decision process performed by leaders within the SME defines the type and quality of the TI integrated into the business processes of SMEs. The successful strategies that promote the integration of TI include decision-makers possessing experience in research, technological knowledge, networking, and strategic management.

Individual innovativeness. Individual innovativeness refers to a person's predisposition to being innovative. Rogers (1995) identified five adopter categories according to individuals' propensity to innovate as derived from the S-shaped cumulative curve of adoption. Although absolute adopter categories exist and percentages of 2.5% (innovators), 13.5% (early adopters), 34% (early majority), 34% (late majority), and 16% (laggards) assigned, there are no definite breaks in the innovativeness categories continuum (Rogers, 1995). However, the classifications assist in determining individuals

likely use and application of technology as well as the level of training required for implementing TI (Çoklar & Özbek, 2017; Rogers, 1995). The individual innovativeness is a supportive skill that facilitates the DOI process but at varying rates of adoption.

Personality traits may influence an individual's measure of innovativeness. Ali (2019) noted a positive association with individual innovativeness and individuals fully engaged with the external world, intellectually curious, goal-oriented, and appreciative of social values. The study completed by Ali (2019) listed certain personality traits as eligibility criteria for identifying innovators and early adopters, enabling operation managers may gauge the best candidates for diffusing technology or integrating TI.

The acceleration of the diffusion rate of product innovation within a business organization occurs through social user networks. Schweisfurth and Herstatt (2015) considered innovation-minded employees embedded in the firm using the innovated products as the main catalyst promoting acceptance by end-users. In this regard, Ali (2019) and Schweisfurth and Herstatt (2015) supported Rogers' (2004) view that innovation easily diffuses when guided by persons categorized as innovators and early adopters. Technical staff predisposed to innovation may act as diffusers of innovation when implementing TI projects or as users of the innovated product to influence laggards and early and late majorities into accepting and integrating TI.

Individual innovativeness may determine the proactive acceptance of TI; however, other social factors existing within the firm may stem the willingness of individuals to innovate. The research conducted by Grandón and Ramírez-Correa (2018)

illustrated the link between the innovativeness of managers of Chilean SMEs and the propensity to accept TI in the business environment. Innovative managers displayed a tendency towards drivers of e-commerce innovation, whereas obstacles to innovation acted as predictors of the attitudes of less innovative managers (Grandón & Ramírez-Correa, 2018). However, uncertainty in the direction of the firm and unknown strategic company goals stifle the innovativeness of individuals and negatively impact the integration of TI (Godoy, Labarca, Somma, Gálvez, & Sepúlveda, 2015; Grandón & Ramírez-Correa, 2018). Inculcating an environment of trust within the firm may nurture the individual innovativeness of managers or serve to transform laggards to early adopters giving rise to integration of TI into business processes.

Rate of adoption. The rate of adoption of innovation is dependent on communication channels and the individual innovativeness of users and implementers. The rate of adoption impacts the rate of diffusion, which is the time between the first knowledge of innovation and the acceptance or rejection of that innovation (Rogers, 1995). The availability of communication channels and the degree of heterogeneity of members within the organization or social system influence the rate of adoption (Gabriel & Da Silva, 2017). The more homogeneous an organization in accepting common goals, the less difficulty experienced in communicating strategies to integrate TI across the organization channels and the more favorable the rates of adoption, integration, and diffusion. However, Rogers (1995) noted that the rate of adoption follows a period of rapid growth, will then stabilize and decline, as depicted by an S-shaped curve. Although

workforces of innovators, early adopters, and early and late majorities result in a rapid rate of adoption, innovation integrated into business operations will stabilize and then decline.

Consumer market conditions may also impact the rate of adoption. The demand by the consumer market for particular technologies matched against the technical capabilities of the organization may not be in sync and reduces the rate of innovation adoption within the firm (Aydin & Parker, 2018). Conversely, Aydin and Parker (2018) noted that the consumer demand for sophisticated technology could push producers in a supply chain that operates outside the confines of the firm to accelerate production of upstream innovation. The managers must then leverage available resources within the firm to integrate sophisticated upstream TI for conversion to products demanded by consumers. The push and pull forces of consumers and suppliers influence the adoption rate of TI within the firm as well as the rate of diffusion from the inception of TI to buy-in by consumers. In this regard, the rate of adoption influences the success or failure when integrating TI or introducing commodities to consumer markets.

Perceived attributes. Individuals tend to evaluate the attributes of innovated goods or services based on their perception of the commodity, rendering perceived attributes as a contributing factor to technology diffusion. The perceived attributes of time for trialability, easily observable results, a relative advantage over other products, not overly complicated, and compatible with other practices serve to improve the rate of diffusion (Rogers, 1995). A study performed by Elmustapha, Hoppe, and Bressers (2018)

revealed that the adopters' perception of attributes correlated significantly with adoption decision-making, supporting Rogers' (1995) DOI concept. Signals of acceptance by the end-user of innovated products suggest the successful integration or implementation, production, and output of TI. The DOI theory is a comprehensive concept that includes acknowledgment of consumer preferences, business management, and technological expertise.

The use of mobile devices to transact trade or m-commerce provides an example of perceived attributes of m-commerce innovation driving consumer demand, and instigating businesses to innovate accordingly. Chau and Deng (2018) noted that the perceived attributes of security, costs, complexity, and compatibility of m-commerce drove the environmental context of consumer demand, competitiveness, and government support and influenced the organizational integration of m-commerce. The demand of consumers also influences the rate of adoption of technology (Chau & Deng, 2018). The benefits of TI, as perceived by consumers, prompt the integration of TI into business operations.

Communication channels. The acceptance of the innovated product by the business operators occurs after its distribution through communication network channels. Diffusion of TI from innovation-inception to acceptance by end-users through the influence of other adopters may signal the power of information flow through communication channels for diffusion of TI (Schweisfurth & Herstatt, 2015). Linking customer acceptance as indicated by production growth and incremental revenues to

innovated products exemplifies the success of DOI theory, as seen through existing examples. These include Ryan & Gross' (1943) experimental hybrid corn study that yielded 600 times over per acre and the European offshore wind farms that grew from 10 megawatts per hour (MW) to 368 MW (Gorenstein Dedecca, Hakvoort, & Ortt, 2016).

The improved business profitability resulting from the diffusion of TI may encourage managers in SMEs to form a social network to exchange knowledge of technologies directly. In 2017, Chesbrough reflected on the progress of OI and confirmed his 2012 prediction that the future of OI would include extensive collaboration between suppliers, business partners, and customers. Interpersonal relationships among business executives based on heterogeneity in ideas, beliefs, and visions stimulate the flow of communication and drive DOI among business operations (da Silva Gabriel & Da Silva, 2017). In this regard, Chesbrough parallels Rodgers' (1962) thoughts on DOI, in that, both scholars agreed on the flow or distribution of innovation strategies through partnering with resource persons external to the confines of each business. The OI and DOI theories infer a dynamic process where innovation practices infiltrate business operations, customer experiences, and wider consumer markets. Efficient networking among businesspersons may propagate the exchange and integration of TI to uphold the ideologies of OI and DOI.

Transfer of innovation knowledge through formal, informal, and digital communication channels to operation managers, end-users, customers, and suppliers contribute to the diffusion of TI. Camilleri (2018) noted that managers of SMEs

understand the engagement of all stakeholders through communication channels to maintain the pace of integration of TI. Digital communication facilities provide a strategic tool that connects all stakeholders for sharing data and motivating work performance and is preferred by managers of SMEs to diffuse information on TI throughout the business (Camilleri, 2018; Tantalo & Priem, 2016).

Business modeling. An observation of the processes of OI, DOI, and innovation strategies may exemplify the significance of appropriate management to effect improved business profitability. The rise and fall of Xerox's Palo Alto Research Center (PARC) provided an example of the advantages of DOI and OI. PARC was responsible for developing internal innovation; however, PARC was not successful in commercializing the newly developed products. Instead, other external companies achieved success through marketing and distributing Xerox's creations (Chesbrough, 2012). PARC exemplified Schumpeter's theory of creative destruction but fell short as a promoter of innovation (Witt, 2002). The transfer of TI from Xerox conformed to Chesbrough's (2012, 2017) concept of OI and Rodgers' (1962) concept of DOI. Chesbrough (2012) attributed Xerox's limited commercialization to the company's closed innovation model, which involved the creation, development, and implementation of innovative products and processes within the confines of Xerox. However, other newly established companies benefitted from researchers leaving PARC and implementing some of these innovations in different businesses, such as Apple, Microsoft, and Nortel (Chesbrough, 2003, 2012; Chesbrough & Rosenbloom, 2002). When using OI and DOI theories, the researcher

focuses more on the outside-in and inside-out parameters of innovation and less on confirming the workability of the innovation and the end-user.

Innovation strategies introduced to the business environment may be systematic or disruptive. Anyanwu (2015) suggested that bold, different, and disruptive innovative strategies provide newer and better work platforms and contribute to stymieing the narrow-mindedness of the Caribbean region. However, Whitton, Parry, Akiyoshi, and Lawless (2015) preferred a systematic model of change to promote sustained asset growth and community wellbeing, especially within the energy sector. Overall, there may be no clear guidelines for choosing disruptive or systematic innovation strategies as customized schemes may offer the best business fit (von Pechmann, Midler, Maniak, & Charue-Duboc, 2015). Examining the internal work processes, the community and customers, and the culture of the organization may provide the deciding parameters for selecting systematic or disruptive innovation methods.

Although many strategies for integrating TI exist, managers in SMEs must determine if the profile of the company allows for the integration of innovation. SMEs may be classified based on ownership structure, type of business trade, labor intensity, and age of the business (Roofe & Stone Roofe, 2016). However, ratios on innovative openness derived from financial and operational data help in evaluating the business capacity to adopt TI (Michelino et al., 2015). The results of ratios calculated using research and development, intellectual property, outsourced projects, and joint development programs indicate the measure of ease or difficulty when integrating TI into

the company's processes (Michelino et al., 2015). When managers of SME consider the adoption of TI, it may be prudent to investigate the company's FIO. The results of the FIO calculations posited by Michello et al. (2015) may offer insights to redefine aspects of the business profile and shape a business environment for integrating TI and enhancing DOI. The FIO is an evolving status as managers in SMEs strategize on process changes to allow diffusion of technological knowledge.

DOI within an organization may depend on the existing level of technical knowledge of the operation managers as well as the type of innovation. The technical skill of managers and the technological infrastructure of the firm may determine the range of TI options available for innovation integration (Michelino et al., 2015). Additionally, the increased access to sophisticated technical knowledge and the dynamics of the consumer market determine the TI developed or adopted by business managers (Souto, 2015). Innovation is integrated through the company based on strategic decisions by management and further established by the workability of the new TI processes.

Operation managers also delineate the TI or combinations of TIs that best fit the profile of the organization. The confluence of existing business processes in developing regions and access to TI from the developed economies influenced the type of innovation and rate of adoption in developing regions (Anyanwu, 2015; Chesbrough, 2017; Malaki, 2013; Tuomi & Neto, 2013). Consideration of the type of industry, level of technological sophistication capacity, and consumer patterns within the local market may influence the rate of adoption and type of innovation (Anyanwu, 2015). The adoption of TI is

dependent on the FIO status of the firm as well as operation managers' consideration of improvement to business efficiency, competitive advantage, and business profitability.

Enhancements to DOI may occur after an investigation of innovation failures. Witell et al. (2015) argued that innovation emerges after 90% of newly introduced innovation fails. Examination of the failed innovation technology, associated business model as well as individual and social behavior patterns reveals actions requiring mitigating measures or avoidance (Marolt, Lenart, Maletic, Borstnar, & Pucihar, 2016; Witell et al., 2015). Developing innovation involves the observation of the dualities in the organization: incremental and radical, product and process, technological and social organization (Lusch & Nambisan, 2015; Witell et al., 2015). A comprehensive review of the positive and negative influences of innovation builds a complete strategic plan.

Caribbean regional convergence. The governments of the Caribbean nations have historically chased after a regional integration; however, the lack of a common monetary unit, regional competitiveness, and differing political agendas have hindered Caribbean integration (Dookeran, 2013; Malaki, 2013). The formation of a Caribbean Community (CARICOM) and the Caribbean Single Market and Economy (CSME) attempted to foster improvements in trade, free movement of labor and fiscal transfers, avoid asymmetric shocks, and improve efficiencies and innovativeness among neighboring islands (Malaki, 2013). However, Dookeran (2013) suggested that Caribbean integration has stagnated and expected Caribbean Convergence to achieve the objectives of CARICOM and CSME. Dookeran (2013) noted that Caribbean states, uniting or

converging as one unit, may have more leverage when transacting business internationally or sharing and adopting innovative technology. The uniting of businesses within a region contributes to a pooling of technological knowledge and business strategies to integrate TI.

Business convergence may improve innovative capacity, DOI, and attain a competitive advantage at a Caribbean regional level (Anyanwu, 2015; Dookeran, 2013; Malaki, 2013). Malaki (2013) and Anyanwu (2015) explored and supported this idea by outlying benefits of improved investment infrastructure, innovative and entrepreneurial competitiveness, and a broader export platform with the coming together of the Caribbean businesses. The clustering of operation managers in the Caribbean increases inter-firm explicit and tacit knowledge and removes the reliance on internal research and development. In this regard, Caribbean Convergence is a strategic tool that assists in integrating TI into business processes.

