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# Examining Technology Adoption and Management Perception of Inventory Management Systems: The Case of Aruba Restaurants

## **Abstract**

The purpose of this paper is to explore the use of automated inventory management systems (IMS) and identify the stage of technology adoption for restaurants in Aruba. A case study analysis involving twelve members of the Aruba Gastronomic Association was conducted using a qualitative research design to gather information on approaches currently used as well as the reasons and perceptions managers/owners have for using or not using automated systems in their facilities. This is the first study conducted using the Aruba restaurant market. Therefore, the application of two technology adoption models was used to integrate critical factors relevant to the study. Major findings indicated the use of an automated IMS in restaurants is limited, thus underscoring the lack of adoption of technology in this area. The results also indicated that two major reasons that restaurants are not adopting IMS technology are budgetary constraints and service support. This study is imperative for two reasons: (1) the results of this study can be used as a comparison for future IMS adoption, not only for Aruba's restaurant industry but also for other Caribbean destinations and the U.S., (2) this study also provides insight into the additional training and support help needed in hospitality technology services.

## **Keywords**

Technology, Management Systems, Aruba, Restaurant, s Aruba Gastronomic Association, IMS, Operations, Inventory Management System

# Examining Technology Adoption and Management Perception of Inventory Management Systems: The Case of Aruba Restaurants

By Kimberly Severt, Robin B. DiPietro and Diana Herrera

*The purpose of this paper is to explore the use of automated inventory management systems (IMS) and identify the stage of technology adoption for restaurants in Aruba. A case study analysis involving twelve members of the Aruba Gastronomic Association was conducted using a qualitative research design to gather information on approaches currently used as well as the reasons and perceptions managers/owners have for using or not using automated systems in their facilities. This is the first study conducted using the Aruba restaurant market. Therefore, the application of two technology adoption models was used to integrate critical factors relevant to the study. Major findings indicated the use of an automated IMS in restaurants is limited, thus underscoring the lack of adoption of technology in this area. The results also indicated that two major reasons that restaurants are not adopting IMS technology are budgetary constraints and service support. This study is imperative for two reasons: (1) the results of this study can be used as a comparison for future IMS adoption, not only for Aruba's restaurant industry but also for other Caribbean destinations and the U.S., (2) this study also provides insight into the additional training and support help needed in hospitality technology services.*

## INTRODUCTION

The use of technology in the restaurant industry is considered to be the most important change since the development of the gas stove and electrical refrigeration. In an effort to respond to greater demands for profitability, restaurant managers are looking to new technology as an alternative to better manage their operations (Mandabach, Blanch, VanLeeuwen, Revelas, & Cole, 2003). Oronsky and Chathoth (2006) reported that technological innovations allow managers to control costs, enhance effective management techniques, and monitor more closely profit/loss mechanisms in real time, as opposed to waiting until the end of the week, month, etc. While information technology (IT) clearly presents opportunities for restaurants, Ansel and Dyer (1999) report that many organizations have been slow to adopt and implement technology in the back of the house, specifically in the area of cost control.

Food-and-labor cost control is of vital importance to any foodservice establishment. According to Rogers (1996), aside from labor, inventory is probably the largest expense in a food-and-beverage operation's financial statement, and many foodservice operations are still trying to control these costs without tracking their inventory. Schwartz

(2008) stated that traditional food-and-beverage control, at least for the past 20 years, has been composed of three elements: profit-and-loss statements (P&L), Management by Walking Around (MBWA), and miscellaneous spreadsheets. The introduction of inventory management software makes the P&L statement less critical, gives managers some specific things to look for while walking around, and typically replaces the spreadsheet component almost entirely. In addition to this, Gale (2007, p.77) affirmed that inventory control software replaces the “time consuming and often inaccurate process of taking physical counts,” while enabling the company to determine where money is tied up in inventory that isn’t moving. In short, automated inventory management provides the edge restaurants require in order to boost profitability.

So what keeps restaurants from leaving the spreadsheets behind and moving to an automated system? Schwartz (2008) stated that although the answer varies from company to company, some probable reasons include familiarity with current practices, unfamiliarity with new approaches, unwillingness to invest, and no motivation to spend the time required in order to implement a new system. Based on this, the purpose of this study is to address the fundamental question: Are restaurants in Aruba adopting and implementing technology to manage food-and-beverage inventory?

Aruba has become a major tourism destination, with the U.S. and Europe being the key sources of visitors. According to the Central Bank Aruba (2009) there were 772,100 million visitor stay-overs in 2007, and the total registered tourism receipts for 2008 were \$1409.50 million. The majority of tourism receipts are hotel and food-and-beverage expenditures.

This study is important not only to the Aruba hospitality industry but also to the many U.S. companies that have restaurants in Aruba or supply restaurants with inventory and/or services. This study is also important to provide insight into some of the challenges faced by other island destinations and remote locations that depend on the long-distance help of service providers for technology needs. The current study aims to (1) provide a benchmark to determine the level to which technology has been adopted by the Aruba restaurant industry and to measure future advancement and (2) identify technology adoption to determine whether there is a resistance to technology adoption that may affect customer service levels and/or inventory management control.

Aruba merchandise exports in 2008 were US\$32 million but the merchandise imports were US\$1035.2 million. Aruba depends on the

import of food and beverages to service the millions of tourists each year. Managing food inventory is critical to the success of restaurant operators since they rely solely on imports to service their customers. Since the majority of tourists are from the U.S. and Europe, they naturally compare the quality of food in restaurants with the quality of food they commonly purchase in the U.S. and Europe. One of the primary differences lies in the transportation of food into Aruba and the time span between ordering and receiving.

Other research questions answered through the current study are:

1. What technology is being currently used in restaurants in Aruba?
2. What inventory management systems (IMS) are used in restaurants in Aruba?
3. What is the level of satisfaction with the current inventory system used?
4. What is the managers' perception towards adopting an inventory management technology system in Aruba?

The final objective of this study is to present the results in the Technology Adoption Model (TAM) (adapted by Wang and Qualls, 2007) to identify the stage of adoption and the implications in the technology adoption process.

