
The Departure of Complexities and Arrival of Success: Multi-Case Research Study of QR Code Adoption in the Gasoline Station Industry during the Economic Crisis

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Abstract

In recent years, digital transformation has been a key focus for many organizations as they seek to remain competitive and efficient in an increasingly digital world. Thus, the economic crisis conveyed by the COVID-19 pandemic has created a new urgency for companies to adopt digital transformation strategies to mitigate the complexities. The study aimed to explore the success of a digital transformation story amidst an economic crisis. The researchers employ a qualitative multiple-case study approach and lean on the Technology Acceptance Model (TAM). The sample cases include both large-scale and medium-scale firms and as a main method of data collection ten interviews were conducted. Our findings revealed that the implementation of the QR (Quick Response) code system was driven by the complexities in fuel shortage that arose due to the economic crisis. It is further depicted that the successful execution of the Quick Response (QR) code system is driven by young employees and their cross-functional teams. Resistance to change is the common barrier observed among employees and the general public which is first reduced and then eliminated with effective communication and employee training. Thereby showing how digital transformation plays the role of economic resilience. This shed light on the best practices for other organizations to embark on their digital transformation journeys even in the face of economic crises. Accordingly. This study can be considered the first that study the success story of technology adoption in a developing country during an economic crisis. It offers a learning opportunity to practitioners on how complexities could be mitigated through technological advancements while alerting managers to practical challenges.

Keywords: *Gasoline station, Quick response code system, Technology adoption*

01. Introduction

In the year 2022, Sri Lanka was facing an economic crisis which is mainly because the country's foreign reserves hit rock bottom with no money for imports of vital food, medicine,

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cooking gas, and fuel which are increasing in price globally as well as in Sri Lanka (Joadetunji, 2022). According to the central bank of Sri Lanka, official foreign reserves declined from US\$ 8 billion to less than US\$ 2 billion (Joadetunji, 2022). Consequently, Sri Lankan government was unable to import adequate fuel to fulfil the country's daily demand. This led the entire country into a crisis and most of the sectors were partially deactivated including schools and universities. All the fuel stations in the country are occupied by extended queues around one or two kilometers long with more than 200 vehicles (BBC News, 2022). Further, there have been many documented incidents of violence at petrol stations, and people were waiting in long queues for several days even without basic needs. People faced many hardships, they were crying, patients were dying and the government is lying (Aljazeera, 2022). Amidst this crisis, nearly 20 people have died since the beginning of the year 2022 (PTI, 2022).

Widespread anger, desperation, and frustration have brought thousands of people onto the street and they continue to grapple with the ongoing economic crisis, the island nation is on the brink of running out of fuel. Motorists were camping outside the fuel stations for days on end and public transportation also took a severe hit because of this. After several failed attempts with several steps to overcome this issue, the government introduced a QR code (Quick Response code system) to distribute fuel on an equal basis among vehicle owners (TVP World, 2022). As there is less possibility to violate the QR code, a major part of the problem was solved, and the country could gradually turn back to its normal operations. As this is a totally new system to Sri Lanka and QR code has not been used to distribute fuel in other parts of the world it is important to study the story behind the successful implementation of this method.

Sri Lanka can be considered a country that has very slow technological adaptation (DCS, 2020). compared with Sri Lanka's total population of 2.2 billion in 2020 and digital awareness represents only 50.1%, when considering gender-wise distribution males 53.7%, and females 46.9% (DCS, 2020). In such a context, introducing a technological base solution for day-to-day needs requires many preparations, awareness programs, and training (Ozkaya et al., 2015). Therefore, in the normal context, no one will expect to implement this kind of system overnight. In addition to that most of the workers in fuel stations are having a limited educational background and are not exposed to any highly technological environment (Jecinth et al., 2016). Given this specific context and limited training while there is huge unrest in the fuel stations, employees managed to catch the system briskly while reducing the major fuel problem in the country. Hence, it would be prudent to consider how they have been managed fuel crisis as it is useful for future crisis management and change management initiatives. Accordingly, the study followed the research questions; How does the adoption of a quick response (QR) code system mitigate the challenges of the fuel dispensing process, What challenges does the company face during an early implementation?