Theory Application

Fernandes and Paunov (2015) assessed the importance of innovation and found that innovation might allow 71% of innovating companies to survive beyond 5 years, while only 55% of non-innovating firms will continue to exist beyond 5 years. Additionally, the Inter-American Development Bank researched the LAC countries and determined that in these countries, a 10% increase in research and development (R&D) spending, increases innovation by 1.7% (Grazzi & Pietrobelli, 2016). Zanello, Fu, Mohen, and Ventresca (2016) also noted that a 1% increase in R&D increased output by

0.6% in developing countries. Managers of SMEs may also innovate by developing the innovative human capital instead of bolstering R&D budgets (McGuirk, Lenihan, & Hart, 2015). Developing employees through education and skilled labor produces more knowledgeable and productive persons that contributed to firm-level innovation (McGuirk et al., 2015). Integrating TI may succeed where there exists the propensity to invest in R&D initiatives that concentrate on developing knowledgeable persons to guide and implement innovation.

Scholars observed the linkage between integrating TI and the acceptance of innovative products by the consumer market in the DOI theory. Witell et al. (2015) posited that the spread of innovation among businesses and through-out an industry is as described by Rogers' (1962) DOI theory, where innovation adoption drives collective acceptance by group consensus, such as mobile smart technology. Likewise, in developing markets, the end-users of technology are considered the diffusers of innovation and were responsible for 50% growth of all mobile financial services (Van der Boor, Oliveira, & Veloso, 2014). The demands of users of mobile technology may drive mobile manufacturers to invest in improvements to the device as well as propagate the use of cellular technology to new users. The driving force for the dispersion of innovation throughout the industry is, to some extent, determined by the consumer market patterns of the intended audience.

The diffusion of TI may be fueled by observing changes in the profit margins. Florida, Alder, and Mellander (2017) observed that the profits earned through R&D

incentivized and prioritized the entrepreneurial creativity above that of the dynamics of competitive markets. However, in the Caribbean region, limitations to research and development may be in the form of financial and legislative restrictions, technical and capacity building constraints, and social barriers (Khan & Khan, 2017). The results of R&D practices may motivate all entrepreneurs to invest in innovations; however, an inadequate economic infrastructure may present barriers.

Within the developing region of Malaysia, the government embarked on the development and growth of knowledge-based economies to achieve the status of a developed country by 2020. Zailani, Govindan, Iranmanesh, Shaharudin, and Chong (2015) noted that empowerment of the Malaysian citizens through formal education, training, and accessibility to life-long learning inspires the development of sustained innovative products and processes. Additionally, Souza et al. (2014) noted the Brazilian government's commitment to implementing vertical science, technology, and innovation policies to attract high-quality investments, create human capital and new technology, and absorb foreign technology in an attempt to catch up to developed countries.

Conversely, Hu and Zhao (2016) noted that the limitations of formal knowledge might rouse other entrepreneurial skills of action through necessity and opportunity-driven. Hu and Zhao (2016) also noted that entrepreneurs customized on-the-job business expertise to improve operations and promote efficient business profitability. Overall, Barge-Gil and López (2015) noted that managers in SMEs are least likely to invest in R&D; however, if they do, usually it is in the early stages of existence, and they are prone

to intensify their R&D efforts. The need to develop employee learning is paramount to the success of the diffusion of TI; however, the decision to acquire knowledge formally or through on-the-job experiences may depend on the manager's perception of the aptitude of the employee.

The proximity of developing nations to the technological frontier invited the introduction of learning institutions to facilitate the catching-up process, the emergence of technology, and its diffusion through the economy (Liu & Giroud, 2016). However, this process promoted the imitation of institutions of developed countries by lesser-developed nations and often resulted in the development of an economic model that imitated existing structures of developed countries not customized for domestic purposes (Liu & Giroud, 2016). The concerns of Liu and Giroud (2016) underscored Valaei et al. (2017) examination of Malaysia's organizational learning capabilities. In Malaysia, inherent intuition and spontaneity, together with acquired knowledge, produced creative innovation strategies (Valaei et al., 2017). The Malaysian example underscores the requirement for customization of TI processes before the implementation of DOI strategies.

TI knowledge sourced from returning expatriates from developed countries improves the level of sophistication of local technical resources (Burmeister et al., 2015; Dookeran, 2013; Gonzalez & Chakraborty, 2014). A study completed by Kenney, Breznitz, and Murphree (2013) noted that returning nationals to Taiwan contributed 27.5% of the equity for TSMC, a government-run information and communication

technology (ICT) foundry producing computer chips. Nations benefiting from repatriates could create learning opportunities to improve business growth and profitability.

The Malaysian tourism experience provided an example of transferred technology through corporate networking for developing countries (Ali, Kim, Li, & Jeon, 2018). The Malaysian competitive environment was the perfect vehicle for the development of theme parks, initially characterized by low-cost strategy and resources sourced from the suppliers of the Disney Theme Parks (Ali et al., 2015). The importance of the buyer-seller relationship and customer relationship both assisted in securing a global competitive edge for the Malaysian buyers of technology.

Zailani et al. (2015) further suggested that Malaysian firms should be encouraged to adopt appropriate external supply chain management (SCM) practices to develop innovative processes to maintain their competitive edge. SCM practices are important avenues for promoting strategic supplier partnerships, better customer relationships, improved customer sharing, improved information technology, staff training, and internal operations (Zailani et al., 2015). The Malaysian automobile industry has also displayed the continued innovation by application of green practices (Zailani et al., 2015). Formal SCM processes by managers in SMEs may foster the diffusion of TI.

Managers of SMEs in developing regions may depend on governmental initiatives to bolster the integration of TI. Mazzarol et al. (2014) noted that SMEs usually make up the largest business sector in developing regions; however, the poor standard of technology employed at SMEs in these localities limits the integration of TI and restricts

the profitability of businesses. Managers of SMEs may access TI through external sources such as multinational co-operations domiciled locally, foreign investors, and partnerships with learning establishments (Dookeran, 2013). However, Eastwood, Klerkx, and Nettle (2017) acknowledge the recurring DOI theme of channeling technological knowledge among businesses expressed by da Silva Gabriel and Da Silva, 2017) by cautioning that successful TI transfers in developing regions required a collaborative approach among the private and governmental sectors. Integrating TI in developing regions requires a tripartite approach of multinationals and the government sector working with SME managers to access sophisticated technology.

National government funding to improve R&D commercial activities proved beneficial to the once developing country of China, now an emerging country. The Chinese government invested a little over 25% of its technology companies and encouraged collaborations between business and learning institutes through incentives (Wiederhold, 2015). When compared to the U.S. market, the U.S. venture capitalists have projected a 7% decrease in investments over the next five years, whereas, China expects to increase its investments in R&D, incrementally, over the same period (Wiederhold, 2015) due to its unique national funding structure. Caribbean governments may adopt the investment practices of the Chinese governments and bolster the financial resource of SMEs.

Some researchers contradict the notion of the immediate transfer of innovation for businesses in developing countries, opting for delayed adoption of innovation (Alizadeh

& Salami, 2015; Lederman, Messina, Pienknagura, & Rigolini, 2014). Alizadeh and Salami (2015) noted that the transfer of innovation in developing economies benefitted from legislative measures and an improved macroeconomic environment. Without these transformational infrastructural resources, developing and integrating innovation is unattainable (Alizadeh & Salami, 2015). This finding was evident in the newly industrialized economies (NIEs) of the East Asian countries where enhanced technological progress through research and development followed initial local efforts on the production of consumption goods (Wan et al., 2015), fueling its long-term success. Initially, establishing the propensity towards innovative openness of SMEs could determine the degree of readiness before the DOI.

Strategies Used to Integrate TI for SMEs in the Caribbean. SMEs are considered the backbone of all developing and emerging economies through the creation of employment and business competitiveness (Abdullah, Ma'aji, & Khaw, 2016; Bahaw, 2017). However, within this business class, a high failure rate of over 70% in the first five years of existence occurred (Fatoki, 2014; França, de Aragão Gomes, Machado, & Russo, 2014). Contrasting themes of positive contribution to the economic growth and restriction of business cycles appear to dominate the commercial expansion process, and so extending the life cycle of most SMEs have been the focus of most scholars (Abdullah et al., 2016; Fernandes & Paunov, 2015; França et al., 2014). One of the solutions that may bridge the gap of commercial expansion and business performance is the introduction of TI to businesses (Abdullah et al., 2016).

Background of SMEs in the Caribbean. The commonality that exists among developing, emerging, and developed regions is that SMEs is the key contributor to the national GDP through employment, revenue, and innovation (Abdullah et al., 2016). However, the life-span of SMEs in developing countries register high mortality rates due to the lack of monitoring emerging technologies, poor strategic management, or employing a survival attitude (França et al., 2014, Woo et al., 2017). Other studies revealed that the business cycle of the companies in developing countries go through negative shocks in recessionary periods as developed donor countries restrict financial aid during these times (Dabla-Norris, Minoiu, & Zanna, 2015). As such, selecting the appropriate geo-economic region to observe TI is an initial consideration of managers in Caribbean SMEs. Decision-makers may find it prudent to observe similar economic regions like South America, Malaysia, and India.

An additional area of interest of managers in the Caribbean may be the processes of management in SMEs in developing regions defined as successful that copied innovation models from other businesses but implemented them differently due to the unavailability of some inputs (Brea-Solís, Casadesus-Masanell, & Grifell-Tatjé, 2015). However, evaluating and implementing sophisticated TI in developing regions by operation managers may be challenging (Abdel-Razek & Alsanad, 2014). A comparison of processes in companies in the developed region of Saudi Arabia and the emerging regions of Brazil and China displayed that knowledge management existed in all regions (Abdel-Razek & Alsanad, 2014). However, the managers in the Saudi Arabian companies

upheld staff development, commitment to innovation, and flexible business operation capabilities, whereas the Brazilian and Chinese companies lacked management strategy and failed to implement innovation strategies successfully (Abdel-Razek & Alsanad, 2014). Operation managers hoping to achieve the benefits of DOI within business operations in SMEs require the appropriate TI knowledge, commitment, staff development in research, and inculcate a flexible business structure.

DOI challenges in the integration of TI. The operational and social challenges in diffusing TI applications within organizations in the Caribbean originate from internal business practices. The operational difficulties result from internal and peripheral processes and encompass the administrative infrastructure, financial positioning, economic conditions, and lack of existing competencies to stimulate market players (Zoo et al., 2017). Social challenges may relate to misperceptions and misunderstanding, lack of knowledge, and existing cultural office thinking (Bahaw, 2017; Zoo et al., 2017). Strategies such as communication network engagement between the customer and supplier or the employer and manager and learning opportunities mitigate the ill-effects of social issues (Mlecnik, 2016). Although challenges are present within organizations, critical assessment may provide possible solutions to promote the successful application of DOI and ABI concepts.

DOI strategies for managers of SMEs in the Caribbean. Researchers observing the relationship of business and economic growth to TI in developing economies highlighted the benefits of DOI in attaining desired targets (Anyanwu, 2015; Chesbrough,

2017; Mazzarol et al., 2014; Rezvani, Jansson, & Bodin, 2015). However, as a precautionary, the adoption of TI might not automatically solve localized problems nor increase the wealth of local institutions (Fernandes & Paunov, 2015; Rezvani et al., 2015). Product and plant innovation may present risks due to failed product launches and poorly managed capital investments; however, a diversified resource base improves the survival rate of the business (Fernandes & Paunov. 2015). Managers of SMEs looking to gain long-term rewards should monitor the integration of TI into business processes to guard against mismanagement of resources.

Research and development. One avenue for strategizing on cost-benefits includes the management of R&D costs by managers of SMEs. Hossain (2015) contended that innovation strategies should ideally be the strategic approach for operation managers of SMEs, where outsourced innovation services replaced the cost of R&D. However, accessing and transforming outsourced innovation services into useful resources required specific strategies to counteract the existing challenges faced by managers of SMEs in the Caribbean (Alleyne, Lorde, & Weekes, 2017; Dookeran, 2013; Rezvani et al., 2015). Customized applications of existing strategies may promote the diffusion and integration of TI to circumvent the challenges faced by operation managers of SMEs.

The majority of Caribbean SMEs contend with limited financial resources and restricted specialized business skills, limiting its propensity to innovate internally or carefully discern technological opportunities when adopting R&D activities (Barge-Gil & López, 2015; Dookeran, 2013). Added to which, TI is a dynamic process, and its

complexity and usage vary by the degree of adoption and technological awareness by the respective users (Haned, Mothe, & Nguyen-Thi, 2014). Managers of SMEs often could not connect the vision to the execution, as the research and planning are inadequate (Haned et al., 2014). R&D activities by managers in the initial stages of existence cement future benefits and are the path to achieving integration of TI and increased profits.

Access to knowledge. Managers of Caribbean SMEs experienced a lack of access to computer software, security concerns, reduced return on investment, and external barriers of social, cultural, legal, regulatory, political, and physical infrastructure (Lui & Giroud, 2016). The global economy becomes more integrated over time, and influences the increased prevalence of superior technological knowledge, incentivizing local business persons to improve their knowledge capacity (Lui & Giroud, 2016). However, within the Caribbean region, spend on research and innovation amounts to 0.13% of GDP, compared to 2% in developed economies (Browne & Shen, 2017). The access to sophisticated technological knowledge may incentivize the operation managers of Caribbean SMEs to invest in the human capital to promote the integration of TI within businesses.