## **LITERATURE REVIEW**

### **Technology in the Restaurant Industry**

Information Technology (IT) advances have drastically altered the way many industries now conduct their business. For instance, Douglas (2007) stated that new technologies have served smart business solutions that have pushed industries to achieve greater levels of internal proficiency in core operational areas. Larsen (2009, p.15) also affirmed that in difficult economic times, savvy operators who realize they need smart systems to get smart results are spending money on technology: "The right technology can mean a significant boost to an operator's bottom line."

The U.S. National Restaurant Association has forecast that the overall economic impact of the restaurant industry is expected to exceed US\$1.5 trillion in 2009 (National Restaurant Association, 2009). Studies have shown that some of the tangible benefits to the restaurant industry that may be achieved through the use of IT are minimization of costs (such as food, labor, beverage, and energy), better employee management techniques, increased revenue management, and the ability to analyze

customer preferences (Oronsky & Chathoth, 2006). The importance of IT in restaurants has also been stated by other researchers. For instance, Leung and Law (2007) considered the fact that IT plays an important role in strategic and operational management; new technologies and innovative ideas support restaurants' daily operations and managerial decision-making. Operations software makes manually monitoring inventory and estimating recipe costs tasks of the past (Gale, 2007). Lockwood (1992) also reported that after instituting a computerized inventory control system, restaurants have been able to trim food and liquor inventories by about 13%. With an up-to-date inventory system, owners can track bartenders' pours and any food shrinkage to help control loss (Gale, 2007).

According to Oronsky and Chathoth (2006), technological advances have also changed the customer's dining experience over the years—the way in which the meal is prepared, the speed at which it is delivered, and the way in which it is received,,just to name a few of the changes. Companies can use technology not only to benefit themselves but also to enhance the experience their front-line people have with guests (Carbonara, 2008). In short, technology offers one of the few opportunities for cutting costs, improving efficiency and customer service, affecting the bottom line, and cutting down on the mountains of paperwork that have been known to bury restaurateurs (Belman, 1997). Futurists and industry experts predict that the increased use of technology in a variety of formats will continue to be a major determinant of success for restaurant operations (Mandabach et al., 2003).

### **Lack of Technology Adoption in the Restaurant Industry**

With the advent of new technology and its impact on restaurant operations, one would believe that most firms in the restaurant industry would be IT-oriented in their operations (Oronsky & Chathoth, 2006). Yet Carbonara (2008) affirmed that, relative to other businesses, the foodservice industry has been slow to incorporate technology into its processes. For years, many restaurateurs have ignored the onslaught of technology and its impact on the restaurant industry (Belman, 1997). While all other service industries are heavily involved in developing technology, restaurants seem to lack interest in the implementation of their own technology (Grimes, 1988).

Researchers have reported different reasons for the industry's lack of technological adoption. For instance, Grimes (1988) stated that although restaurant owners are extremely concerned about ways to make their operations run better, they may not be aware of the possibilities of

automated control and standards. Foodservice operators continually face the challenge of being up to date on IT trends to accurately achieve maximum profit potential (Mills & Feinstein, 2007). Grimes (1988) also argued that technology providers are partially responsible for the lack of adoption; although general systems are developed for other industries, they are very rarely considered for initial use in the restaurant industry. Hence, the restaurant industry is usually several years behind other industries in terms of software technology.

Another main issue seems to be the perceived costs associated with IT and what IT can do to provide a return on investment. Ansel and Dyer (1999) suggested that technology has typically been viewed as an additional cost of doing business, rather than as an investment in future profitability. The absence of formal capital budgeting techniques might explain why restaurants demonstrate a lack of technology implementation. These techniques would enable firms to assess the risk of investing in new technology from a value-adding standpoint (Oronsky & Chathoth, 2006).

Although it has been reported that the restaurant industry is not technologically oriented, restaurateurs need to assess the importance of automating their operations. Belman (1997) asserted that regardless of the size of the operation, today restaurants cannot compete without investing in some sort of technology. The information-intensive nature of the industry requires that IT be used to assist daily operations and business decision-making (Leung & Law, 2007). Ansel and Dyer (1999) derived four possible strategies of current developments that may help focus and drive restaurant IT development. These are (1) gaining strategic competitive advantage, (2) supporting human resources, (3) managing revenue, and (4) minimizing costs. For the purpose of this study, only the fourth strategy will be further discussed and analyzed, putting primary emphasis on the importance of food-and-beverage inventory control as a way to minimize costs, as well as the technological approaches available to restaurants in this specific geographic area.

## **Food and Beverage Inventory Control**

Food-and-beverage inventory cost control is very important to any foodservice business. According to Reynolds (1999), inventory is a current asset that provides no return on investment until it is prepared and sold. Hence, the cost of goods is one of the largest expenses a foodservice operation will have to pay out each year (Rogers, 1996). Poor inventory management practices can greatly affect customer service as well as the operation's bottom line. According to Reynolds (1999),

inventory shortage results in menu items that cannot be offered to guests, and excess inventory provides opportunities for theft. The need for stringent inventory controls has grown during the last decade because liquor costs and insurance costs are higher, and profit margins are squeezed tighter (Riell, 2006).

Restaurateurs need to make sure their inventory control systems are effective. The key to an effective inventory control system is reporting timeliness and relevance (Huber & Pilmanis, 2001). The universally accepted practice used by most restaurants for monitoring inventory control measures is to take a physical inventory typically on the last day of the calendar month (Dittmer & Keefe, 2006). The practice requires counting, recording and valuing the actual number of units in stock. Although this practice is meant to determine control effectiveness, Reynolds (1999, p. 58) asserted, "It is assumed that the individuals who perform the actual counting and recording do so honestly and take reasonable care not to make errors."

Bartenders who pour generously, employees who provide freebies, and employees who steal (all of which is called "shrinkage") are three problem areas that restaurant managers cite that hurt restaurant profits (Hodl, 2006b). Liquor shrinkage has been widely estimated at US\$7 billion a year in the U.S. (Riell, 2006).

According to Schwartz (2008), most restaurants use spreadsheets to manually record inventory and produce the necessary reports. Nevertheless, researchers indicated that restaurateurs consider the practice of taking manual inventory time-consuming, labor-intensive and slow. According to Gale (2007), inventory reports are so labor intensive that they are typically completed and immediately shelved without review for problems or ways to save money. Keeping track of current cost information and other routine spreadsheet maintenance tasks can also take significant amounts of time, thereby increasing labor cost (Schwartz, 2008).

