Analyzing the Adoption of E-payment Services in Smart Cities using Demographic Analytics: The Case of Dubai

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A R T I C L E   I N F O

A B S T R A C T

This paper is an extension of previous research that has been done on factors affecting digital payment adoption in the UAE. This study focuses on analyzing which relevant demographic factors affect new e-payment technologies, mainly in the smart city Dubai, with more complexities and dynamics of variables that affect users' behavior toward adopting new technologies. The current research included a wider range of demographic factors compared to previous studies. Quantitative methods were conducted using a survey of 270 individuals living and working in Dubai. This study revealed that e-payment adoption is very high, which could be aligned with the national digital transformation strategy of the UAE. The results of the chi-square test for independence indicate that using e-payment technologies is positively associated with the level of education and the level of income. This is confirmed by the fact that the UAE's demographic shape is identified by its high-income groups, positively influencing the residents' e-payment adoption. Surprisingly, the significant results for independence were not found between using e-payments and the gender, marital status, age group, and the current professional position in Dubai. This research's contribution adds to both academia and industry in the digital transformation and technology adoption field. Based on the results, it is recommended for decision-makers to leverage education, digital literacy, and income to accelerate moving toward a cashless economy. However, not having statistically significant differences between the rest demographic variables and adoption will encourage businesses and e-payment service providers to deliver new innovative e-payment models and technologies in a smart city context.

1. Introduction

The fourth industrial revolution (Industry 4.0), with its emerging technologies, brought new innovative technologies to reshape the whole economy and our life [1]. However, it is creating many concerns about security, privacy, and governance. It is crucial to adopt a socio-technical approach to manage digital transformation and conduct effective change management strategies to expand it from an enterprise to a society level, especially when it comes to smart cities as more complex systems in the digital economy.

The United Arab Emirates (UAE) case in incubating digital transformation using emerging technologies is considered one of the most exciting cases to be analyzed and investigated in the Middle East. Especially after the launch of the national digital transformation agenda and several futuristic acceleration initiatives toward the digital economy. All of that had created an atmosphere to accept and adapt faster to technological disruptions, mainly in the fast-growing E-Commerce sector [2]. With growth expected to reach 23% annually between 2018 and 2022 with an estimated 27 billion dollars only for E-Commerce transactions in 2022 based on a study done in collaboration between Dubai Economy Department and Visa [3].

The UAE's strategic goal to shift from an oil-dependent economy to a knowledge-based one, firstly accelerated pace of digital transformation projects across all the government sectors, followed by digital innovation in several business sectors to renovate their models and realign with the digital faster. For instance, Emaar properties initiated noon.com, and Amazon

acquired souq.com as evidence of the enormous potential of digital business in this region [4]. Additional factors that enabled the UAE to grow at a higher rate regarding e-commerce and digital payment could be linked with the UAE consumer demographic profile. Such profile is featured by a young internet-savvy population, with high social media usage that reaches 99% and 91% for the internet penetration. Along with more than 66% for smartphone penetration and above 7 hours per day for time spent online, which all of this considered higher than the most mature e-commerce markets worldwide [3]. Moreover, the availability of efficient and reliable payment technologies is crucial to digital business growth in any country. The momentum of digital transformation in the payment services in the UAE attracted Big Tech companies such as Apple, Google, Alibaba, and Samsung to provide their digital payment services as well as local companies such as Etisalat, Beam, and local banks to compete in this sector [5].

The fourth industrial revolution we live in with a broad spectrum of emerging technologies is expected to play an indispensable role in reshaping the whole payment industry. For example, artificial intelligence technologies, particularly machine learning algorithms and face recognition, are currently used to conduct payments as a new trend in China [6]. Also, blockchain technology enabled the creation of cryptocurrencies as a way of payment used by several countries [7], [8]. The success of new E-payment services based on such emerging technologies depends on the maturity of such technologies, environment, and end-users acceptance, which are extremely dynamic and changing fastly, hence require a continuous re-evaluation of relevant demographic factors.

This paper is an extension of work initially presented in the IEEE International Conference on Digitization (ICD) [9], which recommended the need to adopt a socio-technical design approach for digital transformation and innovation the payment services in e-commerce which is evolving exponentially in this region. That initial work recommended the need to reinvestigate to which extent demographics variables are relevant and directly affect e-payment adoption in general and especially for the smart cities context in developing countries. The lack of studies in the current literature about emerging new e-payment technologies in developing countries' smart cities is apparent. We believe this area was not addressed in the existing literature according to our best knowledge or only tackled technical perspective without considering the social factors. Thus the current research aims to provide a more in-depth analysis of how demographic variables influence the adoption of existing and new e-payment technologies in Dubai as one of the most promising smart cities in the whole region.