Hamburg and O'Brien (2014) acknowledged that the restricted learning capacity of managers of SMEs could have adverse effects on the economy if not adequately addressed. Managerial learning improves the strategic direction of the firm and creates an environment for innovation; however, if learning is restricted, importation of TI together with the lack of exports deteriorates the economic outlook (Hamburg & O'Brien, 2014;

Valaei et al., 2017). E-learning, mentoring, practical organizational learning, industry awareness, and societal learning may address the knowledge gap (Hamburg & O'Brien, 2014; Pels & Kidd, 2015). Developing the human resources of an organization improves the employee potential and the business capacity for integrating TI into business practices.

Internationalization and interactive SMEs. Caribbean firms deepening their international or export relationships showed greater levels of ICT diffusion within business operations (Grazzi & Pietrobelli, 2016). The requirement to improve the exporting process within the company acts as a stimulator of sustained internal innovation (Grazzi & Pietrobelli, 2016). The reasoning of Grazzi and Pietrobelli (2016) parallels Hu and Zhao's (2016) thoughts on the opportunity to improve out of a position of necessity. Liu and Giroud (2016) shared a similar view on knowledge incentivizing internal improvements. The managers of SMEs may also strategize for internationalization by the introduction of ICT, a form of TI into business processes.

Foreign direct investment. Managers of SMEs within the Caribbean region benefit from foreign direct investment (FDI) principally sourced from foreign governmental agencies or locally established multinational corporations (Liu & Giroud, 2016). The benefits resulting from FDI also extend to the local economy where SMEs are domiciled (Henry, 2015; Lui & Giroud, 2016). Some of the advantages realized through FDI from the U.S. include increased R&D spending and business expansion, infrastructure development, improved foreign exchange rates, greater openness of the

economy, and improved political ties within the developing economy (Lee et al., 2017; Van der Duin et al., 2014). Managers of SMEs that receive foreign funds may leverage that capital to intensify efforts on research and development to promote the integration of TI, increase the profitability of the firms and contribute to the upgrade of the national economy in the long-run.

Regulated government jurisdiction. Inadequate government policies on intellectual property and ICT, paired with the weak caliber of the scientific community and poor organizational ties contributed to an impaired technology communication network (Dodourova & Bevis, 2014; Hossain, 2015). As a result, only 5% to 20% of managers of SMEs in developing regions used OI (Hossain, 2015; Rahayu & Day, 2015). Possible solutions to this dilemma include the employment of government tax incentives (Tuomi & Neto, 2013) and the creation of SME national organizations to improve SMEs' tendencies of adopting TI from external sources (Hossain, 2015; McLeod, Lewis, & Spencer, 2017). Government intervention through tax incentives will encourage SME owners to invest tax refunds into integration of TI for improved diffusion of innovativeness in SMEs.

Within some developing countries, innovativeness is a required strategy for SMEs to compete domestically and internationally. Alizadeh and Salami (2015) identified government actions in the developing regions of Eastern Asia in the form of implementation of competition laws. This action encouraged competition among firms but limited control of the market (Alizadeh & Salami, 2015). In the Caribbean region, an

environment regulated by competitive laws may follow the pattern of Eastern Asia and improve competition and promote innovation among firms and increase investments in strategies to promote TI.

The practices and experiences of the East Asian countries were similar to the LAC states. Tuomi and Neto (2013) established that FDI and exports are strong determinants of R&D practices that stimulated internal innovation; whereas, technology transfer and interest rates displayed negative correlation signs in LAC economies. Tuomi and Neto (2013) also noted that the transfer of innovation from developed countries only enhanced the economic outlook of developing states when a learning environment existed. Further analysis revealed that regional government stimulates innovative systems and advance R&D in East and South Asia, resulting in more sophisticated R&D practices than Latin America, the Middle East, and Central Asia (Tuomi & Neto, 2013). To this end, operation managers of Caribbean SMEs will benefit from spend in R&D activities and government assistance in promoting strategies for integrating TI. Fazal, Wahab, Yaacob, and Zawawi (2016) observed that governments' prioritization of competitive policies achieved continuous innovation in the developing countries of Indonesia and Malaysia. The implementation of aggressive government policies ultimately improved the investment climate (IC) within each jurisdiction (Fazal et al., 2016). A regulated environment, technology, and innovation support, and the reduced cost of finance are some national policies that influence technology utilization and improve the IC (Fazal et

al., 2016). Within this context, a regulated environment establishes the positive interconnectivity of a regulated environment and the DOI.

Some developing countries may purposely condone weak patent legislature to allow the diffusion of technologies from MNCs to domestic operators to enable the transfer of TI. Souza et al. (2014) noted that weak patent legislature enabled domestic SMEs to acquire TI from MNCs easily. A poorly regulated economy allows the domestic market to enjoy the benefits of a welfare state when TI moves outside-in and local businesses benefit from the easy transfer or TI. However, Souza et al. (2014) cautioned that as economies develop and local businesses innovate exponentially, strong patent legislature is required to protect the creator of the intellectual property.

MNCs moving to new locations expect governments of host countries to offer incentives for TI exchange. Liu and Giroud (2016) highlighted the triad connection of the government, MNCs, and indigenous marketing to enhance innovativeness. Un (2015) however, saw little evidence of this union and expected foreign MNCs to benefit from its association with its foreign counterparts, and innovate more than its domestic fellow members, decreasing competition in the long-run. Where market regulations fall short in establishing the equitable spread of technological knowledge, private governance, initiated by non-government organizations, monitored the codes of conduct, fair trade, and corporate social responsibility (Gereffi & Lee, 2016). Additionally, investigations in the emerging economies of Brazil, Russia, India, China, and South Africa (BRICS) revealed an eco-system of existing patent policy, high-tech exports, and investments in

R&D (Souza et al., 2014). Developing countries desirous of achieving economic growth may increase business profits by adopting an eco-system similar to BRICS. Government intervention through regulatory policy may be required to intercede on behalf of local companies, address domestic business concerns, and encourage a transparent process to improve overall employment and technological gains. Investments in R&D will improve strategies for integrating TI.

Innovating business products and services through BOP. The base of the pyramid (BOP) sector of the community is often overlooked but may possess an avenue for revenue. Pels and Kidd (2015) recognized the differences in economic landscapes of developing and developed states and highlighted the untapped emerging and base of the pyramid markets to aid in developing useful policies going forward. Some firms, such as Hewlett-Packard and Procter & Gamble attempted to address this dilemma by extending their market scope to include low-income earners in developing countries, such as Venezuela and Indonesia (Pels & Kidd, 2015). However, the limited resources owned by the BOP sector may influence a low probability of sustained business development and a reduced margin of innovative implementations: factors important to business growth and wealth development (Dookeran, 2013; Malaki, 2013). The BOP sector highlights a requirement for segmentation of customer markets and addressing nuances when considering the innovation of products. Although infiltrating a market characterized by poverty is challenging, the BOP customer adds new complexity to the diffusion of innovative practices and addresses an important market in developing regions.

Business profile of SMEs. There are benefits to the unique profile of SMEs. Operation managers of SMEs seeking deliberate business improvement over emergent growth opportunities might employ strategic planning to chart the appropriate innovation procedure (Mazzarol et al., 2014). The structure of SMEs, unlike large businesses, depict the closeness of the owner to the decision-making and operating activities of the operations removing the bureaucracy of layers of authority (Mazzarol et al., 2014). This arrangement allowed flexibility in strategic planning to effect incremental innovation and sometimes achieved radical TI changes.

Transition

Section 1 consisted of an overview of the study on strategies by managers of SMEs to integrate TI into business operations to improve business growth and profitability. The components of Section 1 included a review of the professional and academic literature which highlighted the DOI and the ABI theories.

Section 2 includes a discussion of the role of the researcher, participants, research method and research design, population and sampling, ethical research, data collection instruments, data collection techniques, data organization technique, data analysis, and the reliability and validity of the study. Section 3 contains the presentation of the findings, the study's application to professional practice, implications for social change, recommendations for action and further research, reflections, and a conclusion.

Section 2: The Project

This section includes an explanation of the purpose statement and the rationale that supports the research method and design. Also described in this section are the identification of participants, population and sampling, data collection instruments and techniques, data organization techniques, and data analysis. Section 2 also includes the ethical guidelines followed and a discussion on the reliability and validity of the study.

Purpose Statement

The purpose of this qualitative multiple case study was to explore strategies that some operation managers of SMEs used to integrate TI into their business operations to increase business growth and profitability. The targeted population comprised of operation managers from four SMEs in the Caribbean region who successfully implemented TI into their business operations. The findings of this study may advance positive social change by offering information that may lead operation managers to integrate TI into business operations. The implications for positive social change include the potential to develop capabilities of operation managers in SMEs. The integration of TI could promote efficiencies for employees, create products to meet customer demands, and limit business failures for leaders in SMEs. Managers of SMEs, who are able to increase profit margins and sustain the operations of SMEs, might be able to contribute to the circulation of wealth in the local communities.

Role of the Researcher

In the role of the researcher, I assumed the responsibility of collecting, assessing, and interpreting the meaning of the collected data. The researcher is central to the qualitative research process and the main data collecting instrument acquiring rich, detailed, and in-depth data to gain a better insight into the subject of the study (Dikko, 2016; Fletcher, De Massis, & Nordqvist, 2016). The role of the researcher, as explained by Fletcher et al. (2016), includes obtaining valid and reliable data through accessing fieldwork, building rapport with participants, and recording data to extract themes and build new insights. The researcher plays a pivotal role in all aspects of the data collection process of a study.

The relationships the researcher may have with the study participants, topic, and research area raises questions of personal worldview and bias (Roulston & Shelton, 2015). However, the researcher must be ever cognizant of the personal lens and not allow it to distort the viewpoints shared by the participants (Ross, 2017). My expertise lies in the fields of financial and management accounting and internal controls related to businesses in the telecommunication and gold mining sectors. I have limited knowledge about integrating TI, having worked on only three projects where I implemented accounting software systems. I do not have a previous relationship with any of the participants in the companies selected for this study; therefore, bias was not an issue.

An overarching responsibility of the researcher is treating all participants in a research project with the utmost respect and following proper ethical guidelines, which I

accomplished by adhering to the Belmont Report protocol. Through compliance with the 1978 Belmont Report, a researcher practices respect, beneficence, and justice to all human subjects (Friesen, Kearns, Redman, & Caplan, 2017; Hammer, 2016; Hull & Wilson, 2017). Although Friesen et al. (2017) noted that the Belmont Report did not consider the impact on communities and transparency, Hull and Wilson (2017) noted that the U.S. federal regulatory framework, the final Common Rule addressed these issues. The Belmont Report remains a reference for all Institutional Review Boards (IRBs) for ethical principles and guidelines for all research involving human subjects (Hull & Wilson, 2017). As a researcher, I regard the participants as autonomous agents and respectfully sought their consent to participate in and provide data for the study. Mutual agreement on the location and time of the interview facilitated an easy rapport and ensured participants were comfortable physically and willing participants in the study.

Mitigating personal bias improved the reliability and validity of a study. Stapleton (2018) cautioned against cognitive biases arising from personal beliefs and preferences that negatively impact reliable and valid outcomes. Roulston and Shelton (2015) suggested reflective practices for contemplating one's biases as a researcher and allowing for critical self-examination of subjectivity. The use of a protocol for interviewing participants permits consistency and transparency in the data gathering process and serves to diminish the threat of bias (Hurst et al., 2015; Majid, Othman, Mohammed, Lim, & Yosuf, 2017). Other ways of addressing researcher bias include member checking to obtain the participants' feedback and triangulation (Morse, 2015a). Recognizing bias

by reflecting on subjectivity, as well as employing pragmatic checks, ensure the validity and credibility of the study. I mitigated my bias and avoided viewing data through the personal lens by self-examination of my subjectivity, application of the interview protocol, and by member checking where I provided a succinct interpretation of the participants' responses to the participants to check for accuracy.

Designing an interview protocol allows the researcher to consistently follow prescribed steps to collect rich, in-depth data from the participants in an unbiased manner. An interview protocol sets the stage for interviews, which includes member checking and follow-up questions for improving the clarity of the collected data. Castillo-Montoya (2016) outlined a few steps to enhance the quality of data received from participants in an interview protocol refinement (IPR) framework and created a checklist for improving an interview protocol and, by extension, the interview process. Steps of the IPR include (a) aligning interview questions with research questions, (b) conducting inquiry-based conversations, and (c) obtaining feedback on interview protocols (Castillo-Montoya, 2016). By following the interview protocol (see Appendix), I ensured that I consistently used the same interview steps with all interviewees and maintained transparency in the data gathering process. The interview protocol allowed for consistently presenting predetermined open-ended questions in semistructured interviews and scheduling member checking with each participant ensuring the interpretation of responses was accurate.

Participants

The identification and selection of appropriate participants assure collection of valid and salient data that lead to insights and make sense of complex organizational happenings (Darwin et al., 2017; Marks, Wilkes, Blythe, & Griffiths, 2017; Saunders & Townsend, 2016). The eligibility criterion of participants that aligned to the research question was that they must be using or have used successful strategies to integrate TI into their business operations. For my study, I selected four SMEs where the managers responsible for business operations employed successful strategies to integrate TI into their business operations.

