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Digitalization and satisfaction among Peruvian users towards their civil registration office

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CHRONICLE	ABSTRACT
	Digitalization is a reality for everyone, including the government. As a consequence, more governments around the globe started to digitize their services, looking for more user satisfaction. In the case of Peru, the civil registration service, called RENIEC, found its particular way to implement digital solutions for their services. Therefore, did those efforts have any effect on the users' satisfaction? The current analysis using ordinary least squares and Shapley's value evaluated the impact of digitalization on user satisfaction. After the necessary research, we found that the birth and divorce digital process positively affected user satisfaction, while divorce did not.

1. Introduction

Everyone has the right to a nationality (Inter-Parliamentary Union, 2005). This right was declared in the United Nations convention after the second world war as an attempt to prevent the atrocities committed during the war in the future (Inter-Parliamentary Union, 2005). Hence, the first step to recognizing a newborn as a citizen is through the birth certificate (Blitz et al., 2014). Moreover, when they become citizens with full rights, the state should provide them with adult identification (Lyon, 2010). Also, when this citizen desires to marry and establish a family, the state should recognize this union by the marriage certificate (Nicholson, 2018).

However, if things do not go as planned, the couple can ask for a divorce action. Eventually, due to the nature of life, there should be a document that certificates such a sad event when this citizen passes away. The government branch which has the duty to carry out this job is the Civil Registration (Mills et al., 2019). This office records the occurrence and events of the population following the state law. The documents provide humans the necessary recognition of their rights among other citizens and society (Mills et al., 2019). Consequently, a country must have an efficient and productive Registration office to meet development goals (Peters, 2016).

In countries with difficulties integrating their territory and people, the registration process is slow and full of errors. The problems are the lack of local programs to carry the basics of registration, the scarcity of trained staff, the ignorance of the impact of civil registration on social programs, and the inappropriate funding and support (Mills et al., 2019).

It is not valid, though, that civil registration is unaware of technology developments. The use of microfilms and ledgers functioned to keep the data from the paper deterioration (United Nations, 1998). Of course, not all countries can access those facilities. Nonetheless, in recent years information technologies have proven to help correct those issues (Alvarenga et al., 2020).

With the arrival of the internet and modern computers, most countries could fix their registration problems and started to keep a systematic certification of the most important events for their citizens (Abu Bakar et al., 2020). In developing countries like Peru, the digitalization of registration services helped shorten the bureaucracy barriers to citizen civil recording (Registro Nacional de Identificación y Estado Civil, 2021). Also, they helped identify and erase dependencies with overlapping functions that confused citizens (Peters, 2016). Consequently, digitalization helped to transform internal processes and data sharing. However, was there any relationship between the digitalization of the Peruvian Civil Registration Office and citizens' satisfaction with that office?

2. Theoretical background

2.1 Peruvian CVR

The office branch whose job is to recollect the citizens' vital information is called RENIEC, the Registro Nacional de Identificación y Estado Civil. This office was born in 1993 as a centralized office to keep the information of citizens (Registro Nacional de Identificación y Estado Civil, 2013). Before RENIEC, the local municipalities were in charge of the registration form 1853, and the parishes had this responsibility (Registro Nacional de Identificación y Estado Civil, 2019). Moreover, only with RENIEC did the Peruvian ID card come to light. Previous to it, the Peruvian were identified only with a voter ID which, before 1979, only allowed literate people to vote (Registro Nacional de Identificación y Estado Civil, 2013). Hence, there was no feasible way to identify and keep a registry of that group of people. For a Peruvian to have a voter ID was necessary to ask the local electoral office.

After the creation of RENIEC, the Peruvian citizens found a centralized office to get their ID cards for civil, commercial, and judicial purposes. Also, this office is in charge of every civil procedure like births, marriages, divorces, and defunctions. Although this measure provided them with a solution to the high bureaucracy, overlapping functions with the local municipalities still exist.

2.2 Digitalization

Digitalization came along with the information revolution in the second half of the twenty century. Indeed, the first time this term was ever used was in 1971 in an article describing computers' potential (Gbadegeshin, 2019). In a few words, digitalization is a process where everything has a connection to information technologies (Raheem, 2020). Then, information technologies are needed to catch the information of the real world into a language that could be stored into them and shared throughout a path around the world. The language employed was the binary language, and the road was the internet (World Bank, 2021). With the upcoming of the internet, the digitization process booted itself.