The paper is organized as follows. A literature review on related work about e-payment adoption is introduced in section two, followed by section three for the used research methods. Results and discussions are covered in section four; last, the conclusion and the implications of these study findings to the industry and potential new directions for research are presented in section five.

2. Literature Review

Day by day, the diffusion of new e-payment technologies is expanding globally. The World Bank reported that small retailers in 2015 received 15 trillion dollars via technological payment channels, representing 44% of global transactions [10]. The percentage of people who are using cash decreases substantially; for instance, cash users in North America dropped from 16% to 11% in 2020 compared to 2018. In emerging economies, the rate of cash usage is still comparatively higher [11].

It is noticeable that there is a growth in e-payment adoption in countries with active governmental digital transformation and ongoing smart city programs such as China, India, UAE, and Saudi Arabia. For instance, In 2019, both UAE and France headed other countries in delivering a complete set of Citizen to Government (C2G) e-payment services [12]. That reflected how the UAE government is serious about moving into a cashless economy, as revealed by the Central Bank of UAE in 2018 [13]. However, the same report reflected that the UAE ranked 27 among 72 analyzed countries regarding government e-payment adoption ranking. This indicates that more efforts are needed in this full digital transformation journey.

2.1. Demographic Variables and e-Payment Adoption

Even though many studies about e-payment adoption were found in the literature, few studies associated with the adoption of e-payment in the UAE were found, some analyzed the E-payment adoption principally through SWOT and TOWS matrix [14]. Others used the extended TAM model to analyze the factors affecting the adoption of e-payment systems through a survey of university students in the UAE. In [15], the author investigated the factors affecting the adoption of smart government services in the UAE compared to other Arab countries [16], [17].

Authors studied how people from different socio-economic classes would behave differently toward using e-payment technologies and found that people with higher-income use e-payment technologies more than lower-income people since last have less access to ICTs. [18] Additionally, authots found that the level of education and age affected the behavior of users toward e-payment systems obliquely; because the older people are, the more education they get, and the more income they receive, which is proof that it impacts the use of e-payment. However, the study revealed that there is no relationship between e-payment usage behavior and any commodities and services (i.e., food, bills, transportation, etc.)

Their work also studied the correlation between using e-payment and specific channels such as credit and debit cards for online transactions, E-Money, and Money transfer via internet banking channels. The results showed a positive relationship between Credit and Debit Cards usage on the internet and the behavior toward e-payment systems, And a negative relationship between the behavior toward e-payments and e-money. Regarding the relationship between user behavior and money transfer via internet banking is found to be partially supported.

Other studies studied the usage of digital wallets via analyzing the relationship between awareness about digital wallets and demographic variables such as age, gender, income, etc. According to the study, people in the age group of 36-45 are the most interested in learning and using e-wallets. While the people in the group age 26-36 are more interested in using e-wallets than using credit and/or debit cards due to its continent features. As for

the relationship between the awareness of using e-wallets and gender, males are more interested in using e-wallets than Females; additionally, males prefer using e-wallets over cash use [19].

Other authors surveyed Ghana to investigate the influence of demographics on user's behavior toward using e-payment systems and found no significant relationship between gender and the use of e-payment. However, there is a relationship between age and the behavior to use e-payment systems, more precisely, the satisfaction of using the systems; because young people have more expectations from e-payment services, they are not satisfied easily. The level of education is not significantly related to the behavior toward e-payment systems usage; however, according to the study, users with a higher level of education feel less secure using the e-payment services [20].

A different study Investigated how socio-demographic factors affect usage of e-payment systems in Malaysia. According to the study, older people are less motivated to use e-payments. Married people use e-payment more than unmarried people due to the fact that married people have higher living expenses; additionally, they use e-payment systems more frequently than unmarried people in order to save time. The level of education is a significant factor affecting the use of e-payment services; according to the researchers, people with high education levels tend to use more e-payment services compared to less educated people. Additionally, the income level was found to be an important factor to affect the use of e-payment services; people with lower income levels are unlikely to use e-payment services compared to people with a high level of income [21].

The primary demographic variables, such as gender, age, educational level, and income, were studied to explain their impact on e-payment adoption [22]. The different categories of the population were examined to demonstrate this, involving students, employees, professionals, and business people. The research was designed to estimate the individual opinion related to the e-payment systems and their frequency along with demographic aspects. As a result, the educational process has a direct impact on the adoption of new e-payment systems.