I approached the executive leaders of the four selected SMEs and requested and received approval to access potential participants. Høyland, Hollund, and Olsen (2015) emphasized the importance of formally agreed consent from participants but also mentioned consensual buy-in from the other gatekeepers of data: those persons that grant permission to access the participants. Additionally, Peticca-Harris, deGama, and Elias (2016) described gaining access to participants as a fluid process and cautioned of finding alternate ways for initial contact by exercising flexibility to rethink the selection process if participants do not fit the study criteria. However, accessing participants from SMEs may be an easier process than from multi-corporations given the uncomplicated organizational structure of SMEs (Saunders, Gray, & Bristow, 2017). In this study, I submitted Letters of Cooperation to the executive leaders, or gatekeepers of data of four SMEs and received signed approval to conduct my study. I also obtained permission to

access eligible participants and received their contact information, including email addresses. I then issued invitation letters via emails to the selected participants. My relationship with the participants was respectful and I maintained a continuous rapport for on-going discussions.

After establishing the initial access to the operation managers of SMEs, I continued to maintain working relationships by communicating through office emails and office landlines to establish the interview logistics and answer questions on the study. Semistructured meetings were used to conduct the initial and member checking interviews. Høyland et al. (2015) advised that the researcher may require working relationships with the participant as well as other key company stakeholders that need assurance of the value of the research. Porter, Outlaw, Gale, and Cho (2019) confirmed the understanding of Høyland et al. (2015) but further emphasized the importance of an easy working and continuous connection between the researcher and participants that allows for access to data. Additionally, Peticca-Harris et al. (2016) suggested being flexible, anticipating future action, and maintaining professionalism will counteract challenges to a working relationship, such as logistics, lack of comfort with the role of researcher, and withdrawal of consent. In this regard, I maintained a professional working relationship with the participants by listening attentively and being flexible, understanding, and open-minded throughout the research process. I also provided regular updates on the progress of the study to other key stakeholders previously identified as gatekeepers of data to cultivate an environment permitting the gathering of data.

Research Method and Design

Research Method

I employed a qualitative research method to explore and understand how operation managers in SMEs integrate TI to improve business operations. Qualitative research tends to answer *how, what,* or *why* of a phenomenon, whereas quantitative research answers *how many* or *how much* (McCusker & Gunaydin, 2015). Obtaining answers to *what* and *how* managers in SMEs integrate TI involved in-depth exploration through open-ended questions posed to participants. A qualitative method served the purpose of this study, which was to answer *what* and *how* questions of the phenomenon.

Qualitative methods allow for an in-depth approach using open-ended questions for a deeper understanding of the phenomenon. Qualitative methods comprise personal interviewing, researcher observation in a naturalistic setting, and sourcing data from public and private databases (Hammarberg et al., 2016; McCusker & Gunaydin, 2015). The objective of the researcher using open-ended questions is to probe for a meaningful discourse of data (Hammarberg et al., 2016). By employing open-ended questions for the initial and member checking interviews and collecting operating reports and technological plans, I obtained a deep understanding of the topic.

Conversely, a quantitative method is not the best fit for this study because it does not include testing a hypothesis. The researcher employing quantitative methods knows in advance what to look for, obtains data in the form of number and statistics, and test the hypothesis (Griensven et al., 2014; McCusker & Gunaydin, 2015). Quantitative methods

include the generalization to larger populations and augment reliability of data, and qualitative methods permit a detailed examination of the processes within the selected companies allowing for contextual detail (Morse & McEvoy, 2014; Yin, 2017). I did not employ a quantitative method for this study.

The mixed method involves both qualitative and quantitative components and may provide a deep understanding of the subject; however, consideration must be weighed on additional timing, increased costs, and challenges in the research design (Griensven et al., 2014; McCusker & Gunaydin, 2015). Researchers of mixed-method require expertise in both methods, and the data analysis may provide contradictory results between both methods (Griensven et al., 2014). As such, the mixed method was not an appropriate choice for this study because it does not include a quantitative component and time needed for the intensive work associated with this method.

Research Design

I employed a multiple case study design for this study. A case study design captures the definition and context of a situation and illuminates the peculiarities or commonalities to enhance understanding of the cases (Morse & McEvoy, 2014; Yin, 2017). The multiple sources of a case study display similarities, differences, variety, and redundancy of a general population and expose the complexity of business operations (Albrecht & Spang, 2014; Michelino et al., 2015). Data were collected from multiple sources for my multiple case study design from operation managers of SMEs through

interviews and private company plans, and reports for each business case. A case study design was the appropriate choice to explore the phenomenon in my study.

Other qualitative research designs include mini-ethnography, narrative, and phenomenology. Mini-ethnography, narrative and phenomenological designs are used to explore cultural norms, narrate stories, and document unique and personal lived experiences respectively (Fusch & Ness, 2017; Rooney et al., 2016). Researchers may select a mini-ethnographic design to understand a specific area of inquiry related to the cultural meanings and behavior of a group of people (Amaechi & Fusch, 2019; Fusch & Ness, 2017). A narrative inquiry is the storied account of life experienced by individuals that researchers use to understand the complexity of social phenomena (Hold, 2017; Rooney et al., 2016). Phenomenological design is used by researchers to explore the lived experiences of individuals within their life-world (Korstjens & Moser, 2017; Salvador, 2016). Phenomenology is a qualitative research design rooted in philosophy and psychology (Korstjens & Moser, 2017). A mini-ethnographic design was not suitable for this study, as I did not address group cultural behavior in my research question. I did not select a narrative design as I did not gather stories of life experiences of individuals to explore the complexity of a social phenomenon in my study. Phenomenology was not appropriate for this study, as I did not explore the lived experiences of individuals in real life settings for a philosophical or psychological perspective of the phenomenon.

Fusch and Ness (2015) noted that the collection of data from multiple sources enhances data saturation. In qualitative studies, data saturation occurs when no new

themes emerge from data collected from participants (Fusch & Ness, 2015). To reach the saturation of data, I collected data from participants through interviews and private company operating reports, and technological plans until no new data or themes emerged.

Population and Sampling

The population for this study included managers with responsibility for the operations in manufacturing SMEs within the Caribbean region, who used successful strategies to integrate TI into their business processes. Researchers select the method of sampling to identify a subset of participants that best represents the population. Gentles, Charles, Ploeg, and McKibbon (2015) noted that researchers often use purposeful sampling in qualitative case studies. Purposeful sampling is the systematic selection of information-rich cases or participants based on established criteria that offer an important perspective (Benoot, Hannes, & Bilsen, 2016; Gentles et al., 2015). Likewise, Yin (2014) advised that researchers select cases for a multiple case study that yield the best data based on the established operational criteria. I used purposeful sampling for selecting the participants to ensure the collection of rich, in-depth data.

Researchers must consider a sample size when conducting a multiple case study. Tai and Ajjawi (2016) stated that there are no predefined rules for deciding on the right sample size for a case study. Yin (2014) noted that a sample size of two might be adequate for a multiple case study design. However, Marolt et al. (2016) and Hu, Williams, Mason, and Found (2016) explored the adoption of innovation in SMEs and used four participants from four businesses in their multiple case studies. Marolt et al.

(2016) and Hu et al. (2016) indicated that their studies took place where SMEs dominate the business sector by 99.8% and 90% respectively. These statistics correspond to records by Azudin and Mansor (2018), which stated that SMEs comprise 90% of Caribbean businesses. I used a sample size of four participants from four different Caribbean businesses to support data saturation.

Data saturation is the accumulation of rich data guided by scope and replication, and not necessarily the amount of data, to produce accurate and valid data (Morse, 2015b). It is a concept that originated from grounded theory but is applicable to a case study design (Aldiabat & Navenec, 2018). Fusch and Ness (2015) noted that for case studies, the researcher attains data saturation when no new data or themes exist. To ensure data saturation, I interviewed four participants using semistructured interviews and member checking, reviewed private company operating reports, and strategic technological plans. I sought new themes in the collected data until no new themes emerged.

The criteria for selecting participants for this study encompassed an operation manager of an SME in the Caribbean who had used successful strategies to integrate TI in business operations. Yin (2017) and Vohra (2014) noted that the interview with the selected participants is an important source of data for case studies. Vohra (2014) further emphasized the importance of interviews occurring in the participant's natural setting to yield rich data within the context of the field. I conducted all interviews with the participants that fit the established criteria, using the natural company setting in the

participant's office room to ensure privacy and physical and emotional comfort, and enable the collection of rich, in-depth data.

Ethical Research

The researcher must conform to the informed consent process to meet ethical standards before collecting data from participants. Mansour et al. (2015) noted that ethical guidelines for the informed consent process involve institutional review board approval, adequate information shared with participants, and written informed consent to indicate voluntary acceptance by the participant. Mansour et al. (2015) also indicated that ethical guidelines dictate that the researcher interacts with participants respectably, confidentially, honestly, and privately to avoid coercion and inculcate a comfortable environment when obtaining written consent. I exercised due care and adherence to the ethical standards while conducting the informed consent process for this study. The potential participants initially received an email of the invitation letter and the consent form to allow time for reviewing and raising concerns. I then met with each participant at a mutual time in the natural setting of their office room at the worksite to conduct the interview. Immediately before the interview, I ensured full understanding of the consent form before obtaining signatures of consent. Although I received signed consent forms, I informed each participant of the option to withdraw from the study at any time.

Participants must also know of the ethical right to choose not to be in the study or change their mind about participating at any time. Harriss, MacSween, and Atkinson (2017) advised that all human participants be informed of the ethical right to withdraw

consent without retaliation. Most researchers agreed that the ethical right to participant voluntarily, or refuse to participate, denotes the right to withdraw at any time (Hagen, Iversen, Nesset, Orner, & Svindseth, 2019; Roberts, 2015; Samamdipour, Seyedin, & Ravaghi, 2019). Grady et al. (2015) further noted that the risks and benefits of the study shown on the consent form guide the voluntary decision to opt-in or opt-out. Included in the consent form was an explanation of the voluntary nature of the study as well as a notation that the study did not pose a risk. The participant was also made aware by notification in the consent form, that all decisions to decline participation or withdraw at any time will not solicit retaliatory action by company members.

The decision to offer or not offer incentives to participants was declared in the consent form to ensure compliance with ethical standards and a transparent process. Incentives may motivate persons to participate in studies where the time and effort required in attending interviews negatively impact recruitment (Kominiarek, Gay, & Peacock, 2015; Thornton et al., 2016). However, incentives offered should not be extravagant, should reasonably compensate the associated risks, and not cause the undue influence of the participants (Brown, Galea, Davidson, & Khoshnood, 2016; Finkelstein et al., 2015; McKinn, Bonner, Jansen, & McCaffery, 2015). Participants were not encouraged to participate in this study by any incentives as the study posed no risks or inconveniences to participants, as the interviews were held at the work premises at a mutual time.

Researchers will want to guarantee the elimination of all ethical concerns during the research process. Nebeker et al. (2016) and Morse and Coulehan (2015) advised that ethical issues may arise concerning privacy and confidentiality with data management. To this end, Nebeker et al. (2016) noted that data collection occurred only with consenting participants and confidentiality maintained by restricting data viewing and access to the research team. In this study, I collected data from consenting persons and maintained the only access to the collected data.

The physical documents used to collect data from the participants in this study were secured in a locked cabinet, only accessible by me, soft copies were password protected. van Teeffelen et al. (2016) noted that the 5-year status quo of maintaining stored data be agreed by the participant as part of the informed consent, and the participants further agree an extended time. The consent form indicated that data will be kept for at least 5 years, as required by the university. Pending no requests by the university, I will destroy all data related to participants after 5 years by shredding. I will share the completed study with the participating organizations. The research performed by students of Walden University must attain approval from the Institutional Review Board (IRB). The IRB approval number from Walden University for this study is 06-28-19-0295914.

Morse and Coulehan (2015) emphasized the privacy of participants as a core tenant of research ethics and stressed the importance of disguising participants' identities. To ensure the privacy and confidentiality of participants, I did not include the names of

participants in the study and used codes for each person in each organization when analyzing the data. I secured the document referencing the names of participants to the codes, separate from the analyzed data to maintain confidentiality. At all times, the data under examination was codified to protect the names of participants and the organizations where they work.

Data Collection Instruments

The researcher is fundamental in directing the data collection process and is the primary data collection instrument (Cypress, 2017; Fusch & Ness, 2017; Marshall & Rossman, 2014). In this multiple case study, I was the primary data collection instrument and collected data using multiple sources. Chughtai and Myers (2017) contended that readers substantiate the credibility of the researcher in their role of data collection instrument by critiquing the sourcing and selecting different types of data and methods of collecting and analyzing data. Paine (2015) recommended the use of semistructured interviews to allow and stimulate dialogue between the researcher and participant for rich, contextual, in-depth data. I employed semistructured interviews to interact with participants using open-ended questions to emanate rich, in-depth data. I also obtained private company documents comprising of operation reports and strategic technology plans for the selected businesses, and used these documents to verify and triangulate the data collected from the interviews.