Both in private and public organizations, digitalization helps to process and deliver information through computers in a fast way. Then, it helped prevent the loss of important information because of the deterioration of paper or microfilms (United Nations, 1998). Also, the decision time was shorter than last due to the immediately necessary information.

In the public sector, the idea of digital government is changing the quality of public services. In developing countries like Peru, the bureaucracy was exceptionally high to make necessary civil procedures (Registro Nacional de Identificación y Estado Civil, 2021). Then, it impacted national productivity since citizens needed to stop working to spend entire days getting vital documents. Digitalization aims to end this problem by the digital implication of procedures to the citizen (Fischer et al., 2021). It is expected, then, that digitalization has a positive effect on the citizens' satisfaction.

2.3 Public Value

This concept refers to the value users provide to public service quality (Meynhardt et al., 2017). The so-called digitalization is a key to giving citizens quality public services. Of course, citizens must appreciate those services to be considered valuable. Hence, the citizens' general value of the e-government is made when they go after a digital public service (Kearns, 2004). Additionally, Oakley et al. (2006) believe that public value increases after the government improves the quality and quantity of its public services. Moreover, like in the private sector, the digitalization of services also increases the efficiency of the budget expense services (Meynhardt et al., 2017). Consequently, a more efficient government can be reached by expanding and constantly improving its digital services, positively impacting public value.

3. Literature review

The citizens' satisfaction with their government's digital services is a current issue. With the internet disruption and its cost reduction, more countries are getting the necessary infrastructure to implement a digital solution to procedures once tricky. Furthermore, the covid 19 pandemic sanitary restrictions boosted the implementation of more e-government services (Allam et al., 2021). Canedo et al. (2020) stated that citizens would see digitization services positively. Of course, the objective of the implementation of digital services is to ease the procedures. Hence, the path to digitize services also implies the simplification of them. Moreover, Fischer et al. (2021) added that the digitalization of the government should focus on citizens as the target group.

Empirically, the research by Ma & Zheng (2017) showed that European citizens were happier with governments with noticeable digitalization characteristics. This digitalization is only completed when solving the citizens' day-to-day needs, as stated by Bokayev (2021). Only then will the citizens help the e-government services (Danila & Abdullah, 2014). For instance, (Bernhard et al., 2018) found a positive relationship between digitalization degrees and the citizens' satisfaction. However, in Kazakhstan, the government only implemented information technology to manage its information, but not for the bureaucratic procedures that citizens do every day. Analogously, (Kuldosheva, 2021) encountered that in Uzbekistan, the government services were at a basic level which did not encourage the citizens to participate. When the citizens feel that their government is making efforts through digitalization to simplify their lives, it generates satisfaction and loyalty to them (Allam et al., 2021). This phenomenon can be more noticeable in younger users, as claimed by (Alkraiji & Ameen, 2022).

4. Methodology

Due to data length, the research must employ an Ordinary Least Square Regression. This regression must fulfill the requirements provided by (Wooldrige, 2010). Essentially, this regression is noted as:

$$Y_{it} = \beta_1 X_{it} + \propto_i + u_{it}$$

Here, the dependent variable is represented by Y_{it}, while β_1 acts for the coefficients of each independent variable, i.e., X_{it}. The unobserved effects are noted as $\propto_i$ and the errors are represented by u_{it}. Burton (2020) claims that every OLS regression should meet the following assumptions: linearity, homoscedasticity, absence of multicollinearity, normal distribution, and specification.

The linear condition is evaluated through the F test. This condition ensures that the independent variables share both individual and groups a linear relationship with the dependent variable (Burton, 2020). The homoscedasticity condition asks for the constant value of the error variance. An undesired situation called heteroscedasticity wrongly makes the OLS model estimate the coefficient standard error (Yang et al., 2019). The absence of multicollinearity ensures the OLS regression's stability and the regressors' redundancy (Burton, 2020).

Moreover, the normal distribution of the residuals is necessary for every parametric estimation like the OLS regression. This condition's utility ensures the efficiency and correct interpretation of the OLS estimations (Fonti, 2017). Finally, the specification test prevents the omitted variable bias, which might suggest an omitted variable (Wooldrige, 2010).