The impact of age and occupation on e-payment systems usage and their influence on anticipated benefits and speed was examined by [23]. The study revealed that the significance of age on e-payment usage was not that considerable compared to the occupation variable. Furthermore, the paper demonstrated the substantial difference in the perception of e-payment technologies among such categories as business, retired employees and employees, students and homemakers; the three last-mentioned categories have a clear awareness about benefits and speed. Besides, these people have different opinions about facilitating conditions.

A research determined that e-payment card acceptance is not significantly affected by such factors as age, gender, education, and marital status of respondents. However, none of the previous studies investigated how demographic variables could impact e-payment adoption in the context of smart cities with a higher level of digital transformation and maturity of e-government services such as UAE [24].

2.2. E-Payment Channels

Previous studies showed that quick, easygoing, and trustable-payment techniques played an essential role in the success and spread of e-commerce worldwide [25].

Examining e-payment adoption requires an understanding of the new emerging technologies evolving fast and disrupting the whole sector, creating both new opportunities and challenges such as face-recognition algorithms, Blockchain, and implantable/wearable devices that definitely will gain greater acceptance in the future [8], [26].

There are main e-payment channels identified in the previous studies summarized in Table 1 [25], [27], [28] which include but are not limited to the following.

Table 1: The Main e-Payment Channels Identified in Previous Studies

Payment Channels	Description	Examples
Cards payment	This channel includes cards issued by banks such as debit cards, credit cards, internet shopping cards, or issued by shops such as prepaid cards, gift cards, and loyalty cards that can be used in certain shops at the cashier. [29] Most of these cards are using Radio frequency identification technology (RFID).	Bank cards, e-Dirham card, transportation Nol card for transportation, and emirates ID.
Web Wide Web (WWW) Payment	This method requires the use of the internet and websites to make a payment, mainly through internet banking websites or making online transfers or pay through a third party intermediary [30]	This includes PayPal or Cashu, as well as debit accounts using bank transfers.
Mobile Devices	This channel includes all smart mobiles of devices to conduct a payment mainly through several technologies such as digital wallets and mobile applications, SMS, and NFC. [31] [32]	Examples include mobile payment apps like Samsung Pay, Ali Pay, Apple Pay, bank applications, or payment through telecommunication providers such as Etisalat or DU.
Financial Services Kiosks	This approach includes conducting payment transactions through self-service digital kiosks or stand-alone-machines. [33]	Examples of this approach include both non-financial services such as paying bills or purchase a product or a service, as well as financial ones such as money transfer or payment using ATM.
Biometric payments	These approaches include using authentication based on biometric features of the body that are hard to copy and impersonate. [34]	Using several biometrics for an authentication mechanism, including faceprint, fingerprint, voice, and iris recognition
Cryptocurrency	This includes payment that is based on Blockchain technology as the main component of the IT infrastructure. [8]	Among the most well-known cryptocurrencies can be Bitcoin, Ethereum, etc.
Wearable devices	This approach of payment is still new amongst others and includes wearing devices or objects to substitute in the near future card and mobile payment. [26]	Real examples include payment through digital rings or smartwatches.

All previous studies reflected in general the significance of individuals' demographics on technology acceptance/adoption, such as e-payment technologies [35]. However, up to our best

knowledge, no sufficient studies have been made, including new emergent e-payment technologies with regards to demographic variables in smart cities as a special unite of analysis, where the adoption tends to be more complex, dynamic, and faster than other cities [36]. The primary objective of this study is to fill such gap and investigate the role of demographic factors in adopting several e-payment technologies in the case of Dubai as a case of smart city, having in mind the following main questions:

- To which extent various e-payment technologies are adopted in Dubai nowadays?

- How is the e-payment adoption affected by demographic variables?

3. Methods

3.1. Data Collection

The study was carried out using a self-administered online questionnaire, which consisted of two major sections. The first section comprises ten questions intended to collect demographic data and some information about using different e-payments technologies. The demographic information section included eight questions designed to collect information about the characteristics of the participants. Information was gathered about residents' income, current professional position, age, marital status, gender, and educational level. The second section contains 28 statements meant to examine those factors that influence the perception of using e-payment. The items in this section essentially required the respondents to choose to what extent they agreed with each statement. A Likert scale of one to five (1 = strongly disagree, 2 = disagree, 3 = agree to some extent, 4 = agree, and 5 = strongly agree) was used so that participants could rate their degree of agreement regarding the survey statements.