Use of the interview process allows qualitative researchers to collect detailed and rich data (Castillo-Montoya, 2016). More specifically, the flexible structure of the

semistructured interview allows dialogue reciprocity between the researcher and participant for posing follow-up questions to improve clarity to the participant's responses (Kallio, Pietilä, Johnson, & Kangasniemi, 2016). Additionally, the researcher manages the purpose of the discussion, while the perception of the participant guides the direction of the conversation (Cridland, Jones, Caputi, & Magee, 2015). I asked seven open-ended questions and other probing questions for in-depth responses during the semistructured interviews and used member checking to ensure the interpretation of interview responses was accurate. I also followed an interview protocol (see Appendix) during the interview process.

Researchers use methodological triangulation to correlate data collected from multiple sources (Denzin, 2012; Fusch, Fusch, & Ness, 2018). I obtained relevant data from multiple sources in my study that included data from semistructured interviews and private company operating reports, and technological plans from the operation managers. I validated the interview responses from the participants by using member checking. The member checking process facilitates the understanding of the researcher and aids the matching of the researcher's interpretation to the participant's meaning. Member checking mitigates bias and improves the reliability of the data (Harvey, 2015; Morse, 2015a). Researchers verifying the interpretation of responses through member checking clarify the perspective of the participant. As per the interview protocol, I used member checking to confirm the understanding of the concepts to enhance the reliability of the data collection process.

Data Collection Techniques

Researchers using qualitative methods employ multiple data collection techniques, including interviews, member checking, and review of pertinent documents to attain triangulation that enhances data saturation and mitigates bias (Birt, Scott, Cavers, Campbell, & Walter, 2016; Fusch et al., 2018). My approach to collecting the data in this multiple case study involved semistructured interviews and member checking, as indicated in the Interview Protocol. I also obtained private company reports related to operation reports and technological plans. Interviewing participants provide a primary way of collecting data to answer the research question in qualitative research (Castillo-Montoya, 2016; Fusch et al., 2018). Moreover, Birt et al. (2016) underscored the importance of semistructured interviews when carrying out member checking for participants to add comments, or disconfirm interpretations, or permit the researcher to probe further for rich, in-depth data in a spontaneous manner. In this regard, I scheduled initial and follow-up semistructured interviews with each of the four participants, as indicated in the Interview Protocol (see Appendix).

I consistently followed the Interview Protocol to ensure the coverage of all aspects of the study for each of the four interviews. The detail and sequence of activities listed in an interview protocol allow for heightened consistency and dependability of the collected data (Ali, Baker, O'Crowley, Herold, & Buckley, 2018; Castillo-Montoya, 2016). The initial interviews lasted 1 hour and occurred at a mutually agreed time in a natural and private setting. I went through the informed consent process, introduced the

study topic, and invited questions to clear any ambiguity before I obtained a signature on the consent form before proceeding with the interview.

During the interviews, I used an audio-recording device and made relevant notes to ensure the complete and detailed documentation of all responses. I also observed all nonverbal signals and paraphrased questions for the understanding of the participant and asked follow-up questions to prod in-depth answers. The follow-up interview occurred after I transcribed and synthesized the audio and written responses and occurred at the various worksite locations at an arranged time. At the follow-up interviews, I presented the summarized responses to the participant, requested the member checking, and further probed for rich, in-depth data. Other data collected for this study comprised of private company operation reports and strategic technology plans. Data extracted from these documents served to align and triangulate the responses supplied by the participants. I obtained the private company operating reports and technological plans from the respective operation managers.

The data collection techniques used in qualitative research offer advantageous options as well as pose some limitations. Rahman (2017) noted that the interview process involving open-ended questions and member checking with participants elicits rich, in-depth data providing deeper insights into the research topic. In this study, I used interviews for the initial and follow-up interviews with member checking. These interview techniques provided rich, in-depth, and reliable data; however, cognizance of some disadvantages assisted in managing the data gathering process.

Rahman (2017) noted that the disadvantages to data collection techniques in qualitative research may be a small sample size and the length of time taken to collect data. Sutton and Austin (2015) illustrated the lengthy data collection process by noting that transcribing data may take up to 8 hours for a 45-minute interview and produce about 20 pages of data. However, the extensive data obtained may provide insights into the complexity of the subject matter. Although Rahman (2017) considered a small sample size as a disadvantage, analyzing approximately 20 pages of in-depth data per case study is more efficient using a small sample size, as large samples may become unmanageable.

I used member checking in this study to ensure my data interpretation represented the view of the interviewee. Birt et al. (2016) described the member checking process as returning a summary of the responses to the participant to confirm the accuracy of the data. Simpson and Quigley (2016) supported Birt et al. (2016) and further explained that engagement with the participant should be flexible and dialogical to build knowledge construction and allow member checking to improve the reliability of the data collected. During the follow-up interview, I presented the participants with a summarized interpretation of the responses, 10 days after the interview. I requested they recommend changes for clarification or additional data. The dialogical engagement with participants encouraged their interpretation and contributed to the reliability of the data collected from the interviews.

Data Organization Technique

It is imperative that researchers maintain a structured and secure database for securing, categorizing, storing, and retrieving data and a backup database (Kulinski, Boutaugh, Smith, Ory, & Lorig, 2015; Li et al., 2015; Segarra et al., 2016). The storage of raw data collected included a dedicated folder with subfolders on my personal computer with the corresponding backup on an external drive, and hard copies filed in a locked cabinet. The soft copies on each device were password protected. The structure of the stored data included the main folder, subfolders for each business case, and a further subdivision of folders for each participant. Kulinski et al. (2015) offered advice on creating and managing databases, tracking reports, and the resulting efficiencies in storing and retrieving data. The tracking reports used in this study included (a) participant information research logs for recording the participant interview, (b) reflective journals for interview information, (c) attendance log for interviews, (d) interview coversheets, and (e) organization data log for all data stored. According to the university requirements, I will shred all printed documents and delete electronic files after 5 years.

Data Analysis

Researchers may ensure a rigorous investigation by collecting data in multiple ways for methodological triangulation (Joslin & Müller, 2016). Methodological triangulation increases the validity of inference by combining multiple perspectives of the same event to analyze the phenomenon (Braganza, Akesson, & Rothwell, 2017; Kern, 2018). Out of the four types of triangulation developed by Denzin (1970), qualitative

researchers tend to use methodological triangulation for case studies (Fusch et al., 2018). The other types of triangulation being data triangulation, investor triangulation, and theory triangulation (Denzin, 2012). I used methodological triangulation to secure an in-depth knowledge of the phenomenon and validated the findings of this study by analyzing the data collected from two types of data sources. I collected data through semistructured interviews, private company operating reports, and technological plans.

Data analysis of qualitative projects may be a complex process; however, Houghton, Murphy, Shaw, and Casey (2015) and Feldman and Lowe (2015) suggested adopting a framework to assist in organizing data, finding patterns, and extracting themes from the data. Yin (2011) offered a five-step framework for case study data analysis: (a) compiling the data, (b) disassembling the data, (c) reassembling the data, (d) interpreting the data, and (e) concluding. Yin (2011) also emphasized the importance of two or more data sources of evidence for data accuracy and rigor of the case study. I used Yin's (2011) five-step framework to analyze data collected from interviews, member checking, and private company plans and reports. Applying Yin's (2011) framework allowed for the emergence of themes to correlate to the literature review and conceptual framework.

Qualitative researchers may employ software solutions to assist in the data analysis process. Researchers tend to immerse themselves in the understanding and creative interpretation of the qualitative data to ensure rigor in the data analysis (Maher, Hadfield, Hutchings, & de Eyto, 2018). To assist researchers in the data analysis process, Maher et al. (2018) and Phillips and Lu (2018) suggested combining traditional analytical

methods with software solutions such as NVivo. Robertson et al. (2019) and Saura, Palos-Sanchez, and Grilo (2019) provided examples of using NVivo software to analyze interview data through sorting and filtering raw data by codes to determine emerging themes. I used NVivo 12 Pro by QSR International software to identify common incidences, created codes, and developed outlines of themes and concepts.

The data analysis process entailed the repetitive application of extracting key themes from the collected data, continuous comparison, and contrasting of the data and correlating themes to the literature review and conceptual framework. Yin (2011) emphasized the iterative and recursive relationship of all phases of data analysis rendering the process nonlinear and possibly time-consuming. Flexibility in identifying themes from the data and correlating to the literature review and conceptual framework granted latitude for a comprehensive analysis of the data. Awareness of studies published during the ongoing research also provided new perspectives for application to the analytical process. The capability to manage the fluidity of the data analysis process, the use of NVivo software to supplement traditional methods, and attentiveness to new research enabled the effective analysis of the data.

Reliability and Validity

Reliability

Fusch et al. (2018) and Leung (2015) noted that methodological triangulation or correlating data from multiple data sources enhances the reliability of the data collection process. Leung (2015) further asserted that the reliability of the data collection process

ensures the reliability of the findings in qualitative research. I assured the reliability of the findings by using methodological triangulation to collect data from semistructured interviews, member checking, and private company reports, and plans.

In qualitative research, reliability is the dependability of research design, analysis and conclusions determined by the researchers' unbiased approach to research and consistency across different projects (Dikko, 2016; Morse & McEvoy, 2014; Olson McAllister, Grinnell, Gehrke Walters, & Appunn, 2016). Although exact replication of case studies results may be elusive, the trustworthiness and dependability of the study originate with the employment of reliable and valid research strategies (Elo et al., 2014; Morse & McEvoy, 2014). Some strategies to improve the dependability of qualitative studies include acknowledging and removal of researchers' bias (Olson et al., 2016), member checking of data interpretation (Birt et al., 2016; Thomas, 2017), and application of interview protocol guidelines (Dikko, 2016). In this multiple case study, I employed member checking of data interpretation to verify the unbiased and accurate interpretation of the participants' responses. I also consistently followed the guidelines in the interview protocol to elicit data that was accurate and pertinent to the phenomenon to ensure the reliability of qualitative research.

Dependability also results from detailing of data analysis techniques and data collection processes and methods for an audit trail to support subsequent research (Morse & McEnvoy, 2014). An audit trail may be created by the transcription of interview logs into datasets to facilitate the efficient and accurate extraction of thematic codes (Eaton,

Stritzke, & Ohan, 2019). The use of qualitative data analysis software enhances the accuracy of the coding process and improves the reliability of the results (Zamawe, 2015). I enhanced the reliability of the study by describing the data gathering and analysis process to support subsequent research. The transcription of the interviews into datasets and the use of analysis software promoted the efficiency and accuracy of identifying codes for reliable data analysis.

Validity

Methodological triangulation is the use of multiple methods or data sources to enhance the validity of the data collection process and to improve rigor and robustness of the results of the study (Fusch et al., 2018; Leung, 2015). Validity relates to the accuracy and truthfulness of concepts based on the ability of the researcher to produce credible, trustworthy, transferable, and confirmable qualitative research (Cypress, 2017; Dikko, 2016; Olson et al., 2016). In this study, I confirmed the accuracy and trustworthiness of the data collected in the interviews by confirming the interpretation of responses through member checking. Then, I cross-checked the responses to the private company operating reports, and technological plans to enhance the validity of this study. Ascertaining the validity of the data collection process and concepts ensured the credibility, confirmability, and transferability of this qualitative study.

Credibility. Morse and McEnvoy (2014) and Bergh, Sharp, Aguinis, and Li (2017) noted that methodological triangulation promoted the credibility of the study. Olson et al. (2016) noted that validity or creditability in qualitative research as dependent

on the ability of the researcher and on findings that could be defended or confirmed. Data credibility adds value to the findings of a qualitative resource study. Member checking allows for the validation of data by the participants facilitating the credibility of results (Birt et al., 2016; Petrova, Dewing, & Camilleri, 2016). I ensured the credibility of the study by using member checking by the participants for confirmation of the authenticity of data and validation that the synthesized notes reflected their interpretation.

Transferability. Connelly (2016) noted that transferability relates to the ability of others to understand the findings of a study and apply it to their situation. Marshall and Rossman (2014) highlighted transferability to other contexts as one of the defining measures for reliability and validity from a qualitative perspective. Although Marshall and Rossman (2014) noted the difficulty in the generalizability of qualitative study findings, they reinforced its transferability through the use of multiple sources of data collection. El Hussein, Jakubec, and Osuji (2015) noted that the researcher may include rich and descriptive detail when recounting the data collection and analysis of the collected data so readers may determine the transferability of the research. I presented the research findings of the data collected and analyzed from participants, member checking, and private company operating reports, and technological plans in a vivid manner to promote transferability to future readers and qualitative researchers.

Confirmability. Marshall and Rossman (2014) listed confirmability as a criterion for establishing reliability and validity in qualitative research. El Hussein et al. (2015) referred to confirmability as auditability and described the concept as the systematic

recording of the sources of data, sampling, and analytical process that led to the conclusion. The resultant audit trail of methodological decisions allows for repetition of inquiry in a similar setting for confirmability of results (Connelly, 2016; El Hussein et al., 2015). The systematic datasets compiled through audit trails may facilitate the efficient coding of data and reduce the potential inconsistencies in code assignments up to 34% when using raw data (Eaton et al., 2019). I enhanced the confirmability of the study by recording the audit trail of processes and decisions from probing during the initial interviews, follow-up member checking, and cross-checking to the private company reports and plans that led to the research conclusions.