4.1 Decomposition of the coefficient of determination

Commonly, the coefficient of determination [R^2] shows how valid the regressors are towards the dependent variable. However, this indicator runs for the whole model, not for each regressor. Therefore, Huettner and Sunder (2012) proposed a way to decompose the model R^2 to identify the contribution of each regressor.

For that purpose, it is necessary the cooperative application games with utility transfer theory (Huettner & Sunder, 2011). Here, $K = \{1,\dots,j\dots,k\}$ represents the number of the regressors employed. When they are joint, it is represented as $\mathcal{G} = \{G1, \dots, Gl, \dots G\Upsilon\}$. Huettner & Sunder (2011) claimed that the cooperative game with utility is necessary for the R2 distribution. It is represented as $R^2: 2^K \to \mathbb{R}, R^2(\emptyset) = 0$. Here, 2^K express the strength of K and the $\mathcal{G}$-coalition (Huettner & Sunder, 2011).

After assigning the vector φ to each game, getting the payment for each regressor will be possible. Individually, φ no represents any value to the group, but the sum of them or, $\sum_{j\in Gl} \varphi_j = K, R^2 G$ provides the group payment (Huettner & Sunder, 2011). Mathematically, the referred game $(K, R^2, \mathcal{G})$ is known as an external one because it enables another game between coalition groups. Hence, $(K, R_{\mathcal{G}}^2)$, where this game assigns each coalition, $\Upsilon \subseteq \mathcal{G}$, values by $R_{\mathcal{G}}^2(\Upsilon) = R^2(\cup_{G_{l\in\Upsilon}} G_l)$. Here $R_{\mathcal{G}}^2(\Upsilon)$ represents the R^2 indicator in the OLS regression.

4.2 Shapley's values

The Shapley value is the key to distributing R^2, or the payoff, to the game participants. Serrano (2007). Moreover, Owen's value can assign such payment to the coalitions (Casajus, 2009). Since the variables are not grouped, the current analysis will only apply the Shapley value, which is:

$$Sh_j(K, R^2) = \frac{1}{k!} \sum_{\pi\in\Pi(K)} R^2(P_j^\pi \cup \{j\}) - R^2(P_j^\pi)$$

Here, $\pi: K \rightarrow \{1, ... |K|\}$ represents the permutations of K. Hence, $\pi(j)$ is the j participator playing in the π position. Also, Π (K) acts for the total permutations, $k!$, in K. In each π, the players who preceded j are written as $P_j^\pi = \{j' \mid \pi(j') < \pi(j)\}$. Next, $R^2(P_j^\pi \cup \{j\}) - R^2(P_j^\pi)$ will provide the marginal contribution of each j. The assignment will be zero if there is no marginal contribution of j. Finally, Shapley's value meets the assumption of efficiency, symmetry, and marginality (Serrano, 2007).

In summary, the current research will employ as regressors the four digital certificates that provide RENIEC, which belong to Birth, Marriage, Death, and Divorce. STATA will analyze those initial regressors. Specifically, the research will employ the variable selection algorithm to choose the best variables. After that, the regression will be carried along with the R2 decomposition. The post-test evaluation will also occur to check that the model met all previously described conditions.
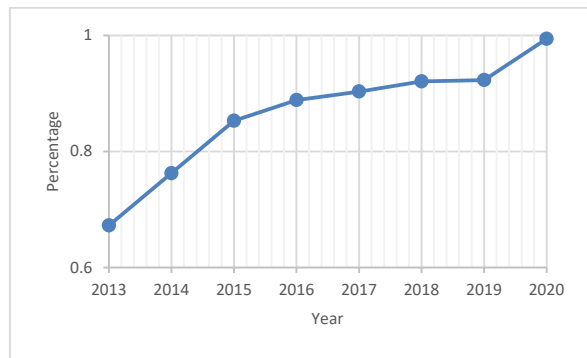
In consequence, the results, discussion, and conclusion will be written.
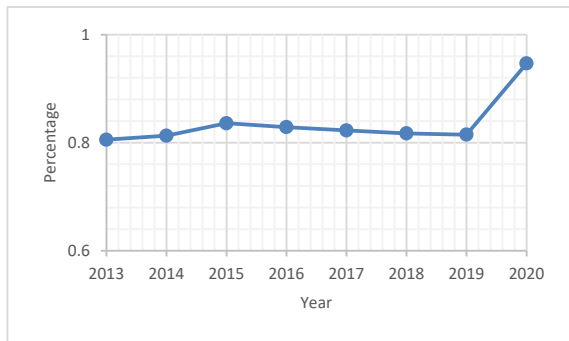
5. Results