Further, this is the first empirical study to focus on a nation in Asia that employed the QR code method to quickly resolve its difficulties at fuel stations amidst an economic crisis. Research on QR codes has been conducted more in developed countries than in developing countries, and they are predominantly served for educational purposes (Goyal et al., 2016; Scott, 2020). All in all, it can be concluded that the adoption of QR codes at fuel stations has been scantily explored in the past literature. Therefore, the research is guided by the research objective "To explore the success stories behind the speedy adaption of quick response codes in fuel stations in Sri Lanka during the economic crisis". Consequently, the result of the study

will provide significant insights for countries passing economic hardships to get rid of those in a successive manner.

02. Literature Review

2.1. Global use of Quick Response Code

A two-dimensional barcode known as a QR code was first developed in 1994 by the Japanese business Denso-Wave. The creator intended for the code's contents to be decoded quickly, resulting in QR standing for "Quick Response" (Rouillard, 2008). The benefit of Quick Response codes is that they hold a lot of data inside of them and whatever type of digital data that can be imagined can be embedded, including text, video, advertisements, personal details, and business card information (Demir et al., 2015).

In the Middle East and Africa, there is an increase in the use of quick response codes which increased from 12% in 2017 to 18% in 2018. Consumers from Germany, the U.K., the Netherlands, Spain, and France participated in the poll. Over half of the respondents (54%) agreed that they have noticed an increasing trend in quick response codes (Gautam, 2018). Similarly, real-time bus information is provided via the smart city bus application with QR code and QR code payment capabilities (Fong et al., 2019). Additionally, QR codes are used for fashion shows, interactive print media, and public check-in points in Australia, and in South Africa. In a similar vein, QR codes are widely used for blended learning in Kazakhstan, Australia, and South Africa (Epstein & Sheldo, 2002; Rabu et al., 2019; Fitzgerald, 1992). In Japan, QR codes are used by automakers as a quick and easy way to track their vehicles and auto parts (Goyal et al., 2016).

2.2. QR Codes Application in the Sri Lankan Context

The Sri Lankan government utilized QR codes for contact tracing of the infected during the COVID-19 outbreak in 2020. Following the trend, The Information and Communication Technology Agency (ICTA) of Sri Lanka starts the "Stay Safe" campaign encouraging QR check-ins at all workplaces and retail establishments to record the guest registry. Meantime, people gradually adopted QR technology, and the government introduce alternative applications with QR codes catering to the daily needs of consumers (ICTA, 2020). The Central Bank of Sri Lanka (CBSL) started a nationwide rollout of the "LANKAQR" digital payments solution in October 2020 and again in November 2021 (CBSL, 2020). Using this application, customers can pay merchants and service providers directly from their bank accounts by scanning a QR Code. Customers can make purchases using a payments app offered by any bank or financial institution that has earned the LANKAQR certification. In 2021, 24 payment applications offered by 21 financial institutions in Sri Lanka received the certification and the payments made with LANKAQR are free for the certified users (Daily News, 2022).

2.3. The Benefits of Using Quick Response Codes

The QR code system is also superior in terms of data storage capacity, technical simplicity, widespread use, lower implementation cost, wide availability, and free programs for reading and decoding by camera-equipped smartphones. These characteristics make this technology

appealing for patient identification, particularly for institutions in developing countries with limited resources (Demir et al., 2015; Charoensiriwath et al., 2015). In low-budget situations, Quick Response (QR) Code technology emerges as a very appealing alternative to automating patient identification processes (Uzun & Bilgin, 2016). They further remarked healthcare providers can quickly get all the data they require by scanning a QR code that links their personal information and past medical records.

In a similar vein, restaurant businesses frequently use QR codes starting from contactless menus to touchless payments. No more reprinting and removing outdated menus from the dining area and all the food purchases are now via online in a much quicker and easier way (Scott, 2020; Rather & Rather, 2019). Alberlianasari, Nabilah, and Rahmawati in 2022, stated that there was an increase in ordering time efficiency since using QR codes was perceived to be faster and more flexible; consumers order concurrently without waiting in queues. On the other hand, QR codes include thematic map data (Chang et al., 2021). This enables consumers to quickly access advertisements, promotions, and other recent information about products or services through simple scanning, allowing for greater involvement (Chang et al., 2021; Shin et al., 2012).