Data saturation. Data saturation impacts the content validity of the research and occurs when no further themes emerge, no new data retrieved, and there is adequate data to replicate the study (Fusch & Ness, 2015; Morse, 2015b). I used the data collected through semistructured interviews, member checking, and private company operating reports, and technological plans to establish emerging themes. Data saturation was achieved when the analysis of multiple data sources produced no more substantial themes.

Transition and Summary

Section 2 of the study included information on the role of the researcher, participants, population and sampling, and ethical research guidelines I followed in this study. I stated that I used a qualitative multiple case study design, and as the primary data collection instrument, I collected data through semistructured interviews using an

interview protocol, member checking, and operation reports, and strategic technology plans. I also explained how methodological triangulation using multiple data sources will enhance the reliability and validity of the study. Section 2 also included data organization technique and data analysis. Section 3 contains the presentation of the findings, the study's application to professional practice, implications for social change, recommendations for action and further research, reflections, and a conclusion.

Section 3: Application to Professional Practice and Implications for Change

In Section 3, I present the findings from my research, compare the findings to other research, and link the findings to the literature review and conceptual framework in this section. Section 3 comprises the presentation of the findings, applications to professional practice, implications for social change, recommendations for action and for further research. I also summarize my reflections and end with the conclusion.

Introduction

The purpose of this qualitative multiple case study was to explore strategies that some operation managers of SMEs used to integrate TI into their business operations. Data were collected through interviews and operating reports and technological plans from four operation managers of four manufacturing companies located in the Caribbean islands of Trinidad and Barbados. The findings revealed strategies that the operation managers, used to integrate TI into business operations to increase business growth and profitability.

Presentation of the Findings

The overarching research question for the study was: What strategies do operation managers use to integrate technological innovation into business operations? The four emergent themes identified were (a) customization of technological innovation, (b) empowerment of adopter-based end-user, (c) government intervention, and (d) supplier-buyer networks. All four participants possessed knowledge in the successful integration of TI into their business operations and manage the continuous improvement of their

technological operations. The private company operating reports and approved technological plans contained details on processes and plans for integrating TI into business operations. I discuss each theme and the related subthemes in the following sections.

Theme 1: Customization of Technological Innovation

Theme 1 in the findings of the study is customization of TI executed by the operation managers. In an attempt to improve the quality of business products and processes, the four participants (P)s considered adopting available technology and customizing to the specific business requirements instead of developing innovative in-house solutions from inception. Moraes Silva, Lucas, and Vonortas (2020) stressed that the costs and intricacies of internal research and development deter managers at SMEs from internal development of original technological concepts. Moreover, the linkages to learning institutes and other technology-based businesses promote openness and collaboration on innovation and diffusion of sophisticated technology (Moraes Silva et al., 2020). The deterrence from developing TI in-house as identified by Moraes Silva et al. (2020), and associations with learning institutes and technological establishments, align with the findings of this study.

Three subthemes of technological innovation strategy, continuous improvement, and R&D rationalized the main theme, customization of TI. Table 3 reflects Theme 1 and the associated subthemes that emerged from the participants' responses and review of the private company documents. The operation managers follow the technological plans in

implementing the TI projects and review the production processes as detailed in the operating reports.

Table 3

Frequency Theme 1 and Theme 1 Subthemes

Resources	Number of resources	Customization of TI (theme)	TI strategy (subtheme)	Continuous improvement (subtheme)	R&D (subtheme)
Participants	4	30	9	10	6
Documents	7	9	5	7	4
Total frequency		39	14	17	10

Note. TI = Technological Innovation; R&D = Research and Development. The documents included operating reports and technological plans.

The findings of this study indicated that the technological plans reflect the core strategy of the respective manufacturing company and point to the customization of acquired innovative technology. P1 noted that "customizing [generic equipment] ensures a high-quality end product." P1 reviews the recorded entries in the operating reports to determine the improvements to the process run required to ensure a high-quality end-product. Consultations with a tertiary learning institute provide technical support to P1 for process improvements. The findings of this study related to customization of equipment and collaboration with learning institutes promote the integration of TI into business processes.

Likewise, P2, P3, and P4 conformed to the guidelines of their respective technological plans as well as reviewed the operating reports completed by the

production staff to ensure a resulting end-product that satisfied company standards. The participants P2, P3, and P4 engaged in developing new products; however, they utilized knowledge and expertise external to the company. Prabowo, Singgih, Karningsih, and Widodo (2020) noted that SMEs form liaisons with technical service providers for specialized advanced technology and market knowledge when developing new products. P2 noted that "New products may take two years to be developed," based on the availability of externally sourced technology, internal knowledge, and budget allotment. The participants stated that the customization of acquired TI equipment, either through outsourced or internal R&D, allowed the integration of new technology for higher-quality products, more efficient operations, and increased profit margins. The findings indicate that operation managers implement a business strategy of customizing procured TI based on specific production standards to build efficient, competitive, and responsible operations.

Technological innovation strategy. Defining a technological plan centered on OI advances innovative business capabilities required to improve business products and processes. The approved technological plans of the respective participants included budgetary details for the acquisition and implementation of existing technology into business operations. Santoro, Quaglia, Pellicelli, and De Bernardi (2020) noted that executive heads of SMEs benefit from openness to external technology due to the lack of tangible and intangible internal resources. A technological plan is an initial step in acquiring externally sourced TI. P1 stated, "optimize [the] potential for quality products,"

as one of the company's core strategy, and P3 indicated that plans exist for "additional conversion plants." Procuring OI supports TI strategic technological plans within SMEs. It is an action encouraged by Rosa, Chimendes, and Amorim (2020) through partnering with technology companies and learning institutions that offer inexpensive alternatives that replace the development of new technologies. Rosa et al. (2020) further note that OI generates the flow of technical learning from innovative ideas to innovative products and processes and the dissemination to consumers, and so accomplishes the diffusion of TI. Both P1 and P3 sourced sophisticated TI equipment, and their respective operating reports revealed enhanced work time and effort, improved cost-benefits, and reduced carbon footprint, thus optimizing business resources. Limited staff numbers, technological learning, finances, and time make it impractical for participants P1 and P3 to engineer the equipment from inception. Moraes Silva et al. (2020) noted that the resource constraints that characterize SMEs support OI within businesses. The access to TI in the global markets affords managers OI options for the improved technical capacity to spearhead the integration of TI in SMEs.

P2 noted that the company "strategically source machinery" and targets production levels at 20% higher than the industry's benchmarks. P2 advances a 2-prong strategy of purchasing machinery that is cost-effective and positively impacts the profit margin, as well as production efficiency up to 20% more than the expected levels. The notation from the operating reports guided P2 in achieving the surplus 20% target. Although this stretch target ensures achievement of the industry's benchmark, it is also

instrumental in spurring efficiencies higher than established targets. P2 also selects particular elements within the production process for technical upgrades after review of the operating reports to improve production efficiency. The study findings of combined cost-effectiveness and production efficiency drive new and timely technological solutions and corroborate Magistretti, Dell'Era, and Verganti's (2020) views on proactively managing process, organization, and knowledge within a short time frame. Applying TI upgrades to components of the production process improves overall productivity and increases the integration of innovation in SMEs.

P4's primary strategic goal of the technological plan is to "move up the value chain" by gradually developing new or expanding existing production activities. Paus (2020) noted that the middle-income economies of the Caribbean should develop domestic TI competences to transition up the value chain, incrementally increase production performance, and achieve sustained productivity growth. However, P4 asserts that "the challenge is determining the approach that works," in moving up the value chain and requires cost-benefit and research. P4 notes that the integration of TI may include "acquiring equipment or outsourcing elements of production."

The participants accepted that automation through available technology would enhance the efficiency of production. The diffusion of the introduced TI, however, may require a flexible structure for adopting changes and the acceptance of the implementers of TI (Michelino et al., 2015). Empirical calculations of FIO ratios establish the company's openness to innovation and may verify the business capabilities to integrate

TI. However, the level of record-keeping within SMEs' did not allow for minute detailing to provide the data needed to compute the FIO ratios. The data from the operating reports and technological plans catered to improving production efficiencies and product quality, not costings and revenues on inbound and outbound processes. The technologies adopted by the participants supported the goals of individualized companies' technological plans of innovation, improved quality and quantity of products, and enhanced production efficiencies. Although analogous parameters shaped each participant's technological plan, each participant applied unique open technological innovations to ensure successful outcomes to the particular business operation.

Continuous improvement. Continuous improvement of processes and products allow improved production efficiency and enhanced product quality and is achievable through the synchronized actions of the operation manager and workers. Garone, Villalba, Maffioli, and Ruzzier (2020) noted that Caribbean companies that continuously improve operation procedures achieve greater productivity. Linking the company targets to recorded output creates a chance to monitor production and take corrective actions to minimize gaps and ensure continuous improvements (Garone et al., 2020). The findings of the study revealed a vigorous regime of monitoring processes through the operating reports, documenting, and comparing to the targets included in the technological plans. Additionally, analysis of the data exhibited the readiness of the managers to implement new procedures by guiding the workers to incorporate changes to the production line. The

action of the operation department innovates preexisting technology through customization.

All participants shared the significance of monitoring the production process cycle and documenting its activity in operating reports. P1 indicated that "the strategy of observation and data logging" of each production run in the operating reports identified complex or simple process changes required for a satisfactory output. Similarly, P2 evaluates each process run and the resulting end-product to "identify needed improvements to remove redundancies and increase cost-savings." P3 notes the importance of reviewing the operating report after each production run to ensure an efficient process and quality output or to identify required changes. P3 reviews the automated "production status report produced at 10:00 PM every night for the mill and converted output." The operating reports reviewed by P3 include details of machine calibration, production type, brand, and product count, and any record outside a specified range highlights issues for correction. P3 noted, "management and staff follow a culture of continuous improvement at all times." Muscio and Ciffolilli (2020) assert that monitoring the technological activities across European manufacturing firms resulted in enhanced technological integration for improved productivity, production quality, and work conditions and correlates to the findings of the study. Likewise, Garone et al. (2020) supported the business practice of monitoring manufacturing processes in LAC countries through recording and evaluating data to improve operations continuously.

Identified measures for enhanced production efficiency contributes to the continuous improvement of business operations.

Routinely evaluating the operating reports and comparing production output and process improvements to the technological plan improve business operations. P4 noted that the company experimented with imported equipment to improve the efficiency of the operations. Work continues on the development of more efficient methods, as P4 stated, "More modification is needed to resolve the spinning element." Ringberg, Reihlen, and Rydén (2019) expounded the benefits of combining managerial decision-making and technological developments to transform businesses by diffusing innovation incrementally, radically, or revolutionary. Reimagining existing TI, through collaboration with implementers on the production line, learning institutions, or suppliers of technology, repurposes the TI for the specific and relevant application. The notations in P4's operating reports indicate a continuous evaluation of the equipment employed to improve the process. Ringberg et al. (2019) noted the delicate balance of replacing manual processes with automation and synergizing on existing norms and internal work relationships.

Continuous improvement of processes also contributes to high-end quality products. P1 manages the processing of a local agricultural crop, and by observing, documenting, and fine-tuning the processing routine created a product that won silver and bronze medals at international trade shows. Likewise, P2 manages the operations of a health food processing plant and has secured a local customer base through the regular

delivery of high-quality products and the intermittent introduction of new products. P3 directs the manufacturing operations of household consumer products and supplies the Caribbean consumer-base and some South American countries contributing to the nation's foreign exchange. P4 processes and refines an indigenous tropical crop into a high-quality product for an exclusive market. Continuous improvements at each establishment contributed to profitable margins.

Research and development. Operation managers of SMEs within the Caribbean tend to implement externally sourced TI and do not require dedicated internal resources of a research and development department. However, tailoring the acquired TI to the unique specification of the production process involves some measure of an investigation conducted internally, or externally through outsourced services. While Moraes Silva et al. (2020) promoted liaisons between companies and learning institutes for robust technological investments, Schiller, Klerkx, Poortvliet, and Godek, (2020) noted a balanced agroecological approach instead of industrial-intensive input for agricultural companies. As indicated in the technological plan, P4 pursued discussions with national agencies and tertiary level learning institutions to partake in a government-funded project. P4 noted that "part of the funding can be used to acquire equipment which will allow value add to local processing. The external funding will permit the company to diversify the revenue streams and move up the value chain." Moving up the value chain is a core strategy of the company and supported by the technological plan. P4's approach ensures a sustainable and agroecological approach, as described by Schiller et al. (2020).

Managers may collaborate with learning institutes or specialist technical centers to improve knowledge or outsource particular elements of the production process to benefit from economies of scale.

Managers may also partner with standard bureau organizations to establish quality control standards. Fujino and Siringoringo (2020) noted that national agencies specifically formed to engage in research and development activities directly solve societal problems, promote corporate innovation, and contribute to technological policy. Exploiting the knowledge and experience of nationally formed expert groups economizes on time and research costs. The findings indicate that the engagement of independent agencies like the Caribbean Industrial Research Institute (CARIRI) and U.S. Food and Drug Administration (FDA) to test the nutritional level and quality of newly introduced products. By following the guidelines of the technological plan, P2 worked in partnerships with suppliers of production equipment to upgrade the level of automation on existing equipment as well as "engaged independent bodies like CARIRI and FDA to check [*sic*] on new products."