Researchers and restaurant operators have reported that automated inventory control systems offer countless benefits for enhancing profitability in the restaurant industry. Lockwood (1992) stated that automated inventory control allows managers to balance inventory, food costs, and cash flow with greater accuracy and speed than by eyeballing the shelves and cash register. The key is the ability to take a physical bar inventory that is more accurate and roughly half as time consuming as a pencil-and-paper inventory (Scarpa, 2009). Some of the inventory tracking software includes features that determine the value of

current inventory and calculate how much inventory is being lost, how much each menu item costs, which menu items generate the most gross profit, and how much of each menu item is being sold (Rogers, 1996). Scarpa (2009) reported that these features help operations lower beverage cost, increase managerial efficiency, and reduce dollars tied up in inventory. Alternate technologies can also combine the point of sales (POS) system used in restaurants and other retail operations with an inventory management system. These technologies are often used in grocery stores, where an immediate knowledge of inventory can help with ordering and inventory control.

In addition to these benefits, operators have also suggested that one of the main advantages of automating inventory control, regardless of the type of technology used, is time reduction. Restaurant owners have affirmed that rather than spending time just tabulating results, managers are now able to analyze and react to the results generated by the system (Gale, 2007). Howard (1994) also stated that the automation system is freeing up managers by about 10 to 15 hours per week, which allows them to focus more on customer and employee relationships.

Restaurant operators have also reported positive financial results after implementing automated inventory control systems. Food-and-beverage inventories can be maintained at a lower level. This translates into ensuring that money is being put to work rather than sitting on shelves (Lockwood, 1992; Riell, 2006; Sheridan & Matsumoto, 1999). Recognizing the importance of this technology, The Art Institute of New York now teaches inventory software programs to its 1,200 culinary students because they consider it an essential skill (Goldhagen, 2003).

There are several types of food-and-beverage inventory management systems available to restaurant operators. Three types of technologies will be highlighted in this study (1) Scanner/scale aided technology (which can also be integrated into the POS system of the restaurants if available), (2) Beverage dispensing technology, and (3) Radio Frequency Identification Devices (RFID). Table 1 provides a list of the different technologies available to restaurant operators, along with a description of how they work and the pros and cons associated with each.

**Table 1**  
**Food and beverage inventory management technologies**

TECHNOLOGY	HOW IT WORKS	PROS	CONS
<b>Scanner/scale-aided Technology</b>	<p>Uses scanner or scaled-aided measurement.</p> <p>Data is entered into software that calculates pouring cost and highlights variances (Scarpa, 2009)</p>	<p>Can be used for both food and beverage items.</p> <p>Offers consistent accuracy of inventory taking, no matter who is doing the counting (Herr, 2008).</p>	<p>Ongoing scanning or weighing of the entire inventory stock (Rubinstein, 1997).</p>
<b>Beverage Dispensing Technology</b>	<p>Each bottle has a magnetic ring connected to a soda fountain-style gun dispenser</p> <p>Allows the system to record all drinks poured while keeping track of each liquor used (Hodl, "Liquid Gold," 2006a).</p>	<p>Eliminates over-pours and comps offered by bartenders (Hodl, 2006a).</p>	<p>Can only be used for beverage control.</p> <p>Customers may not like drinking from a human assisted vending machine (Herr, 2008).</p>
<b>Radio Frequency Identification Devices (RFID)</b>	<p>This is the latest inventory tracking technology.</p> <p>This technology measures and transmits the amount of every shot of liquor poured to a personal computer running specialized software (Scarpa, 2009).</p>	<p>Can be used for both food and beverage items.</p> <p>No scales, scanners, barcode tags or dispensing guns needed. Everything is done wirelessly.</p>	<p>Very expensive (Rubinstein, 1997).</p>

## METHODOLOGY

This study was exploratory in nature because the aim was to determine whether restaurants in Aruba were adopting the use of technology in food and beverage operations. If so, what technologies were utilized and for what purposes? It was of special interest to investigate what inventory management systems were used, gain insight into the management perceptions of using such systems, and identify the technology climate and adoption position within the various organizations. By identifying these specific questions, the study results gauge the level of technology adoption in Aruba restaurants and provide a benchmark for development in the future. It also provides technology producers and food-and-beverage suppliers with an insight into the perceptions of managers regarding the IT products related to inventory control and management.

After a thorough review of the literature, a qualitative design was deemed most appropriate to gain a holistic picture of a situation, issue or concept (Stainback & Stainback, 1988). Interviews with managers and restaurant owners were selected for this data collection process because they provided the ability to gain first hand information from restaurant operators at the destination. Interviews were also deemed appropriate because the research was designed not only to capture what technologies were being used, but also investigate reasons why or why not restaurateurs were using or not using the new technologies that are available for them in inventory management (Bogdan & Biklen, 2003). A case study design is deemed appropriate when a researcher seeks an answer to “what,” “how,” and “why” questions in the study design (Adler & Ziglio, 1996; Yin, 2003). The current study has characteristics of an exploratory case study that is focused on contemporary events and seeks to answer “what” and “why” questions; therefore, the case study research methodology was deemed to be appropriate.

This study was supported by the Aruba Gastronomic Association (AGA), which is part of the Aruba Hotel and Tourism Association (AHATA). Members of this association are committed to culinary and service excellence by making food safety a priority. As AGA has a broad and diverse membership, representing different types of restaurants in Aruba, it was deemed to be a suitable source for the selected population of this study.

Restaurants were randomly selected using Microsoft Excel’s random feature. From the 26 AGA member restaurants, two were

discarded for being the place of employment of one of the researchers. From the remaining 24 restaurants, a random sample of 12 was selected and asked to participate in the study. Although there are many restaurants in Aruba, the AGA restaurants are located in the primary tourist district, and revenues are much higher due to the volume of tourists served. This was another reason the researchers felt this sample was appropriate for the destination and overall purpose of the study.