Fig. 1, Fig. 2 and Fig 3 demonstrate the results of birth, death and divorce digital certificates evolution over the period 2013-2020, respectively.
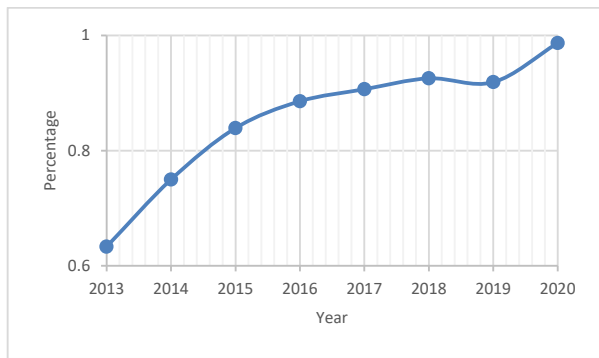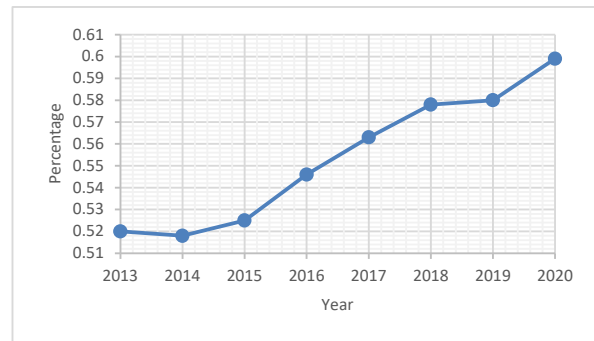

Fig. 1. Birth digital certificates evolution 2013-2020

Fig. 2. Death digital certificates evolution 2013-2020

Fig. 3. Divorce digital certificates evolution 2013-2020

Fig. 4. Users´ satisfaction with RENIEC

Table 1
Statistical observations on births, deaths, divorces and confidence

Measure	Births *	Deaths *	Divorces *	Confidence
Mean	0.86	0.86	0.84	0.55
Min	0.63	0.67	0.81	0.52
Max	0.99	0.99	0.95	0.60
Coef of var.	0.13	0.12	0.05	0.06

* in proportion

Table 2
Variable selection

Predictions	R2	Mallow	Akaike	Akaike corrected	Bayes
1	0.80	8.33	-5.90	0.10	-5.74
2	0.85	5.91	-7.45	5.89	-7.21
3*	**0.92**	3.18	**-12.75**	17.25	**-12.43**
4	0.90	5.00	-11.20	72.80	-10.81

* chosen prediction

Table 1 shows the variables employed for this analysis. As stated before, the researchers used the selection variable algorithm to choose the best regressors, as shown in Table 2. Also, Table 1 portrays the descriptive statistics of the analyzed variables. According to the selected variables in Table 2, it was not necessary to include the marriage process digitalization. Hence, this variable did not have any relevance to the satisfaction of Peruvian users towards RENIEC.

Hence, Birth digital certificates represented 86% of the total certificates given by RENIEC. Death digital certificates also had the same proportion as birth, curiously. Births, Deaths, and Divorces had digitalization rates above 80% in the analyzed period. Fig. 1, Fig. 2, and Fig. 3 show that the growth rate of digitalization certificates has been continuous from the beginning to the final period.

The results are shown in Table 2. Here, it can be noticed that the chosen variables were according to the third prediction. It was determined since most indicators, i.e., R^2, Akaike, and Bayes, arrived at the same conclusion.