Managers in SMEs tend to employ varying degrees of research and development in their operating procedures. P1 assisted with the development of and complied with a technological plan that promoted safe ecological practices and emphasized "employee training and development." P1 investigated sustainable and cost-effective technical solutions that would leave a "minimal carbon footprint like the introduction of solar and battery system," with the aim to "employ solutions that make economic sense." Some

skills cultivated internally better support the specific business need to improve production efficiency (Doran, Ryan, Bourke, & Crowley, 2020). Per the technological plan, P1 also actively encouraged the application of on-the-job learning and training programs. Garavan et al. (2020) advocate that training positively impacts business performance. P1 confirmed that the application of skills gained from the training programs and job experience transformed acquired technology into customized TI.

Correlation to the conceptual framework. The tenets of the DOI theory aligns with the findings of this study. Tarde's (1890) concept of diffusion and Ryan and Gross' (1943) diffusion of innovation through a model framework contributed to Rogers' (1962) DOI theory. Vargo, Akaka, and Wieland (2020) explained that innovation diffuses through the adoption of thoughts and existing technology, and its dissemination in consumer markets. The activities of all workers in an organization diffuse innovation internally in the workspace and externally across multiple societal perspectives (Vargo et al., 2020). Räisänen and Tuovinen (2020) offer the solution of digitalization through OI to promote the diffusion of TI in SMEs in developing regions. Räisänen and Tuovinen's (2020) proposal mitigates Mohan's (2020) observation of the disadvantageous circumstances of the Caribbean companies operating behind the technological frontier. In this regard, the components of DOI described by Rogers (2004) as an innovation-decision process, individual innovativeness, rate of adoption, and perceived attributes perpetuate the integration of TI. I used the DOI theory to describe how operation managers of SMEs may employ strategies to integrate TI successfully.

Theme 2: Empowerment of Adopter-Based End-User

Theme 2 in the findings of this study is the recognition of the empowerment of the adopter-based end-user. Choi, Cundiff, Kim, and Akhatib (2018) value job satisfaction as an empowering tool to positively influence innovative behavior within the company. Additionally, Rhule and Allotey (2020) consider adopter-based end-user as an essential contributor to innovative decision-making within the business community. The input garnered from the implementers of TI add value to the production process and may improve the acceptance of technological change and foster diffusion of TI. Table 4 outlines Theme 2 and the associated subthemes, resources, and frequencies.

All four participants stressed the engagement of employees in the decision-making process related to integrating TI into the business process. The technological plans of P1 and P2 included strategies to develop staff through sponsored academic courses, training workshops, and additional job responsibilities to improve the workers' input to the decision-making process. Likewise, P3 and P4 employed policies to improve the innovativeness of the individual through training programs and imbued an environment of continuous improvement. P3 noted that "the certification and detailed orientation in certain skills ensure staff is immersed in the culture of continuous training and are adequately prepared to operate machinery and monitor risks." Brönner, Salah, and Lienkamp (2020) noted that learning opportunities empower workers. The findings of this study indicate that participants promoted the empowerment of workers by the creation of a learning environment. The empowerment of the adopter-based end-user may

also arise through the subthemes of acceptance or buy-in of technological changes and encouraging feedback.

Table 4

Frequency Theme 2 and Theme 2 Subthemes

Resources	Number of resources	Empowerment of adopter-based end-user (theme)	Buy-in by adopter-based end-user (subtheme)	End-users advocate changes (subtheme)
Participants	4	16	10	4
Documents	7	7	6	5
Total frequency		23	16	9

Note. The documents included operating reports and technological plans.

Buy-in by adopter-based end-user. Accepting and understanding newly introduced TI by the adopter-based end-user facilitates the adoption of innovative technology and the associated changes to production processes. Wilson, Maharaj, and Maharaj (2020) noted that the active engagement of all persons in the innovative system would enhance the SME's competitiveness and also transform the economies of developing states. The data presented by the participants indicated that informal and formal communication channels, scheduled meetings, and fostering a culture of innovation and rewards promote the trust and buy-in of the adopter-based end-user. The degree of workers involved in the technology decision-making process reciprocates a proportional involvement in TI integration.

The participants in this study fostered the buy-in of end-users by involving them in most aspects of the decision-making process concerning the integration of TI into the business process. The operation managers encouraged informal and formal lines of communication by practicing an open-door policy for impromptu discussions and held scheduled meetings. P1, P2, and P3 conducted formal meetings with the workers to discuss the notations in the operating reports and consideration of changes in the production process. Brönner et al. (2020) noted that nurturing a culture of learning and innovation assures that production line staff influences the outcome. P1 notes, “Any introduction/change to operations involves a democratic decision process by workers.” P1 reports that being part of the decision-making process prompts staff to accept changes to the operations willingly. P1 notes, “For the most part, there was always staff buy-in as staff members are an important part of the operating process as machines and companies cannot operate themselves.” P2 also collaborates with staff members on innovative ideas, but also tries to instill pride and ownership of the work process through interaction with the consumer-base. P2 noted that “production staff members accompany marketing staff to interact with satisfied customers in the hope of instilling work pride.” P3 has instituted a reward system of monthly bonuses based on employee information on production efficiency, production quality, and safety practices evidenced by the recorded entries in the operating reports. The actions of the participants underscore the significance of staff buy-in of the corporate culture of innovative action and continuous improvement.

End-user advocate changes. An environment that inspires creativity and comprises of workers that are appropriately skilled or qualified will elicit proposals from end-users on TI. Choi et al. (2018) referred to the creativity and creative self-efficacy that results from an environment that supports risks and failures and innovative behavior. Promulgating the acceptance of risks and failures within certain guidelines creates a business environment of workers that initiate corrective and progressive actions.

P1 mentioned that "most of the time, innovative changes would originate with staff. Staff is motivated to suggest changes as they are the processors of the raw material." P2 carefully considers all proposals for implementation, imbuing an environment of work-appreciation and ease in the suggestion of ideas. Similarly, P2 advocates the adage throughout the workplace that "there are no bad ideas," and, therefore, cultivates an environment that encourages end-users to contribute to ideas on the integration of TI. P4 included staff on the testing of new technological equipment and garnered their feedback on its workability before full-scale implementation. The operating reports contain logs detailing the testing of ideas pertaining to TI and the ensuing results. Choi et al. (2018) and Wilson et al. (2020) posit the view that the innovative potential of workers influences the competitiveness of the company. Wilson et al. (2020) further stated that the innovation capabilities of SMEs in Trinidad and the wider Caribbean is dependent on the interactive relationships among all staff.

Correlation to the conceptual framework. The principles of the ABI theory align with the findings of this study. Surry and Farquhar (1997) developed the ABI

theory from Rogers' (1962) DOI theory. Mohan (2020) asserts that human capital plays a primary role in efficiently employing technology to achieve firm competitiveness and improve profit margins and corroborates with Surry and Farquhar (1997), who underscored the end-user as the primary force for change. The meaningful engagement of the adopter-based end-user is pivotal in diffusing TI through the organization. I used the ABI theory to explain how operation managers can integrate TI into business processes by empowering the adopter-based end-user. The social interaction of the operation managers and the production line staff produce synergistic relationships to solve production issues and advance the technology of operations.

Theme 3: Government Intervention

National financial regulations and trade policies provide the economic and legal infrastructure within which the SMEs operate. Although the governing legislature of each Caribbean island differs, it influences the operations of the four participants either positively through concessions or negatively through financial or legal restrictions and affects the integration of TI. SMEs within the Caribbean trail behind developed regions in technical savviness and are globally competitively challenged (Mohan, 2020); however, Asheim (2019) notes that a framework that supports innovative implementation policies may provide solutions. Asheim (2019) indicated that national innovation policies might generate positive structural changes, such as economic diversification and competitiveness. The introduction of TI within Caribbean manufacturing firms benefits from policies formulated to protect the cost-effective purchase of operational equipment.

However, achieving improved integrated and comprehensive national policies would improve technological Caribbean SMEs and may occur if national agencies partner with SMEs. Table 5 outlines the resources and frequencies that support this theme and associated subthemes.

Table 5

Frequency Theme 3 and Theme 3 Subthemes

Resources	Number of resources	Government intervention (theme)	Government legislature (subtheme)	Partnering with SMEs (subtheme)
Participants	4	11	4	6
Documents	7	5	6	6
Total frequency		16	10	12

Note. The documents included operating reports and technological plans.

Government policies influenced the business decisions of the four participants. P1 noted that the government's revitalization of certain industries allowed for "preferential loans and addressed the barriers of under-capitalizations to address upgrades and additional machinery to produce economies of scale." As such, P1's technological plan included capital investments for equipment upgrades. Conversely, P2 and P4 note that increased assistance in branding, marketing, and attendance to trade shows may improve the competitiveness of the respective firms. The technological plans of P2 and P4 included plant upgrades where negotiations with suppliers or bank managers provided financial support. Likewise, P3's technological plans included business expansion contingent on government passing new trading agreements with South American

governments. Innovative government policies may address the specific concerns of business managers and alleviate the issues experienced when integrating TI.

Government legislature. The participants advised that Caribbean governments offer exemptions of duty on imported equipment, providing manufacturers employ local raw materials as well as on the re-importation of externally refined local crops. These policies support measures to introduce TI by Trinidadian and Barbadian managers of SMEs and contribute to increased competitiveness. However, taxes levied against equipment when local raw materials are not employed, curtail the procuring of TI and cause operation managers to seek alternate avenues of cost savings within their scope of operations. Wilson et al. (2020) note that any national policy on innovative operations must be contextual to the peculiarities with each developing state. The findings of this study revealed the impact of national policy on integrating TI in businesses.

The participants P1, P2, and P4 manage processing operations that convert locally grown agricultural products into consumer items and benefit from local concessions. P4 noted that “there is no duty on the re-importation of overseas processed locally grown material or on equipment purchased and imported for local processing.” P4’s technological plans, therefore, included the outsourcing of elements of the production process to European businesses equipped with specialized technological know-how. The technological plans of P1 and P2 included budgets for overseas sourced equipment that could deliver on high production standards. Participant P3 manages the operations of a manufacturing company using imported raw materials and is liable for taxes on the

imported equipment used in production. P3 noted that the taxes paid "erodes the profits gained from exports." The products manufactured by P3 support interregional markets and provide foreign exchange to the local economy; however, when developing P3's technological plan, the expectation of future taxes on overseas procured TI defines the spend allocation. Asheim (2019) noted that a regional innovative systems approach that focuses on learning, competitiveness, and economic growth provides smart specialization strategies. Asheim's (2019) view coincides with Dookeran's (2013) vision that called for regional convergence of policies on science and technology. Regional harmonized trade policies that address the collective key individualized concerns of business executives of Caribbean SMEs offer a potential solution that directly supports the integration of TI at a micro and macro level.

Partnering with SMEs. Alliances between national agencies and SMEs may constitute a framework that supports technological upgrades to business operations and realize social and economic national gains. Crespi, Garone, Maffioli, and Stein (2020) highlight the benefits of government grant schemes in R&D in terms of improved technological knowledge, DOI, and improved productivity in SMEs in Chile. The four participating managers acknowledged the supporting role of established national agencies, but offered additional recommendations for government agencies to foster working relationships or implement policies beneficial to SMEs at a national level. P1 noted that increased accessibility to preferential loans might improve investments in technical upgrades and associated research. Crespi et al. (2020) noted that government-

funded strategies promoting R&D partnerships with learning institutes reduce the knowledge gap, improve production efficiency, and diffuses technological knowledge.

P2 mentioned that "operations of the company are affected by government [*sic*] fiscal policies such as [an approval process for] accessing foreign currency and the low focus on the agricultural sector." P2 manages a processing plant in Trinidad utilizing agricultural sources and requires foreign exchange for purchasing technically advanced equipment sourced overseas. The governing authorities of Trinidad instituted a National Innovation System (NIS) program aimed at developing innovation within SMEs and diversification from hydrocarbons (Wilson et al., 2020). The NIS program hoped to address issues of access to funding and technical learning in the low-technology sector; however, Wilson et al. (2020) point to shortcomings in the formalization of the NIS program. Redirecting attention to the NIS program may alleviate concerns of P2 and other managers in a similar plight.

P4 manages the operations at a Barbadian company and notes that "the government may also facilitate processes to encourage links with agencies and investors for access to grants but not necessarily negotiate the terms." P3 suggested, "the netting off vat payable to the government" against all refunds due from national agencies. Asheim (2019) noted that regional governments might improve TI by following Smart Specialization Strategies (S3) like that instituted by the European Union. S3 targets the inclusion of technologically advanced activities, economic diversification, greater knowledge complexity, and a sustainable economy where each member country identifies

its competitive advantage and then specializes in its capabilities in their unique way (Asheim, 2019). A government program following the components of S3 may facilitate seamless transactions between local SMEs, international supply management chains, and consumer markets for advancing the integration of TI.

Correlation to the conceptual framework. The integration of technology is central to the DOI theory. Wilson et al. (2020) noted the importance of introducing TI to increase the competitiveness of Caribbean SMEs in the domestic and international markets. Mohan (2020) and Wilson et al. (2020) observed the low technical capacity of SMEs in the Caribbean and highlighted the importance of government assistance in developing technical business programs. Promoting innovative technology by a national authority heightens the integration of TI by business managers and also contributes to economic betterment. The DOI theory helps to explain how the government's diffusion of innovative technological programs that cater to SMEs may assist operation managers in successfully integrating TI into the business environment.