3.2. Sample and Population

The participants in this study were individuals living and working in Dubai. In this research, a nonprobability sample technique is used for collecting responses. To achieve the objectives of the current research, the researchers of this work used the convenience sampling technique, which is a type of non-probability sampling where population elements are selected for inclusion in the sample based on the ease of access. In some cases, judgment sampling is used where the researchers' judgment is used for selecting participants who are considered as representative of the population. A sample size of 270 eligible respondents was collected to conduct the study from the targeted population of individuals living and working in the Emirate of Dubai.

The pilot study was done on 15 individuals in Dubai before its dissemination to satisfy the face validity. Cronbach alpha, which is a measure of reliability based on the internal consistency of the constructs, was calculated and found to be 0.913. This indicating that the data collection instrument has attained a relatively high level of reliability. Hence, all items are retained.

3.3. Data processing and analysis

The respondents' collected data are recorded and coded in the Statistical Product and Service Solutions (SPSS v.25). For achieving the purpose of the study, a quantitative approach of research is used. Additionally, we used percentages technologies for counting all the yes-category of the items listed in the research tool instrument to measure each factor that influences the perception of using e-payment methods. The researchers used a t-test to perform a comparative analysis of using e-payment technologies between the gender and marital status, where each one of them has two categories. They also used the ANOVA test to compare the different educational level categories, individual income, and age groups. To validate the stated hypotheses, the researchers used the Chi-Square test of independence to test the association between the demographic variables used in this study and the use of e-payment technologies.

3.4. Research Hypotheses

Since the researchers in this paper mainly aimed at investigating the influence of demographic variables such as income, current professional position, age, marital status, gender, and educational level on the adoption of e-payment technologies, this study attempts to test and verify the following six hypotheses.

H_1: There is a relationship between gender and adoption of e-payment

H_2: There is a relationship between profession and adoption of e-payment

H_3: There is a relationship between age and adoption of e-payment

H_4: There is a relationship between education and adoption of e-payment

H_5: There is a relationship between marital status and adoption of e-payment

H_6: There is a relationship between income and adoption of e-payment

4. Results and Findings

4.1. Demographic Characteristics of The Respondents

We conducted an online survey to analyze the adoption of e-payment technologies in Dubai based on different demographic variables. A total of 379 respondents visited the survey's link, and 270 respondents (71.2%) completed the survey.

Table 2 summarizes the demographic characteristics of the respondents to the survey. The table shows that 52.6 % of the participants were males, 10.4 % were born before 1980 (Generation X), 32.6% were born between 1980 and 1994 (Generation Y), and 57% were born in 1995 or above (Generation Z). Twenty percent of the participants were married, and in terms of education, 26.3 % of them had High School or lower, 12.6 Diploma, 41.5% Bachelor's degree, 11.5% Masters and 8.1% were Ph.D. holders. In terms of the monthly income, the study found that 55.2% of the respondents have an income below 10000 Dirhams. 14.3% from 10000 to less than 20000, 18.2% from 20000 to less than 30000, 5.9% from 30000 to less than 40000 and 6.3% having a monthly income of at least 40000 Dirhams

4.2. E-Payments Channels

The enormous development of e-payment technologies in Dubai led to an increase in adopting such technologies by its

residents. Table 3 shows that out of 270 respondents, 84.3% of the individuals in Dubai stated that they are now using e-payment technologies, only 8.6% never used it before, and 7.1% used it in the past they are not using it anymore. This indicated that the majority of individuals in Dubai having experience in e-payment technologies.

Table 2: Demographic Characteristics of the Sample

Criterion	Category	Number	Percent
Gender	Male	142	52.6
	Female	128	47.4
Age Group	Less than 1980	28	10.4
	1980-1994	88	32.6
	1995 and above	154	57
Marital Status	Single	215	79.6
	Married	55	20.4
Education	High school or lower	71	26.3
	College (2 years program)	34	12.6
	Bachelor's degree	112	41.5
	Masters	31	11.5
	Ph.D.	22	8.1
Monthly Income	Below 10000	149	55.2
	10000 up to less than 20000	38	14.1
	20000 up to less than 30000	47	17
	30000 up to less than 40000	18	6.7
	40000 or above	13	4.8
Total		270	100

Table 3: The Frequency Use of e-Payments

Category	N	Percent
I am now using e-payment	226	84.3
In the past, I used to deal with e-payment, but am not using it now	19	7.1
I have never used it before	23	8.6
Total	268	100.0