Due to the scope of the study and after careful review of other restaurant studies, the sample size was deemed appropriate but would have been extended if the selected interviews did not reach saturation of data. This occurs when the researcher is no longer hearing or seeing new information (Severt & Palakurthi, 2007). Sample size extension was not deemed necessary as sufficient data was derived from the sample population. Other qualitative studies done in the restaurant industry have similar sample sizes (Murphy & Murrmann, 2009; Suboleski, Kincaid, & DiPietro, 2009). Semi-structured interview questions were prepared in order to collect data from the participants and serve as a format to administer information received during the interview. Analyzing data from different angles, or corroborating with other sources, increases the reliability of the research (Severt & Palakurthi, 2007). The 28 questions were broken down into four different parts.

Part one consisted of five independent/structured questions, which were designed to retrieve information on the participating restaurants in order to gain a clear indication of the restaurant's size, volume of sales, and years of operation. Part two sought to get an indication of technology adoption in general. Participants were first asked whether they used technology as an aid in the operation of their restaurants and then they were asked to identify in which areas it is used. The third part inquired about the frequency of taking inventory; the food-and-beverage cost percentage aimed for monthly; inventory control practices to prevent theft, waste and spillage; and the persons responsible for inventory control and purchasing. The next set of questions was used to collect data on the key areas of the inventory management system used; first participants were asked an independent question

on whether they used an inventory management system. This was followed by a dependent question asking to identify which system was used. The next question was used to identify reasons for not using an automated system. The following four semi-structured questions used in this part of the interview were used to stimulate additional information on effectiveness and efficiency of the Inventory Management System (IMS) in place. The last set of Likert-scale questions in part three was used to indicate whether participants “agreed” or “disagreed” on the importance of both inventory control and the use of an automated IMS, as well as on the satisfaction level with the current IMS used. Answer options included: “strongly agree,” “moderately agree,” “neither agree/disagree,” “moderately disagree,” and “strongly disagree.”

Finally, the last section of questions was designed to collect demographic information from the person being interviewed, representing the selected restaurant, e.g., gender, age, level of education, home country, and years of experience.

## **DATA ANALYSIS**

On completion of the twelve interviews and transcriptions, the data was imported into the qualitative software, NVivo8. This program was used to assist in sorting, coding, and analyzing the data. The researchers independently coded the data into different “nodes” and then the coding was compared to determine the intercode reliability of the analyses. The intercode reliability ranged from 84.2 to 98.0, which meant that the two researchers coded the data the same 84% to 98% of the time. The quantitative data collected from the interview questions was input into SPSS, version 15, to determine descriptive and frequency results.

## **RESULTS**

### **Restaurant Managers Interviewed**

The summary of restaurant demographics provided in Table 2 indicates that 16.67% have been in business from 1-5 years, 41.67% from 6-10 years, 16.67% from 11-15 years, 8.33% from 16-20 years, and 16.67% for 21 years or more. In terms of the number of guests that are served daily on average, 8.33% reported that they serve from 51-100 guests, another 8.33% serves 101-150 guests, 41.67% serves 151-200, and the remaining 41.67% serve more than 200 guests on a daily basis. The majority of restaurants, or 66.67%, have an average check price of \$26-

\$49, 8.33% under \$25, 16.67% above \$50, and 8.33% did not want to provide that kind of information. To keep the anonymity and confidentiality of the participating restaurants, the restaurants will be identified as Restaurant A, B, C, and so forth.

**Table 2**  
**Demographics of restaurants**

	Freq.	Percent
<b>Number of years in operation?</b>		
1-5 years	2	16.67
6-10 years	5	41.67
11-15 years	2	16.67
16-20 years	1	8.33
21 years or more	2	16.67
Total	12	100%
<b>How many guests served on average daily?</b>		
51-100	1	8.33
101-150	1	8.33
151-200	5	41.67
Above 200	5	41.67
Total	12	100%
<b>What is the average check price for dinner?</b>		
Under \$25	1	8.33
\$26-\$49	8	66.67
Above \$50	2	16.67
N/A	1	8.33
Total	12	100%
<b>Number of employees?</b>		
Under 15	1	8.33
16-29	5	41.67
30-44	1	8.33
Above 45	5	41.67
Total	12	100%

Table 3 shows that out of the 12 participants interviewed, 8% have been working in the restaurant industry 1-5 years, 41.67% have been working 6-10 years, 8.33% have been working 11-15 years, and 41.67% have been working more than 20 years. In terms of the amount of years participants have been working in management, 50% have been doing it for 1-3 years, 33.34% for 4-6 years, 8.33% for 7-9 years, and 8.33% for longer than 10 years. The majority of the participants (58.33%) were born in Aruba, 16.67% in Mexico, 16.67% in Holland, and 8.33% in Iran. Regarding gender distribution, 75% of participants were male and 25% were female. In terms of age category, 33.33% fit a range of 25-34 years-old, 33.33% are in a range of 35-44, 25% are between 45 and 54 years old, and 8.34% are over 55. Finally, the majority of participants (41.67%) have achieved a four-year degree, 25% have some college, 16.67% graduated from high school, 8.33% have a two-year degree, and 8.33% have a graduate degree, as well.

**Table 3**  
**Demographics of participants**

	Freq.	Percent
<b>How long have you been working in the restaurant industry?</b>		
1-5 years	1	8.33
6-10 years	5	41.67
11-15 years	1	8.33
16 years or more	5	41.67
Total	12	100%
<b>How long have you been in this position?</b>		
1-3 years	6	50.00
4-6 years	4	33.34
7-9 years	1	8.33
10 years or more	1	8.33
Total	12	100%
<b>What is your country of origin?</b>		
Aruba	7	58.33
Mexico	2	16.67
Holland	2	16.67
Iran	1	8.33
Total	12	100%
<b>Gender</b>		
Male	9	75.00
Female	3	25.00
Total	12	100%

Age			
	25-34	4	33.33
	35-44	4	33.33
	45-54	3	25.00
	Over 55	1	8.34
	Total	12	100%
Education Level			
	High School	2	16.67
	Some College	3	25.00
	2 year degree	1	8.33
	4 year degree	5	41.67
	Graduate degree	1	8.33
	Total	12	100%

***Research question 1 results: What technology is currently being used in restaurants in Aruba?***

Based on the interviews conducted, it was discovered that the majority of the restaurants use technology in at least one area of the operation. Out of the 12 participating restaurants, 33.3% use a reservation system, another 33.3% use a website to manage their reservation system, and the remaining 33.3% use no system at all. Regarding the use of a POS system, 41.67% use the system “Micros,” 25% use “Aloha,” 1 restaurant uses a chain-based system, another restaurant uses an unnamed POS system, and the remaining 16.67% use no POS at all, but only a manual order recording and a cash register.