Besides, Joseph (2016) states that the "Just in Time" (JIT) education methodology can be aided by the usage of smartphones to retrieve information contained in QR codes. However, the assumption that QR codes' functions go beyond all expectations is supported by the successful application of QR codes in study areas, and academic library settings (Hicks & Sinkinson, 2011). Similarly, data from the combined evaluations of teachers-users and students demonstrated that QR Code as an attendance monitoring system was typically very highly acceptable in terms of reliability, efficiency, accuracy, usefulness, security, and confidentiality (Fahim et al., 2019). Further, a smart attendance system with QR Code speeds up the attendance-taking process and saves important teaching time. He also emphasized that this program helps students to avoid the repercussions of poor attendance, which should be specified in the school's policy and academic standards (Rizal et al., 2016).

Therefore, the researcher decided to do a qualitative case study research because the QR code adaptation in fuel stations in Sri Lanka is social norms research which is more subjective.

03. Study Design and Methods

This study adopts a subjective viewpoint believing that multiple realities exist because the research interpretations rely on the fuel station respondents' experience, knowledge, understanding, and beliefs. Further, this research focuses on the real underlined details of a situation and the reality behind these details. Such as what problems each gas station employee faced during the economic crisis, how they dealt with them, and how they found the solution QR code system to rectify the problems they face. In this study, an in-depth understanding to gather multiple insights relating to QR code adoption is obtained to enhance the effectiveness of the findings. Additionally, it explored what different experiences they have obtained even if the technology is similar across the sites. Those unique realities are reflected in the study. Catering to these purposes of the study, we employ the interpretivism research philosophy to explore the unique context-specific characteristics, experiences, and coping strategies of the different fuel stations and their employees which are highly subjective in nature.

The qualitative research method studies phenomena in their natural setting and tries to understand or explore an idea that people bring to these settings (Silverman, 2000). The overall orientation of this research study is to analyze the success story of QR code adoption in fuel stations amidst the economic crisis and the covid-19 pandemic. Considering the aim of the study, the most suitable strategy to follow is qualitative-based research. The choice is supported by the following. Qualitative research seeks to acquire the variety and depth of data required to interpret and analyze the phenomenon under study (Bryman & Bell, 2011; Silverman, 2000). Moreover, it allows the researchers to delve into a phenomenon or a situation thoroughly and investigate the socially constructed nature of reality through social experiences (Denzin & Lincoln, 2000).

In investigating the success story of QR code adoption in fuel stations, this study employs the case study approach as it was considered appropriate when answering the exploratory nature of research questions (Yin, 2012). Accordingly, the researcher used the multiple case study approach recommended by Yin (2012) as it "either (a) anticipates similar outcomes (a literal replication) or (b) predicts contrasting results but for foreseeable reasons (a theoretical replication). In this study, each employee at a gas station shared their own experiences in adopting QR codes as part of the research project, however, combining all their accounts into single research gave a more complete view of the practical effects that this technology might have.

This study occupies a snowball sampling approach and it allows the researcher to use their own judgment to choose participants. Keeping with this approach, researchers found participants by connecting with or through personal contacts who meet the requirements for the study. The researcher initially starts looking for participants in the Colombo district mainly in Kaduwella, Malabe, and Ganemulla cities as the QR code system was initially adopted and widely practiced in Western Province. The researcher picked this region because it made it possible for researchers to conduct in-person interviews and a higher number of gas stations located in the capital city of Colombo that uses QR code technology. Further, researchers purposefully considered two large-scale fuel stations which were participated in the QR test implementation.

This study used both primary and secondary sources of data, while it mainly used primary sources of data such as interviews and focus group discussions. Additionally, a review of secondary data sources such as company proceedings, and industry reports of the case study firms were referred to confirm the data gathered through the interviews. As a main source of data collection, face-to-face in-depth interviews were conducted to build rapport and build trust among both participants and researchers. In order to guarantee consistency in the data collected, the researcher used a pre-defined semi-structured interview guide by covering all key aspects of research questions, theory, and past empirical studies. In total, ten individual interviews were conducted with the key members of all selected five fuel stations who are having more than 10 years of experience in the same industry. All interviews were conducted physically at the fuel station premises. Interview questions cover the areas of QR code implementation challenges, system adoption and training conducted, customer inquiry handling, and way of measuring the success and effectiveness of the QR code system. The researcher also played the role of an observer and field notes were used to record the data collected through the own observations. Similarly, QR code operations, practical challenges of implementation, and real-time system update functions all could be able to witness at the premises. Field notes of this study were valuable in refining the patterns of findings,

identifying themes, direct quotes from participants, researcher reflections and interpretations, contextual information, and any other notes deemed relevant to the research objectives. All in all, the researcher's own observations and field notes provided descriptive details to paint a vivid picture of the organizational setting and the focus of the study.