Despite the enormous development of payment technologies for the governmental sectors in Dubai, the individuals') acceptance rates for the different e-payment channels have been found to be satisfactory. According to the survey's results, about 76 percent of individuals gave preference to Contactless Cards. However, 24 percent of them prefer to use cash until now. Furthermore, the acceptance rate of Online Payment(s) was found to be 66 percent, while 46 percent of individuals relied on Mobile Payments. Wearable Payment Devices and Digital Currency are seen to have lesser excitement among individuals, where 5 percent of the respondents believe that they would be using each one of these techniques. The Website Domain Payments and ATM through Different Mobile Applications are also seen to have even lesser excitement among individuals where only one percent of the individuals in Dubai believe that they would be using each one of these techniques. Finally, the rate of acceptance of Artificial Intelligence Payments is only 0.6 percent. Even we expected that Artificial Intelligence Payments would not be used at all at the time of data collection of this research since that technology was not available but in a few smart cities around the world. As per the diversity of people in Dubai, we expect that those who used that

technology initially comes from these cities and will make these technologies transfer faster to Dubai based on government support to attract new technologies for their residents.

Out of the 51 nationalities that participated in this study's survey, the acceptance rates of different payment channels for the 11 dominant nationalities living in Dubai are summarized in Table 4. The table revealed that most of the dominant races selected Contactless Cards as their first choice with a percentage exceeding 80% for the Canadians, Indians, Pakistanis, Lebanese and Saudi Arabians, while it was between 68 and 77% for UAE, Egyptian, Iranian, Chinese and Jordanians. The Online Payments are selected as a first choice for the Syrian (85%) and Chinese (75%), and as a second choice for the Canadian (80%) and most of the dominant nationalities (50 to 69%), but not for the Lebanese, who selected Mobile Payments as a second choice. Only the Chinese have chosen Mobile Payments as their first choice, and all the other dominant nationalities set this digital mode of payments as their third choice with percentages of users around 50%.

Table 4: The Distribution of e-Payment Channels Based on the Dominant Nationalities in Dubai

e-Payments Channels							
	Online Payment	Contactless Cards	Mobile Payment	Payment Kiosks	Wearable Payment Devices	Digital Currency	Artificial Intelligence payment
UAE	60% (53)	77% (53)	55% (53)	2.8% (53)	4% (53)	3.5% (53)	15% (53)
Jordan	64% (25)	68% (25)	56% (25)	25% (25)	0% (25)	4% (25)	8% (25)
Egypt	69% (13)	77% (13)	53% (13)	31% (13)	0% (13)	7% (13)	7% (13)
Syria	85% (13)	61% (13)	46% (13)	54% (13)	7% (13)	15% (13)	0 (13)
Lebanon	36% (11)	82% (11)	46% (11)	18% (11)	0% (11)	0% (11)	9% (11)
Saudi Arabia	66% (6)	100% (6)	17% (6)	16% (6)	0 (6)	0 (6)	0 (6)
Iran	62% (8)	75% (8)	50% (8)	25% (8)	0% (8)	0% (8)	0% (8)
Canada	80% (15)	87% (15)	40% (15)	7% (15)	6% (15)	0 (15)	0 (15)
India	62% (25)	80% (25)	38% (24)	13% (24)	8% (24)	8% (24)	4% (24)
China	75% (4)	75% (4)	100 (3)	75% (4)	50% (4)	50% (4)	25% (4)
Pakistan	50% (12)	91% (12)	42% (12)	25% (12)	8% (12)	0 (12)	0 (12)

4.3. The Use of e-Payment technologies for Regular Services

The participants in the survey were asked to identify the most frequent uses of e-payments for regular services, such as paying utility bills, food, clothing, electronics, phone internet, insurance, travel, education, road toll, and entertainment. The analysis of data revealed that most individuals in Dubai use e-payments for food (77%), clothing (71%), entertainment (67%), phone internet (57%), utility bills (48%), and travel for leisure (41%), whereas the paying for road roll, education, and electronics were used by about 35% of the individuals in Dubai for each one of these regular services.