In the back of the house area, it was reported that 11 restaurants, or 92%, use “QuickBooks” for accounting purposes. As for technology used in the kitchen or back-of-the-house areas, only the capabilities that the POS systems provide were utilized. There were no additional technologies used in the back-of-the-house systems. In general, it can be observed that restaurants see the importance of using technology in certain areas of the operation and thus are not reluctant to adopt technology in general. The majority of restaurants use accounting software and a POS system, which are both very important for revenue, sales, and expenses control.

***Research question 2 results: What inventory management systems (IMS) are used in restaurants in Aruba?***

The findings in Table 4 show that although five (42%) restaurants use some type of IMS, none of them uses a fully automated system in their operations. Two of the restaurants use a system to track liquor inventory, but still use manual count for food items. One of them

uses a Personal Digital Assistant (PDA) to take inventory and interfaces the food sales with the inventory usage and cost, but not with all the items. The reason for this, according to a restaurant H manager: *“In Aruba, for us it is very difficult; we have recipes in Aloha and then we check all the items, but every week we have price changes, so it’s a lot of work if you want everything to be 100%, so we do it, but we take key items and then we do inspections to do it, but not with the whole menu.”*

**Table 4**  
**Types of inventory management systems used**

	Frequency	Percent	Valid Percent	Cumulative Percent
Not fully automated	5	41.67	41.67	41.67
To be implemented	1	8.33	8.33	50.00
Spreadsheet	1	8.33	8.33	58.33
POS/No IMS	3	25.00	25.00	83.33
No system	2	16.67	16.67	100.00
Total	12	100	100	

On the other hand, restaurant L uses software for food items and recipe control, but still uses manual tracking for liquor usage. Although the restaurant bought a scanner for improved control of the inventory, the manager said: *“We have had no time to set up all the information needed for it to work properly, so we prefer to do it manually until we find the time to do it.”*

One of the restaurants uses a POS system that has a feature called “product management.” This function compares inventory usage with sales; however, inventory counts are still done manually. Another participant uses a feature of the POS system for stock control, but will implement a newer system. Nevertheless, they will still do the inventory manually. When asked whether they would move to using an automated system so they can take inventory digitally instead of manually, the answer given was: *“No, not for the time being, I don’t think so. The economy, you know...”*

Another restaurant is also in the process of implementing a fully automated system that will handle everything, including reservations, sales, inventory control, etc. Other participants use no POS system, but use Excel spreadsheets for recipe control and thus inventory usage. Of

the remaining restaurants, two use no inventory tracking system at all, and although the other three use POS systems, they do not use the features these systems offer for inventory control. One comment given by the manager of restaurant I in relation to not using the inventory control features of its POS system was: *“Well, we tried to do it with “Aloha”, but some way or another it did not really work out and you know, you have to update your system every day and it really did not work out, and we are not that big of a restaurant, so we have to do it manually.”*

These results suggest that although restaurant managers/owners find it important to have some type of IMS, they are not aware of the capabilities and benefits of using technology in this area. It can be said that even those restaurants that are using an automated system are not aware of the benefits it can offer, because it is not being used to its full capacity. This result indicates that additional training and services may be needed to maximize the capabilities of technology in which an investment has already been made, and it may be a reason that other restaurants are reluctant to implement such systems.

Using a cross-reference analysis made in SPSS between the types of IMS used and the number of years the restaurants have been in operation, it was observed that the five restaurants that use a “not fully automated IMS” have been in operation one-to-ten years. The restaurant that is in the process of implementing a system has been operating for less than five years and those that use a POS system (without using the inventory management features) have been in operation from 6 to 20 years. It was also observed that the two restaurants that do not use an IMS at all, have been in operation for longer than 20 years, thus giving insight into why they may be reluctant to adopt new technology. Although the owner of one of these restaurants (restaurant G) has been evaluating the possibility of adopting new technology, it was stated that the reason for doing it was the following: *“It’s been 30 years we have been using the same technology- which is 3 pieces of paper, one receipt goes to the chef, one receipt goes to accounting, one receipt goes to back of the house, so that is how we have been controlling it for the last 30 years, so getting the new machine is really just an upgrade, because we have had honestly no problems whatsoever with the three sheets, because there is no way you can steal!”*

This finding indicates that newer restaurants or restaurants that have been in operation for less than ten years are more likely to adopt a technology for inventory control than those that have been in operation for more than 20 years.

***Research question 3 results: What is the level of satisfaction with the current inventory management system (IMS) used?***

When asking participants to rate their level of satisfaction with the current IMS used from “Strongly Agree” to “Strongly Disagree,” the majority of restaurants, or 58%, answered that they “Moderately Agree” that they are satisfied, and the remaining restaurants answered “Strongly Agree.” A cross reference analysis made in SPSS was used to compare the type of IMS used with the level of satisfaction of using such. Restaurants reported different levels of satisfaction with the current system used, regardless of whether it was automated or not.

Based on these results, it can be stated that, in general, restaurants are satisfied with the type of IMS used, regardless of having an automated system. Taking these results with the results from research question 2, it can be stated that restaurant managers/owners do not actually see the need for using an automated system.

***Research question 4 results: What is the managers’ perception towards adopting an inventory management technology system in Aruba?***

When asking the six participants who do not use an automated IMS why they do not adopt an automated system for inventory control, four of them reported that the main reason is budget. The owner of restaurant K mentioned that besides budget, he also considered “time” to be a constraint; he commented: *“It’s probably easier to use technology, but we’re a small restaurant. We find it easier just to do it manually. It’s probably faster to do it at a computer, but we just haven’t had the time to go into it and do it.”*

Another comment from a participant: *“For a small company that we are, you know, we never considered it. Nobody ever thought— no. With a small company there are a couple of things you don’t have the money to invest in.”* One participant stated: *“Maybe we will adopt a system; it depends, not this year, because this year has been very bad for all of us, so most probably not...maybe if things go well.”*

The remaining restaurant (Restaurant G) does not consider time or cost to be a reason for not moving to an automated system, the owner just considers that: *“This is the way we have been doing it for the last 10 years and I’m just accustomed to doing it like this!”*

The data revealed the participants’ other perceptions regarding the implementation of automated systems. These included (1) fluctuating electrical supply, which can have a negative effect on the system and can generate data loss, (2) maintaining and keeping up hardware, (3) training

employees who have been accustomed to using a manual system for many years, (4) updating prices as well as entering new items purchased on a regular basis (time consuming), and (5) tracking liquor usage with 100% accuracy, because bartenders have different pouring styles.