In this vein, the QR code reading process, consumer protection measurements, and fuel dispensing procedure with real-time updates were witnessed. Accordingly, interview data were complemented by observations made at each fuel station. All the interviews were tape-recorded and transcribed verbatim to eliminate the possibility of missing any significant information.

All the transcriptions are named with the designation of the relevant personnel and kept securely in softcopy format. Thereafter, before starting the data familiarizing process researchers carefully read through the main research questions and theory to always keep them at the back of their minds. Then read through the transcripts several times while listening to the audio and actively observed the meanings and patterns in the data. This familiarization helped a lot to identify interesting points, relate data with the theory, understand the data pattern and relationship with each other, and build up semantic (data-driven) codes. Next, clarifications and further insights were obtained through several rounds of telephone conversations with the same managers interviewed, and obtained their consent over the transcriptions to ensure credibility.

04. Data Analysis

For qualitative data to be useful, it needs to be analyzed and understood (Saldana, 2016). Thematic analysis was employed to identify and report on repeated patterns among QR code adoption, benefits, employee feedback, and experience. All authors used independent parallel coding to generate initial codes. Following that, the authors get together and discuss the initial codes. At that phase, overlapping codes were recognized and those used for further analysis as the same process improves the validity of the qualitative data analysis process. Aside from that, the authors could classify them into two sets of codes: latent and semantic. Several back-and-forth movements are maintained throughout the text so that prominent codes were clearly identified and successfully grouped similar codes into one theme.

Following that, sub-themes were searched for before generating the final themes. Thereby, researchers were able to compress the key into five major themes and considered them as the major takeaways from the discussions. The Excel spreadsheet was used to analyze this and compile the research findings. Furthermore, the general inductive approach was used for data analysis as it offers a simple and systematic set of procedures for analyzing qualitative data that can yield reliable and valid results.

Thematic Analysis is used to organize things according to the common characteristics and to identify the patterns among QR code implementation and business excellence and employees' attitude, and experience with QR code adoption. Thematic Analysis is used to organize things according to the common characteristics and to identify the patterns among lean institutionalization and business excellence and employees' attitude, and experience with lean adoption. Under this approach, as the first step, the researcher transcribed all the interviews to eliminate the possibility of missing any significant information. All the

transcriptions are named with the designation of the relevant personnel and kept securely in softcopy format. Then researchers familiarize themselves with the data by reading through the transcripts several times while listening to the audio and actively observing the meanings and patterns in the data. As a third step, initial codes were created. Based on the existing understanding of past literature and research questions. Next interview quotes are assigned to each code appropriately. As a fifth step, the researcher moved group codes into themes. Grouped together, all the extracts associated with a particular code into a theme. The sixth step is to evaluate and revise the theme. At this stage, it ensures each theme has new data, maintains boundaries for each theme, pinpoints a clear view of which extracts belongs to each theme and what does not. When found multiple themes that seemed similar, merged them together or removed one when a theme does not have something to contribute to the overall analysis. While thematic analysis formed the basis for data analysis, we used word cloud to depict the word frequency of data by emphasizing the most frequently used words and phrases in the questionnaire. This software-driven constant comparative method assisted in determining the popularity of each word and large phrases were coded manually. Word cloud's efficiency and visual demonstrations supported grabbing the comprehensive content quickly. Succinctly, all the analyzed information is supported by the technology acceptance model.

05. Results and Discussion

Our field evidence suggests that issues relating to fuel dispensation have been rectified with the QR code system. It also revealed fuel stations experience benefits from the use of the QR code system, in a way reducing the disputes, queues, and fuel station employees' work hardships. Even though people were not that much into technology before, with the initial training they were used to operate the system smoothly. We flatten the key findings next.