For investigating the most frequently used e-payment techniques -based on location, the survey respondents were asked which e-payment techniques they use most regularly and from where. As observed in Table 5, more than 47% of Dubai individuals used Online Payments most frequently from home, 45.1% at shopping malls, 26.6% at work, 24.9% at the bank, and 19.2% at school. More than 48% of individuals are using Contactless Cards most frequently at home, 58.1% at shopping malls, and around 25% at each of the work, banks, and schools. The use of Mobile Payment and Payment Kiosks ranked third and fourth, were 33.3% and 17.4%, respectively, of the individuals in Dubai, are using these two e-payment techniques from home. Almost 35% and 20% of the individuals are using them at shopping malls. Mobile Payments are used by about 20% of the individuals in Dubai at either the bank or at work. However, Payment Kiosks for almost half of this number for the same regular services. Less than 5% of individuals are using Wearable Payment Devices, Digital Currency, or Artificial Intelligence Payment at any one of the mentioned regular services

Table 5: Percentages of the Most Frequently Used e-Payment Channels based on the location

e-Payment Channels							
	Online Payment	Contactless Cards	Mobile Payment	Payment Kiosks	Wearable payment devices	Digital Currency	Artificial Intelligence payment
Home	128/ 47.4	131/48.5	90/33.3	47/17.4	13/4.8	11/4.1	11/4.1
Malls	122/ 45.1	157/58.1	93/34.4	53/19.7	12/4.4	10/3.7	13/4.8
Work	72/26.6	69/25.5	56/20.7	33/12.2	11/ 4.1	5/1.8	5/1.8
Bank	67/24.9	70/25.9	55/20.3	28/10.3	8/2.9	8/2.9	7/2.6
School	52/19.2	66/24.4	31/11.4	22/8.1	6/2.2	5/1.8	4/1.5

4.4. Comparative analysis of using e-payment techniques between groups

This part of the research identified the difference in using e-payment technologies among the different categories of each demographic variable used in this study. The investigation is based on the differences in using e-payments values between the different categories of each variable by analyzing and examining the Mean scores (M) and Standard Deviation (SD) of each category's values supported by performing the two independent samples t-test and ANOVA test.

As predicted, findings of the study show that males are more interested in using e-payment technologies (M = 3.91, SD = 0.81834) than females (M = 3.72, SD = 0.90083). As shown in Table 6, results from an independent samples t-test indicated that the difference between the two genders was significant, t(268) = 1.810, p = 0.071 at a 10% alpha level.

Likewise, the married participants were outperformed (M = 4.0242, SD = 0.67237) the singles (M = 3.7690, SD = 0.89818) in using e-payment technologies. Moreover, the results from an independent samples t test showed that the difference between the

two groups of the marital status was significant, t(108) = -2.332, p = 0.021.

Table 6: Group mean scores in relation to the gender and marital status variables

Variable	Group	Mean (M)	Standard Deviation (SD)	t-cal.	p
Gender	Male	3.9108	0.81834	1.810	0.071*
	Female	3.7213	0.90083		
Marital Status	Single	3.7690	0.89818	-2.332	0.021
	Married	4.0242	0.67237		

*The mean difference is significant at 0.10 levels.

Table 7: Descriptive Statistics for the Using of e-payment for the Educational level, income, and the Age variables

	N	Mean	Standard Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
High school or lower	71	3.7793	.85994	.10206	3.5758	3.9829
College	34	3.8333	.71657	.12289	3.5833	4.0834
Bachelor's degree	112	3.7143	.91573	.08653	3.5428	3.8857
Masters	31	4.0323	.85355	.15330	3.7192	4.3453
Ph.D	22	4.1818	.71067	.15152	3.8667	4.4969
Below 10000	149	3.7987	.85847	.07033	3.6597	3.9376
10000 up to less than 20000	38	3.8333	.88955	.14430	3.5409	4.1257
20000 up to less than 30000	46	3.8986	.83109	.12254	3.6517	4.1454
30000 up to less than 40000	18	3.9074	.73924	.17424	3.5398	4.2750
40000 or above	13	3.9692	1.14167	.31664	3.0793	4.4591
Less than 1979	28	3.9881	.79857	.15092	3.6784	4.2977
1980-1994	88	3.7311	.99918	.10651	3.5194	3.9428
1995 and above	154	3.8420	.78493	.06325	3.7170	3.9670

Additionally, the ANOVA test's large p-values indicate no significant differences among the different categories of the participants' income, educational levels, and age groups regarding the use of e-payment technologies. Moreover, the descriptive statistics presented in Table 7 show that participants with high education levels tend to use more e-payment technologies compared to less educated participants increased slightly and gradually from 3.77 for the High school or lower educational levels to 4.18 for the Ph.D. holders. Even though the p-value of the ANOVA test was large for the monthly income, the study found that this variable is slightly affecting the use of the e-payment technologies; people with lower income levels are unlikely to use e-payment services compared to people with a high level of income. Similarly, the study of e-payment technologies found that the participants born before 1979 are the most interested in using e-payment technologies, with an average of almost 4. While the

participants born between 1980-1994 are least interested in using e-payments technologies with an average of 3.73, and the young participants born after 1995 are in the middle with an average of 3.84.