Using this information, it can be stated that although 83.34% of the restaurants reported budget to be the main reason for not adopting an automated IMS, managers also perceive different challenges attached to the implementation of the system, thus reinforcing their reluctance towards adoption.

### ***How satisfied are users with the automated IMS used?***

Five participants who use an automated IMS were asked to rate their system on a scale from 1 to 5, with 1 being very poor and 5 being excellent. All of them rated it as a 4 or “Good.” The majority of participants commented that when you give yourself a five, there is no room for improvement. The manager of restaurant B said, *“I don’t give it a 5, because it is not linked to my sales.”* The manager of restaurant H also commented: *“I think it is easier to use, the only problem is if you want to do this good, then you need a cost controller, like the hotels have that function and only that person is putting every invoice, every item in the system, and making sure the process is up to date and that your system is 100%. But the system works easier, you have a small PDA, you make your inventory and it goes in your system and then more or less you know if everything is good.”*

In addition to this, the participants that use an automated system were asked whether they consider the support provided by these companies to be good. The five restaurants answered that they don’t really need that much support since they have learned how to use the system throughout their years of experience, but still they consider that the support offered on the island is not good. Manager of restaurant H commented: *“I think the company is not doing well enough, they can do better. I think they should make a troubleshooting guide, that’s an issue they have and I’ve told them many times, but they don’t do it and that would make their lives so much easier and for us too.”*

Restaurants are satisfied with the automated inventory system used and therefore do not find it necessary to use the system to its full capacity. Operators even consider they do not need the companies’ support and that they are able to operate the system efficiently. These results suggest that the companies that sell the automated IMS systems need to provide more support to their customers and train them in all the benefits. Even

though they may indicate that they do not find it necessary to utilize the systems full capabilities, the restaurant operators may find many of the features time saving and thus may lead to better service times, quality, and overall efficiency.

Participants were asked to rank the importance of an inventory control for restaurants on a Likert scale, from 1 = "Strongly Agree" to 5 = "Strongly Disagree." One hundred percent of the participants answered "Strongly Agree." The majority of the restaurants related the importance of inventory with money and revenue. Using as a reference the findings discussed in the research questions, it can be stated that although all restaurants consider inventory control to be highly important for their profitability and revenue, they do not consider the link that adopting an automated IMS would enhance inventory control greatly and therefore boost profitability and results.

Using the same scale as the previous question, participants were asked whether they considered the use of an automated inventory system to be important for the restaurant. The results indicate that 50% of the restaurants answered "Strongly Agree," 33% answered "Neither Agree or Disagree," and the remaining 17% answered "Strongly Disagree." A statement of each answer will be provided in order to get an insight into the managers'/owners' perception of this topic: (1) *"Strongly agree because you can get whatever reports you want or create whatever you want. It gets down to every detail, everything. It's better! With a manual system, it's tough!"*

(2) *"I consider that neither agree nor disagree, because inventory is still something that you can do the old fashioned way. It's very simple if I go now in the bar and I count the bottles of beer and I do a small inventory and then if tomorrow I check it again, it should match my sales. It actually makes your life easier but it's not necessary."*(3) *"I strongly disagree because as long as somebody keeps track of.... everything matches up with the cashier, accountant takes everything; they do everything. If there is one thing wrong, we know about it and we will catch it right there."*

These findings suggest that although restaurants are not using automated IMS, some of them are starting to realize the importance of adopting such a system. A few still see no difference between using automated versus non-automated.

When asking participants the frequency with which they take inventory, one reported that they do it daily, six restaurants do it monthly, four of the restaurants do it daily and monthly, and the remaining restaurant does it daily, weekly, and monthly.

Participants were asked to provide the food-and-beverage cost percentage they aim to achieve per month. Although no range was given, there were some frequencies in the food-cost percentage. Three restaurants reported 27% food cost, four reported 30%, two aimed for 32%, and the remaining three did not want to provide this information. In terms of the beverage cost percentage, a wide variety of percentages was provided, ranging from 15% to 32%.

Using this semi-structured question, participants were able to identify different procedures they use for inventory control from theft, waste, and spillage. Several options were identified, but among the most common and popular were using security cameras, monitoring reports of waste and spoiled items, performing spot checks, taking inventory daily, monitoring through the POS system, monitoring food-and-beverage cost percentages, and controlling through constant supervision from owners/managers.

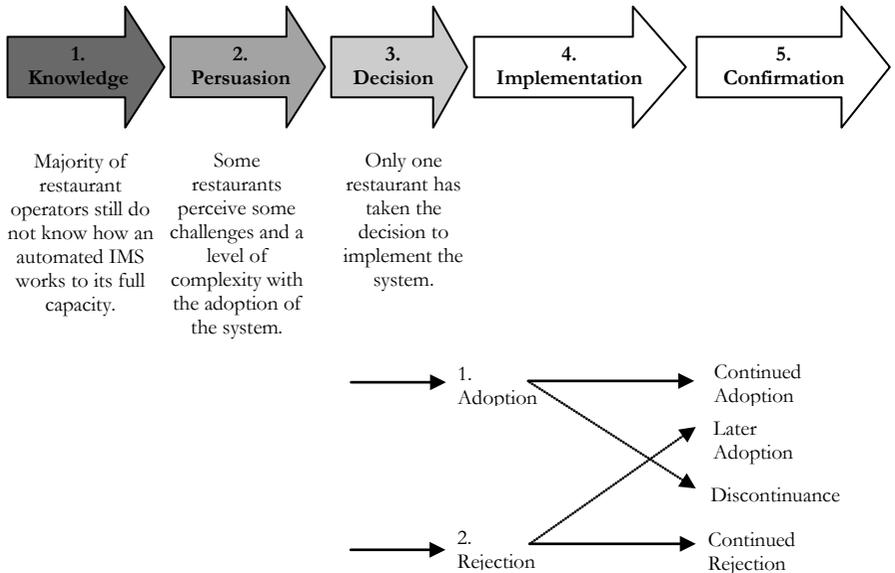
### **Application of Theoretical Framework**