5.1. Adoption of the quick response (QR) code system

The adoption of quick response codes in the automation process is necessary for society to prevent unnecessary stocking and selling of fuel illegally to third parties. Fuel station 5 manager elaborated:

“With the severe fuel shortage, some people have seized the opportunity, fuel gets unloaded from vehicles for illegal sale on the black market, then it is sold at exorbitant rates to desperate Sri Lankans.”

The above statement verified the sentiment of people who were waiting for 3 to 4 days to get just 2000-2500 Sri Lankan rupees (USD \$6-7) worth of fuel at each time. This is not enough, and some people would unload fuel from their vehicle and sell it for a higher price. The findings further revealed that a liter of petrol is about 450 rupees and the black-market cost was 2500 rupees, almost six times higher. Consequently, the government minister of power and energy introduced a new fuel rationing scheme at the request of the President. Fuel station 1 supervisor commented:

“QR code base fuel pass was introduced and successfully tested in the pilot project before going national. After implementation, the country enhances the security in the

filling station armed guards were deployed helping with the implementation of the digital QR code system.”

In this QR system, Sri Lankans had to register in a web portal announced by the government, where people put their vehicle chassis number, driving license number, and one national identity card number. Accordingly, the system issued a QR code that is scanned at the fuel station before dispensing fuel. Manager fuel station 2 claimed:

“QR code system prevent polling and black marketing which became somewhat relief for us with proper distribution of fuel.”

Abdul Rabu, Hussin, and Bervell (2019) stated that the use of QR codes in the classroom has been identified as an important tool for promoting both active and distributed learning, particularly in higher education. Charoensiriwath et al. (2015) note that the use of a proper QR code system creates high accessibility and successful integration of everyday workflows without disrupting their normal operations and that the system is useful to the hospital process. Reinforcing the above idea, this research proves that the QR code system is an efficient mechanism for dispensing fuel fairly among the community during the economic crisis.

5.2. Employee Training

As revealed through interview data, almost every staff member emphasizes the word “training” when discussing their QR adoption journey. The idea of training is currently gaining traction as one of the key elements correlated to employee success. Fitzgerald (1992) signifies training as a tool for assisting individuals in contributing to the organization and succeeding in their existing jobs. Especially, in the wake of the COVID-19 pandemic and economic crisis, people require some level of training in order to satisfy business expectations, make contributions to the firm, and achieve a high level of success (Chang et al., 2021). This played a significant part in shaping QR code adoption at the chosen case study firms in a short period of time. Fuel Station 1, fuel station 2, and fuel station 3, specifically mentioned soon after the Ceylon Petroleum Corporation training, they trained their employees on the QR code system, and it helps them to adopt the QR code system within a short period of time. Manager fuel station 1 remarked:

“During the test run period, I received training on how to use the QR code system for fuel issuing to customers. Then, I trained my staff members, and they adopted the QR coding system quickly with the support of our younger generation of employees. These young bloods are familiar with mobile phone usage and for them, it is just like another mobile app”.

Accordingly, it is evident that training helps to improve the knowledge and information about a specific field while making an opportunity to create a network among senior and junior employees. Fuel station 2 manager shared similar insights:

“Employees received training on how to use the QR code system for fuel dispensing from the fuel station owner over the seven days period. We shared the global QR code adoption successive stories with our employees which built trust and motivation as this

is a good system and other countries are also using it for their several businesses. The government has declared that before implementing a QR code system at fuel stations, this should be mandatory and adhered to by every fuel station in Sri Lanka. Our fuel station staff members got the training during those seven days, and it helped us use the QR code system conveniently.”

Accordingly, it is evident that the technical training worked with the fuel station employees in the process of adopting the QR code system.

5.3. Young generation support over QR code implementation

Rather and rather (2019) stated that among the younger generation, smartphones have become incredibly crucial and essential communication instruments. In this regard, the fuel station 1 supervisor commented:

“When I don’t have my phone, I feel separation anxiety. In my free time, I always use it, so the QR code is just another mobile app for me. We gave training to our senior staff on how to use this QR code app and how to enter the details of the quantity of fuel before dispensing and it was not a big burden for us thereafter.”