5. Testing Hypotheses and Discussion

This study uses a sample of 270 individuals living and working in Dubai on a self-administered online questionnaire to assess how e-payment adoption is affected by demographic variables. The study tested and verified five hypotheses that assumed the adoption of e-payment technologies is influenced by gender, current professional position, age, educational level, marital status, and income level.

5.1. Hypotheses Testing

This section discusses the association between the use of e-payments and demographic variables aiming to investigate the importance of individual's demographics on the adoption of e-payment technologies, Findings of the study show that about 55% of individuals the Ph.D. holders and 52% of the Masters' holders are using Mobile Payments comparing with about 42% for the individuals with the lower education. This yields that the higher educated individuals in Dubai tend to use more Mobile Payments than lower educated individuals. On the other hands, Dubai's individuals with low income (less than 10000 dirhams) and students are using Online Payments significantly with a lower amount (about 60%) comparing with those individuals with high income or from none students current professional position categories (more than 71%) with a maximum percentage of users from the executives' category which reached to more than 82% of them.

Table 8: Chi-Square Test for Independence, H_0: Using e-Payment (Variable 1) and Variable 2 are Independent

Variable 2	Chi-square	Asymp.Sig. (2 sided)
Gender	3.291	0.193
Education	14.923353	0.060653
Marital Status	3.715201	0.156047
Monthly Income	18.292553	0.019137
Age	5.528197	0.237262
Current Professional Position	8.653823	0.565242

Table 8 shows the chi-square ($\chi2$) test results for independence between the using e-payment technologies and each of the demographic variables investigated in this research. Statistically significant results at a 5% alpha level were found between the use of e-payments and the monthly income (Asymp.Sig. = 0.019137) and at a 10% alpha level between the use of e-payment technologies and the level of education of the individuals in Dubai (Asymp.Sig. = 0.060653). This indicates that the relatively high income of the individuals and the high levels of education increase the opportunities for using e-payment techniques. Therefore, the use of e-payments is positively associated with the level of education and the level of income; hence, the 4th and the 6th hypotheses are supported.

In contrast, statistically significant results for independence were not found (with a (Asymp.Sig. more than the 5% alpha level) between the using e-payments and the gender, marital status, age group, and the current professional position of the individuals in Dubai. Therefore, the association between the use of e-payment technologies and each one of these demographic variables (as stated in the 1st, 2nd, 3ed, and the 5th hypotheses) is not supported.

Results of the study show that the majority of individuals in Dubai having experience in e-payment technologies. Despite the enormous development of payment technologies for Dubai's governmental sectors, the individuals' acceptance rates for the different e-payment channels be satisfactory. The chi-square ($\chi2$) test results for independence indicate that the use of e-payments is positively associated with the level of education and the level of income and supports the 4th and the 6th hypotheses (see Table 8). This is confirmed by the fact that the UAE's demographic profile is identified by its high-income levels, which positively influence the consumers' e-payment technologies adoption.

Surprisingly, the significant results for independence were not found between the using e-payments technologies and the gender, marital status, age group, and the current professional position of the individuals in Dubai (see Table 9). Therefore, the association between the use of e-payments and each one of these demographic variables (as stated in H_1, H_2, H_3, and H_5 hypotheses) is not supported.

Table 9: Results of Tested Hypotheses

No.	Hypothesis	Finding
H_1	There is a relationship between gender and the adoption of e-payment	Not supporting
H_2	There is a relationship between profession and adoption of e-payment	Not supporting
H_3	There is a relationship between age and adoption of e-payment	Not supporting
H_4	There is a relationship between education and adoption of e-payment	Supporting
H_5	There is a relationship between marital status and adoption of e-payment	Not supporting
H_6	There is a relationship between income and adoption of e-payment	Supporting

5.2. Discussion

The high growth rate of the digital transformation of payment transactions in the UAE across several sectors, especially in the government, backed with the vision to move for a cashless economy, forced many users to try new e-payments technologies that are not well prepared for it. By the time that created more familiarity with and acceptance to try new innovative e-payment channels [37].