The final objective of this study was to present the results in the Technology Adoption Model (TAM) (adapted by Wang and Qualls, 2007) and identify the stage of adoption and the implications in the technology adoption process. Based on the findings and discussion of this study and using an integrated theoretical framework, the current position, perception and organizational behavior of restaurants in Aruba towards technology adoption will be indicated. Using the Model of Five Stages in the Innovation-Decision Process, by Rogers (1995), the following model (Figure 1) shows the stage in which Aruba's restaurants are located based on their adoption of technology for an IMS. The results suggest that restaurants in Aruba have not arrived beyond the "Decision" stage. Although some restaurants use some type of automated IMS, the capabilities of the system are not being fully utilized. This can be attributed to the fact that employees lack knowledge of how to use the full system effectively. The results indicate that restaurants should currently be categorized in the knowledge stage; nevertheless, since some of the restaurants have gone through stages 1 and 2 and only one has arrived at stage 3, a brief explanation of the first three stages will be provided.

Figure 1 Postulates where Aruba's restaurants are in the Innovation-Decision Process of an automated IMS (adapted from Rogers, 1995). There are five stages in the overall process. The first stage is identified as *knowledge*. The majority of the restaurants are still in the process of determining what systems are available and how they work.

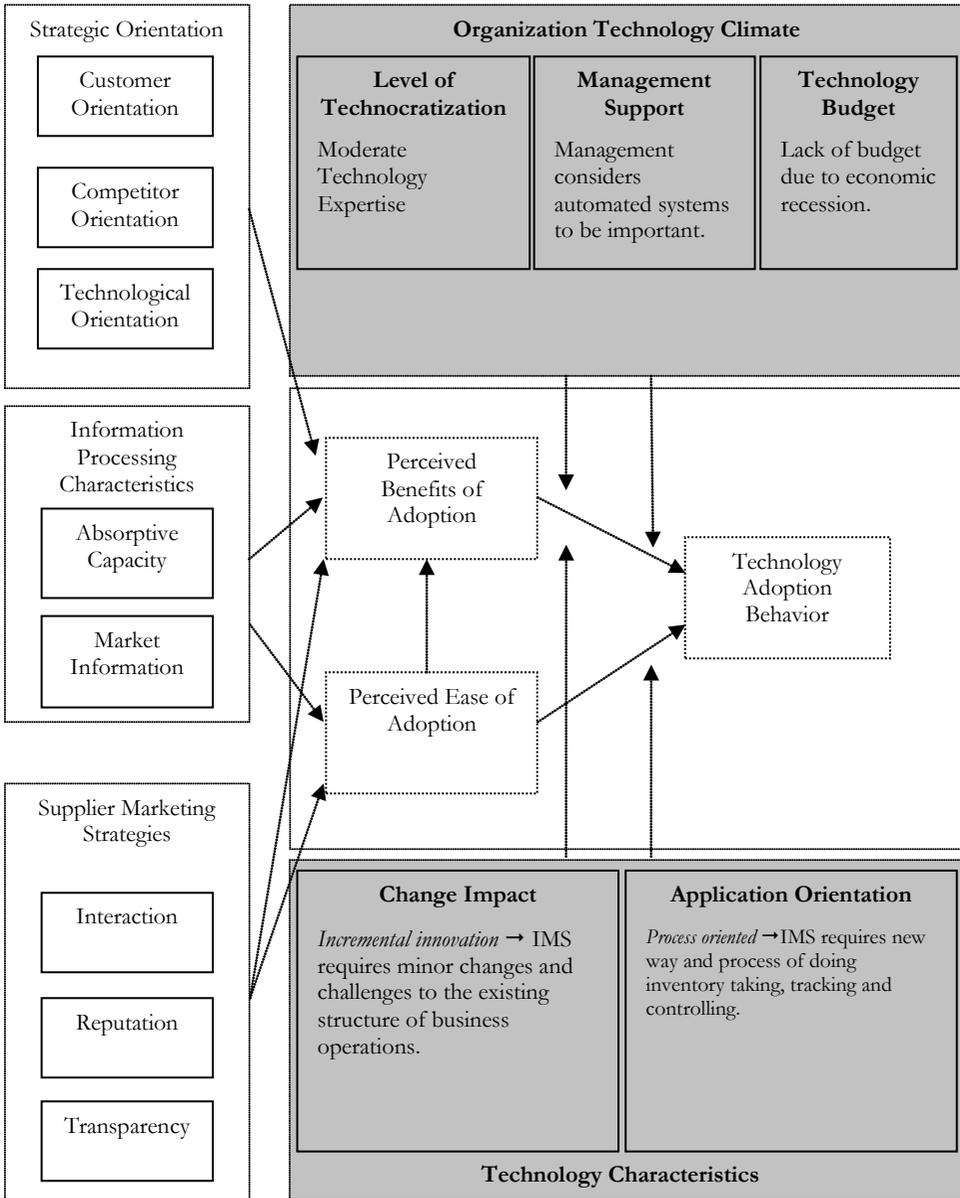
The reason for restaurants being in this category can be attributed to a lack of support by the companies that offer such systems in Aruba. Some restaurants are not interested and therefore have not entered the process yet. The second stage is identified as *persuasion*. Few restaurants have arrived at this stage; those that had identified some challenges and difficulties in the ease of use, time, training of employees, etc. This can be attributed to the fact that the knowledge acquired was not complete and therefore hindered them from seeing the actual benefits the system provided and how profitable it could be. The third stage is the *decision* stage. Based on the data, only one restaurant had arrived at this stage. After obtaining accurate knowledge and shaping a positive attitude towards the innovation, it decided to adopt the technology and use all the features of the system to maximize capacity. As of the date these interviews were conducted, the restaurants had not arrived at the fourth stage, known as the *implementation* stage. The final stage is called the *confirmation* stage.