Table 3
The summary of the regression results

Variable	Coefficient	Standard Error	t	p>t	95% confidence interval		Shapley
Births	25.80	6.81	3.79	0.019**	6.88	44.72	46.60%
Deaths	-26.68	7.89	-3.38	0.028**	-48.59	-4.78	43.12%
Divorces	3.62	1.48	2.44	0.071*	-0.49	7.73	10.29%
Constant	96.96	0.65	148.09	0.00	95.14	98.77	
F			29.47	0***			
R2	0.92						

*** at 1%, ** at 5%, * at 10%

Table 3 shows the regression results necessary to accomplish the research's primary objective. Hence, it can be seen that the satisfaction of Peruvians for RENIEC had a positive relationship with birth and divorce certificates digitalization. However, it is interesting that death certificate digitalization had a negative association with the confidence among Peruvians about RENIEC. Birth certificate digitalization contributed 46.6% to the overall R2, 92%. Also, the negative impact of death certificates on satisfaction in RENIEC represented 43.12% of the absolute determination coefficient. Finally, divorce digitalization had the lowest effect [10.29%] on the dependent variable.

It is necessary to add that the F test, which shows the model linearity, found that the model is correct.

Table 4
The summary of the post-test evaluation

Test/results	
Autocorrelation	
Chi2	p
0.67	0.41
Homocedasticity	
Chi2	p
0.03	0.85
Multicollinearity - VIF	
VIF	
3.69	
Distribution	
Chi2	p
0.65	0.7221
Specification	
t	p
0.8	0.46

The post-test evaluation, described in Table 4, showed that the model evaluation was correctly built. The autocorrelation test showed that there was no interference among the independent variables. Also, the Multicollinearity test described that the variables were not redundant. The homoscedasticity evaluation proved that there were no heteroscedasticity problems in the model. Moreover, the distribution test portrayed that the model had a normal distribution. Finally, the specification test showed that there was no omitted variable bias.

6. Discussion

The current analysis found that two services positively influenced the satisfaction of Peruvian people towards RENIEC. They were birth and divorce digital procedures; nonetheless, death procedure services negatively affected Peruvian users. With the onset of digitalization, more methods started being carried by information technologies. However, it is a continuous process that still is not implemented, as shown in the Figures portrayed in the current study. Therefore, it seems that only birth and

digital divorce procedures had the effect observed by Allam et al. (2021)and Bernhard et al. (2018). The explanation can be the same as Canedo et al. (2020) and Fischer et al. (2021), the simplification of the procedures.

Peruvian citizens were unhappy about the death procedures because the digitization techniques might not solve their necessities (Bokayev, 2021). Therefore, they did not find the digital strategies more helpful than the traditional ones (Danila & Abdullah, 2014). The failure to provide the citizens with a proper level of digital services influenced their satisfaction with RENIEC (Kuldosheva, 2021).

Users of the death process are generally mature people who do not have the same ability as young people to understand digital procedures quickly. Hence, they might find this procedure tedious and unsatisfactory (Allam et al., 2021). On the other hand, people who usually employ the services of birth and divorce are younger than the users of the death process. Hence, they feel that those digital services make their life easier as stated by Ma & Zheng (2017). Of course, young users are more ready than older ones for the digitization process's changes. Therefore, young users feel more comfortable about digitalization than mature users.

7. Conclusion

After selecting and analyzing the variables that explain Peruvian users' satisfaction with RENIEC, it can be concluded that digitalization does not necessarily provide more pleasure to users. Although the birth and divorce process digitalization indeed explained more than 50% of the total coefficient of determination, the dissatisfaction with the death digital process was the second most relevant regressor. As stated before, the digital process of birth and divorce positively affected the coefficient of determination, but the digital process of death did not. Hence, not everyone is pleased with the digitalization of the primary process RENIEC. The reasons behind it might be the difficulty those processes represent for the users, their level, and the lack of correlation with the users' necessities.

Not every user of RENIEC has the same age and education level. Hence, it is more manageable for young users than older ones to adapt to digitalization. Therefore, RENIEC might still consider it necessary to keep some processes or part of them according to the characteristics of their users. In the process with plenty of digital users, it is also imperative that those processes have the adequate level to meet their needs. For instance, RENIEC might start and strengthen the implementation of digital payments or provide the required documents quickly without going into the physical offices. Furthermore, a digital process must be more accessible than a physical office. Hence RENIEC might start working to facilitate those laborious processes with the help of digitalization.

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