The above statement proves that the younger generation drives this initiative followed by the senior staff. The fuel station 2 manager added:

“We did not use any special techniques for our staff to train on the QR system, but we selected employees who are playing mobile games often and first installed the QR app on their smartphone devices. Within a week they grab all the functionalities, and their mobile technology knowledge was an advantage to us to run smoothly.”

These comments verified that the younger generation played a key role as resource persons to drive the QR technology implementation. Past literature highlights that QR codes are used more frequently by practical users than by experienced users, and there is a positive association between electronic device ownership and QR code usage (Ozkaya et al., 2015).

5.4. Benefits of the QR code system

The literature stated that there was an increase in ordering time efficiency since using this QR code was perceived to be faster and more flexible, consumers could order concurrently, and consumers did not need to queue to order restaurant menus (Alberlianasari et al., 2022). Fuel station 3 manager noted:

“This is a huge advantage to them because it helps to fuel station employees to reduce their stress. Moreover, customers are adopting a systematic method to take the fuel and maintenance their discipline and Consumers' attitudes have changed as a result of the QR code”.

He further commented,

“Before the QR system, we worked day and night and some employees got sick. After implementing the QR code system, huge queues and customer disputes have been reduced, which was a great relief for us”

Based on the above sentiments, it is apparent that after the QR code implementation, they can perform their duties efficiently with a balanced mindset. Castaldo, Melillo, and Pecchia (2015) stated that mental stress impairs performance in the workplace and in everyday life and is one of the leading causes of business success.

06. Conclusion

Drawing evidence from five different fuel stations in Sri Lanka, this paper explores how fuel station employees adopt QR code systems promptly during an economic crisis. Even if employees use the same platform of QR code, in certain cases, the physical technologies were not comparable since different fuel stations used different mobile phone brands based on their preferences and financial capabilities. Furthermore, employees did not receive the same training on how to use the technology, but with their abilities and fuel station staff support or based on Ceylon Petroleum Corporation instruction, they were able to capture the QR code system in a short period of time.

The result of the study determines how quickly fuel station employees adopted the QR code system amidst the economic crisis. Accordingly, findings show that all the fuel station employees verified that implementing the QR code system for fuel dispensing is a better system introduced by the government. As a country people benefited from the use of the QR code system, such as reduced disputes, queues, and fuel station employees can work without any stress. The Technology Acceptance Model (TAM) is a theoretical framework that evaluates individuals' acceptance and usage of technology. Similarly, in the given case study firms, an individual's intention to use technology is influenced by their perception of the usefulness and effectiveness of the technology, as well as the perceived ease of using it. TAM also posits that external factors such as social influence, training, and technical support can affect a user's perceived usefulness and ease of use, leading to changes in their technology acceptance and usage behavior, which is depicted in the above study findings. TAM has been widely recognized and extensively used in various fields to understand and predict users' attitudes and behaviors toward technology, and it has been an influential model for designing and evaluating the success of new technologies.

The researcher discovered that most fuel station managers chose the younger generation of employees who used smartphones for QR code system training, which will assist them in implementing the QR code system within a short time and may even eliminate some bottlenecks in the situation. Future researchers may study the entire county with a broad perspective identifying how to successfully adopt the QR code system in the entire fuel station in Sri Lanka. Hence, this study provides eye-opening insights for strategy developers as they can enhance their capabilities with QR technology. Similarly, this study contributes to the existing literature on technology adoption in the gasoline station industry during an economic crisis, as a ramification for fuel shortage and community disputes. From a theoretical point of view, it illuminates the technology acceptance model while emphasizing its usefulness, ease of use, and behavioral intention. It thereby adds to the ongoing dialogue

on technology adoption and provides empirical evidence along the lines of insights that emerged from past scholars, such as Davis, Bagozzi, Warshaw (1989), and Lai (2017).

This study helps practitioners from several categories. First, business organizations who are interested in implementing environmentally friendly and cost-effective data-capturing systems will find this wise. Second, countries that are facing an emergency with a shortage of necessities can have a detailed picture of the story of technology adoption and its contribution to crisis handling. Third, software development companies interested in offering more advanced software solutions by synchronizing all company daily demands will find this study insightful.

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