**Figure 1**  
**Innovation-Decision Process of an Automated IMS**  
*for Aruba Restaurants (adapted from Rogers, 1995)*



Using the Technology Adoption Model (TAM) by Wang and Qualls (2007), Figure 2 indicates where Aruba’s restaurants currently are in the technology adoption process. The model shows how the organizations’ technology climate and technology characteristics, as perceived by managers/operators, affect the adoption of an automated IMS.

**Figure 2**  
**Aruba Current Technology Adoption Model**  
*(adapted from Wang & Qualls, 2007)*



The first part of the model addressed is labeled the “Organization Technology Climate.” It includes three components: level of technocratization, management support, and technology budget. For the “level of technocratization,” it can be said that Aruba’s expertise in technology is moderate, as there are some restaurants that use reservation and POS systems as well as software for accounting purposes. For “management support” it was observed that management attitudes towards technology adoption were not negative. Half of the respondents stated that they consider the use of an automated system for inventory control to be strongly important. “Technology budget,” the third component, was an issue that was highlighted during the research. The majority of the restaurants stated that due to the economic recession they don’t have the budget to invest in an automated system and they would probably implement a system when the economic situation turns around.

The “*Technology Characteristics*,” another part of the TAM model has two components: (1) change impact and (2) application orientation. The “change impact” is considered the type of innovation proposed, which is an automated IMS. It can be said that it falls into the category of incremental innovation. The reason for this is that implementing this system requires minor changes and challenges to the existing structure of business operations. When applying the case of Aruba restaurants to the adoption model, the “application orientation,” it can be said that the IMS is a process-oriented innovation, due to the goal of introducing a new way of controlling inventory. This can represent a challenge to the technology adoption, as it was previously stated that these types of innovations are less preferred by organizations than product-oriented ones. This may be the reason why manager/owners do not consider it as important to invest in the technology during difficult economic situations.

## **LIMITATIONS AND FUTURE RESEARCH**

This was an initial exploratory study to identify the adoption of technology for food-and- beverage inventory control in restaurants in Aruba. For this reason, the results of this study are limited in scope because the sample size was small. Despite the small number of restaurants, the sample selected was thought to be good representation of the industry at large on the island and provided a good basis for examination. Another limitation was that the restaurants selected were members of the Aruba Gastronomica Association, and therefore have been in operation for more than a year. The limitation in this is that the findings suggested that newer restaurants are more likely to adopt the

technology and hence the research may not have shown whether newer restaurants are currently using the technology on the island.

Although there were some limitations in the study, the results offered evidence that have provided a better understanding of restaurant owners'/managers' perceptions of adopting an automated IMS in Aruba. Future research should then consider investigating the relationship between years of operation and technology adoption, as well as use a larger sample size in order to be able to generalize the findings. The results of this study can be used in subsequent research to determine whether there is a predominant trend towards a lack of adoption of technology for inventory control in restaurants in Aruba, in other island economies, or throughout other locations around the world.

## CONCLUSIONS AND RECOMMENDATIONS

Overall, the results of this research point out that although restaurants in Aruba have not been reluctant to adopt technology in some areas, such as accounting and front of the house (POS), they are not technologically oriented towards incorporating an automated inventory management system (IMS). Even though all restaurants recognize the importance of inventory control, they are not maximizing its effectiveness by using an automated system; in fact, it was observed that the majority of the restaurants are still using manual practices for inventory management. Even the restaurants that are using some type of automated IMS are not taking advantage of all of the benefits this offers, as they are not using the system to its full capacity.

Although it was reported that half the respondents consider it important to have an automated system for inventory control, different factors and perceptions are dissuading restaurant owners/managers from adopting the system:

- *Familiarity with approach:* the results of the research indicated that some reluctance towards adoption can be attributed to the number of years the restaurant has been in operation, especially the restaurants that have been operating for longer than 20 years. The older the restaurant, the more difficult it is for them to adopt the changes, as they are accustomed to the system they have used for so many years. On the other hand, the newer the restaurant, the more likely it will adopt the technology.
- *Budget:* considering the current economic situation, managers/owners consider that investing in the technology is costly and not necessary.

- *Time*: there is a perception that implementing an inventory management system is time consuming.
- *Lack of support*: there is a lack of support from the systems' distributors; therefore, managers/owners are not informed on all the features the systems offer.
- *Technology characteristics*: some characteristics the system requires are perceived by managers/owners as challenging. Some of these include maintaining the system, training of staff, transforming the process, and others.

Based on the findings of this research, one of the most important recommendations the researcher would make for the restaurant industry of Aruba is "Training." Associations such as the Aruba Gastronomic Association, and the Aruba Hotel and Tourism Association should make a commitment to provide restaurants with the information necessary for them to be able to implement an automated IMS effectively. To do this, several topics need to be discussed in order for the managers/owners to assess the importance of adopting such systems. These topics would include the following:

- *Impacts of Information Technology*: considering the current impact technology is having in all aspects of business, it is very important for restaurant managers/owners to see the importance of investing in technology for the management of their restaurants; this is essential, especially for operators who have been working in the industry for many years, as they are more reluctant to transform and change. Technological innovations can help a restaurant operation minimize costs, boost profitability, and much more.
- *Importance of inventory control*: managers/owners need to be aware of the potential losses an ineffective inventory control can produce. Employee theft, waste, spillage, and ineffective inventory tracking are a few of the things that can affect a restaurant's profitability, potentially even causing bankruptcy.
- *Benefits of using an automated IMS*: it is important for managers/owners to know and understand that controlling inventory with an automated IMS is ultimately less time- and labor-consuming than using a manual procedure, and it is more accurate, thus offering more control and increasing the restaurant's profitability.

- *Types of automated IMS available:* in order for restaurants to be able to adopt an automated IMS managers/owners need to know what systems are available in order for them to analyze which system can better suit their specific needs.
- *Long-term orientation:* it is important for restaurant owners/managers to evaluate the impact of technology with a long-term orientation. A long term orientation would help them understand that such investment is worth it, because it would bring many benefits for the company in the long term. Nevertheless, many users of automated IMS have reported quicker return on investments than was initially anticipated.

Besides this, the companies that are offering the automated IMS on the island should also improve the support given to its customers by constantly updating them on new technologies and applications available and by providing trainings in how to manage the system applications to their full capacity.

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