Theme 4: Supplier-Buyer Networks

Cultivating supplier-buyer relationships provides an important safeguard for the continuous operability of production processes. The four participants cultivate business relationships with suppliers of technological equipment and establish contractual liaisons for after-purchase support. Any equipment upgrades, urgent repairs, and routine maintenance require a well-orchestrated arrangement for immediate accessibility for servicing as all the participants sourced their equipment from overseas suppliers. Potter

and Paulraj (2020) note the increased reliance on strategic supplier-buyer relationships for designing, developing, and maintaining technological products. The participants outlined the strategic importance of supplier-buyer alliances in acquiring TI and after-purchase support for the continuous integration of TI. Table 6 outlines the resources and frequencies that support this theme.

Table 6

Frequency Theme 4

Resources	Number of resources	Supplier-buyer networks
Participants	4	6
Documents	7	4
Total frequency		13

Note. The documents included operating reports and technological plans.

Business executives may depend on the expertise of suppliers of innovative technology to advise on the most appropriate TI models. Partanen, Kohtamäki, Patel, and Parida (2020) noted that managers within resource-constraint SMEs exploit supplier-chain competences outside the business operations to experience economies of scale. Operation managers may not possess the technical know-how or resources to advance the technical level of the organization, and must rely on the specialized dexterities of external alliances to supply explorative R&D and strategic knowledge flow to improve performance. The associative relationship between supplier and participant depended on the innovative needs and know-how existing within the SMEs.

P2 consults with the executive team and “draw on their experience to advise on asset purchases.” P2 explained that the executives’ experience involved a close familiarity with the international suppliers of the production equipment and detailed knowledge of the equipment technical specifications. The executive team would leverage its technical expertise when negotiating with the suppliers. As such, P2’s technological plan is developed based on input from the executive team. Potter and Paulraj (2020) specified that the inter-relationship between the firm’s leadership and the supply chain forms an innovation partnership where business leaders gain superior technical assets to boost performance benefits. Developing a pipeline of innovative technology programs secures the integration of TI into business practices.

P3 invested in a sophisticated TI system and described it as, “a real-time integrated system that interfaces with operations, production, purchasing, procurement, finance and accounting, sales, and inventory management, including shared-data on spares held in all plants.” Such highly specialized technology limits the choice of suppliers of equipment and servicing arrangements but intensifies the TI knowledge relationship between the existing supplier and P3, and warrants the service retention provision in the technological plan. Magistretti et al. (2020) noted that managing technology knowledge is a main determinator of technology development and contributes to the complexity of TIs. The technical support provided by the specialized service team to P3 promoted the adoption of a highly integrated business process system for the integration of TI.

Operation managers determine the preferred option of integrating TI into the business processes based on cost-efficiency and production-efficiency parameters. These options may include outsourcing certain elements of the production cycle, in-house research, or acquiring TI to supplement the work process. P4 outsourced the production cycle of one commodity to an overseas company due to the absence of localized specialized expertise, and the external production process deemed more cost-efficient than developing in-house. P4 advised that "processes [*sic*] took place in Italy due to the absence of a local entity with skill and equipment in this regard." Doran et al. (2020) believed that outsourcing is a viable option when external skills are superior to in-house abilities and contribute to the company's competitive advantage. Although P4 did not improve the firm's TI capacity through the outsourced alliance, the local community gained access to superior quality goods, while the Italian producers shared economies of scale that may generate novel TI at the auxiliary producer. The findings of the study indicate that the supplier-buyer network also diffuses innovative technology at the supply side.

Correlation to the conceptual framework. Within the Caribbean, creating supplier-buyer networks to procure innovative technological equipment or outsourced contracts aligns with the DOI theory. Brönner et al. (2020) mentioned that a sustainable supply chain to support technology or knowledge transfer is paramount to diffusing TI from the suppliers to the business. Managers in developing regions gain from supplier-buyer alliances where the external skills, learning, and contacts weigh more efficiently

and effectively than the internal production. The supplier-buyer networks promote DOI by integrating appropriate TI into the business process and to the consumer-base.

Applications to Professional Practice

Exploring the strategies that operation managers of SMEs use to integrate TI into their business operations provided existing strategies that managers may employ to address the unsuccessful integration of TI. Managers of SMEs continue to encounter challenges when implementing innovative technology into their business procedures, mainly due to a lack of knowledge (Nair & Chellasamy, 2020). Understanding the challenges in integrating TI may better prepare operation managers of SMEs in developing strategies to improve the integration of TI. The findings and recommendations of this study aid in providing solutions that operation managers can employ when integrating TI into their business procedures to increase business growth and profitability.

The participants in the study offered suggestions of strategies they found cost-effective when integrating TI in business operations. The emerging themes identified in this study consist of (a) customization of technological innovation, (b) empowerment of adopter-based end-user, (c) government intervention, and (c) supplier-buyer networks. The findings of the study provided insight into the importance of tailoring available TI to fit the specific needs of business operations and establishing a business environment that fosters innovativeness at all levels of the organization. Additionally, building positive interrelationships within the workplace to garner input from employees, and externally

with the supply network and national agencies to propagate the successful integration of TI.

Managers of SMEs fail to integrate TI into business practices to continuously improve business processes for production efficiencies, business growth, and improved profitability. The findings of this study added to the knowledge base by providing a roadmap to business managers on strategies that promote the integration of TI into the business process. Operation managers may employ these strategies to alleviate the challenges encountered when integrating existing technologies into the business process.

Implications for Social Change

The findings of this study could contribute to positive social change by guiding business managers in transforming business operations, directly enhancing the working environment of production-line persons, and contributing to general societal well-being by providing quality goods to communities. Chege and Wang (2020) linked the introduction of technology in SMEs located in developing countries to the positive effects of job creation, improved productivity, competitiveness, exports to international markets, and overall economic development. By building on the body of knowledge on successful strategies to integrate TI, the findings of this study may help operation managers of all Caribbean domiciled SMEs to understand operations within a technological landscape. Additionally, the integration of TI into business processes improves the technical capabilities of production processes creating a more efficient work environment to enhance the work effort of employees. The findings contribute to the enhanced

knowledge of managers and improved working logistics of employees and may also benefit surrounding communities.

Local communities experience positive social changes through the circulation of wealth and the distribution of sophisticated products. Improved production efficiencies increase the growth potential of the company and the company's profit margins. Duan, Cao, and Edwards (2020) noted the importance of enhanced efficiency, increased productivity levels, and improved profits enrich the key stakeholders and contribute to positive societal changes. The customer markets of surrounding communities can access high-quality consumer goods, and the improved contributions to GDP may fund social well-being programs or develop other commercial investments for the upliftment of society.

Recommendations for Action

Operation managers who apply the findings from this study will avoid the pitfalls of inefficient production processes, limited or negative business growth, and operating losses. Choi and Chandler (2020) noted that the failure to implement innovative measures reduces the efficiency, responsiveness, and competitiveness of an organization. Reciprocally, Choi et al. (2018) supported the view that technological innovation is important for the survival and competitive resilience of firms. The findings of this study may assist operation managers in manufacturing firms to mitigate the challenges and effectively manage the integrating of TI in their businesses. In this study, I explored strategies employed by operation managers of SMEs and academic literature on how

managers successfully integrated TI to meet business requirements. The findings underscored important lessons and recommendations for action in (a) customization of innovative technological resources, (b) empowering the adopter-based end-user, (c) collaborating with national agencies, and (d) building supplier-buyer networks. The subthemes indicate guiding steps for useful action by operation managers.

Additionally, the study findings might relate to other non-manufacturing SMEs domiciled in the Caribbean as well as SMEs located in other developing regions. Managers responsible for operations in SMEs may benefit from the successful strategies outlined for integrating TI into business operations. Within the Caribbean region, the other business types that dominate the SME landscape and could benefit from the findings of this study include organizations in tourism, professional services, governmental agencies, and agricultural sectors. I will disseminate the findings from this study to business leaders through professional journals and academic literature. Additionally, I will present the findings of this study to the participating managers using traditional and online conferencing facilities.

Recommendations for Further Research

In this study, I identified two limitations. The first limitation was choosing purposive sampling. The sample size of this study included four participants at a managerial level responsible for the operations department. A recommendation for further research is the inclusion of other non-managerial personnel involved in the integration of TI within the company. Future studies could include operation plant

supervisors and production line workers. I employed a qualitative method; however, future research could include a mixed-method or a quantitative method study that includes a survey to a larger population.

The second limitation was using two data collection methods. I collected data from interviews and documents of operating reports and technological plans. An additional source of data collection for qualitative case studies is direct observation of activities related to work meetings, factory tasks, or field visits. Additionally, focus groups may provide diverse opinions from a small group of persons. A second recommendation for further research is using more than two sources of data collection.

Reflections

The Doctor of Business Administration program at Walden University was a challenging yet rewarding experience. Preparing scholarly research in an online environment required a high level of commitment and discipline. I explored the topic of integrating TI in SMEs in the Caribbean to understand the challenges encountered by and remedies available to business executives operating in locations behind the technological frontier. To limit my personal bias, I followed an interview protocol and verified my interpretations with the participants.

The data gained from the participants provided valuable insights into the resourceful application of strategies to integrate sophisticated TI into the business processes to meet specified targets. I appreciate their willingness to share their experiences and knowledge in a competitive industry. I broadened my perspective on

integrating TI into the SME environment as I learned of specific challenges and the practical, adaptable, and innovative methods employed by business executives to implement successful strategies. Sharing the findings of this study with business executives at other SMEs will improve their understanding of successful strategies to integrate TI in the workplace.

Conclusion

A fundamental strategy for business competitiveness and improved production efficiency is the successful integration of appropriate innovative technology into business operations. Business managers may achieve this objective by implementing sophisticated technology using a comprehensive and well-thought-out strategic technological plan. Effective strategies to integrate TI in business processes is pivotal for successful outcomes in improved efficiency, business growth, and increased profits. Operation managers that follow a strategy of customization of TI to adapt to the specific business needs, engage and empower workers, and utilize the supplier-buyer networks and relationships with national agencies improve the likelihood of successful integration of TI. Operation managers of manufacturing SMEs and other types of business may apply the findings of this study to develop successful and comprehensive strategies to integrate TI and improve business competences.

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Appendix: Interview Protocol

Interview Protocol	
Process	**Script**
• Introduce the interview and set the stage	Thank you for taking part in this interview. The interview process is for data gathering from participants for the study entitled "Strategies to Integrate Technological Innovations for Caribbean Small and Medium-sized Enterprises." The responses obtained in the interview will help to explain the overarching question in this study, "What strategies do operation managers use to integrate technological innovation into business operations?" This interview does not evaluate your techniques. I am the only one privy to the data obtained, and I will destroy all files after 5 years. The interview is scheduled for 1 hour, and you may interrupt at any time. I will use an audio-recording device so that I accurately capture your responses. Please let me know if you agree. Here is the consent form for your review and signature. You may ask any questions for additional clarity.
• Distribute interview questions • Watch for non-verbal cues • Paraphrase questions as needed to improve understanding by participants • Ask follow-up probing questions for in-depth answers	1. What strategies did you use to improve the integration of TI into your business operations? 2. What strategies did you find most useful when improving the integration of TI into your business operations? 3. How did you prepare the end-users when integrating TI into your business operations? 4. What strategies did you use to prepare end-users to improve the integration of TI into your business operations?

	5. How did the end-users respond to the integration of TI into your business operations? 6. How did the government's policies and concessions influence the strategies you used to integrate TI into your business operations? 7. What additional information would you like to share about your company or the strategies you use to improve the integration of TI into your business operations?
• Wrap up the interview thanking the participant	Thank you for the interview. I appreciate you taking the time to share your knowledge on integrating TI.
• Schedule follow-up member checking interview	I will request a follow-up interview after I have reviewed the data collected. The purpose of the interview is to verify that my interpretation accurately reflects the knowledge shared with me.
• Introduce follow-up interview and set the stage	I will share a printed document listing the questions and my interpretation of the responses collected. Your confirmation or clarification of the responses for each question will raise further related questions. The follow-up interview is scheduled for one hour.
• Share a copy of the succinct synthesis for each question • Bring in probing questions related to other information, adhering to IRB approval • Invite participants to review the transcript. • Walkthrough each question, read the interpretation, and ask: Did I miss anything? • Note the comments provided on the summarized interpretation of the response to each question.	1. What strategies did you use to improve the integration of TI into your business operations? Succinct synthesis of interpretation of question 1. 2. What strategies did you find most useful when improving the integration of TI into your business operations? Succinct synthesis of interpretation of question 2.

3. How did you prepare the end-users when integrating TI into your business operations?

   Succinct synthesis of interpretation of question 3.

4. What strategies did you use to prepare end-users to improve the integration of TI into your business operations?

   Succinct synthesis of interpretation of question 4.

5. How did the end-users respond to the integration of TI into your business operations?

   Succinct synthesis of interpretation of question 5.

6. How did the government's policies and concessions influence the strategies you used to integrate TI into your business operations?

   Succinct synthesis of interpretation of question 6.

7. What additional information would you like to share about your company or the strategies you use to improve the integration of TI into your business operations?

   Succinct synthesis of interpretation of question 7.