This study revealed a more updated analysis of the demographic variable of this dynamic market on the mode of use and channels. Most of the dominant nationalities selected Contactless Cards as their first choice. Online Payments are selected as a second choice for most of them. Most of the dominant nationalities selected Mobile Payments as a digital mode of payments as their third choice, with percentages of users more than 56%

The present study reveals the fact that most users had experience in e-payment technologies. The research's remarkable

results revealed that about 70% of the individuals use more than one e-payment technology frequently. The most significant two categories of e-payments sectors included the food (77.4%) and clothing (70.7%), while payments for government services were the most versatile where 48.1% of the individuals pay for Utilities (Electricity, Water, Gas), 57.4% pay for Phone/Internet, and 35.6% for transportation and road toll gates.

Regarding the popularity of the payment channels, both Contactless cards and online payments have been dominating by 75.9% and 65.6% of Dubai individuals, respectively. Followed by Mobile payment (including Mobile Bank Apps, Apple Pay, Ali Pay and Samsung Pay) and Payment Kiosks (such as kiosks in shopping malls, airports, Etisalat/DU, DEWA, and Dubai Police) ranked the third and the forth with percentages of users reached to 46% and 25% of Dubai consumers (individuals) respectively.

Other new emerging e-payment channels were lower than expected in terms of diffusion, such the new and innovative payments through Virtual currency (including mobile games currencies, Linden Dollars of Second life, and Facebook coins) and Artificial Intelligence payment (such as Face Recognition payment), as well as wearable payment devices (such as apple watch, rings, etc.) are all considered to be futuristic e-payment techniques used in emerging markets. These new methods are still being utilized rarely in Dubai (about 5% for each method), and the majority of the people who are using these technologies are expats mainly from China. These technologies are expected to be more dominating due to the reliability of technology, convenience, and specialization based on the needs of younger generations (i.e., Generation Z).

The fact that the UAE's demographic profile is identified by its high-income levels influences individuals' e-payment technologies adoption positively. As per the results of this study, the individual's monthly income is mainly the most crucial demographic variable for the adoption decision of e-payments. Additionally, this study found statistically significant results between the adoption of e-payment and the level of education. Therefore, the adoption of e-payments is higher for more educated individuals than those who were less educated. While the study found that the other four investigated demographic variables (age, gender, marital status, and current professional position) had no statistical influence on the adoption of e-payment technologies.

6. Conclusion and Implications

6.1. Opportunities for Theoretical Contribution

The results of the study can be utilized by the industry of the digital transformation and technology adoption/innovation field in relooking or revamping their strategies for digital payment technologies.

E-governments should pay more attention to education and income as results prove that using e-payment technologies is positively associated with the level of education and the level of income. Also, the companies in this field should devise the policies and strategies to attract more people to smart cities like Dubai, regardless of their demographic category, as results prove that the significant results for independence were not found between using e-payments and the demographic variables

investigated in this research, i.e., the gender, marital status, age group, and the current professional position of the individuals in Dubai.

Unlike the other studies, the researchers' contribution of this work is creating a proposed theoretical model with an opportunity for gap filling the demographic variables compared with the other studies. This will shed light on the need to design and create compelling digital payment services based on the socio-technical approach rather than the technical one in smart cities regardless of their citizens' demographic categories.

6.2. Implications and Future Work

This section highlights the future research based on the current work results, especially on analyzing the key factors affecting the adoption of new technologies and services provided by new Fintech services, which is evolving fast and making many questions marks on the future of the traditional e-payment service providers in the region. The implications of this study will update change managers and digital transformation practitioners, and consultants to identify relevant correlations among e-payment technologies and demographic variables for this region. This will help all organizations looking to consider digital transformation for payment to benefit from the result to design competitive strategies based on the innovation of e-payment services, which is more customizable, user-centered, Omni-channels, smart, and powered with AI and business analytics.

The current study is not without limitations of selecting one city leading the region in digital transformation, such as Dubai. In the future, it can be interesting to analyze additional cities and do comparative analysis among them. Another issue can be the focus on user's requirements/demographic analysis can be limited base on the socio-technical theory, which can include in higher levels of additional analysis requirements collected from a group of users, community, or the whole society. As we can go one step simultaneously, these limitations give implications to the researchers to move further in the current area of research. (The implications of this research will help both researchers and digital transformation practitioners, mainly in the government and leading businesses, to design and develop more effective digital payment services for people in the smart cities [35], [36] based on the socio-technical approach rather than merely technical one.

There are many opportunities for further research using the current variables of the study and the questionnaire on a broader scope. Further research may include individuals from other emirates in the UAE to explore the inter-relations among the current demographic variables and the factors affecting the adoption of e-payments in the UAE.

Conflict of Interest

The authors declare no conflict of interest.

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