Smart Tax Compliance Through Digital Transformation In Colombia

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Abstract
This study analyzes the impact of digital transformation on tax compliance in Colombia, considering the intensive use of electronic documents and tax platforms. The objective was to determine the relationship between digital accounting and the degree of tax compliance perceived by professionals in the sector. A quantitative, non-experimental and cross-sectional methodology was applied using a structured questionnaire of 20 items on a five-point Likert scale, validated by experts and with a Cronbach's alpha of 0.89. The sample was made up of 350 accounting and tax professionals, to whom the instrument was applied between January and June 2025. Exploratory factor analysis identified three main dimensions, while the polynomial regression model and ANOVA confirmed the statistical significance of the relationship. The results show that accounting digitalization has a real, although non-linear impact on improving tax compliance in the Colombian context.
Keywords: Tax administration, Digital accounting, Smart tax compliance, electronic documents, Digital transformation.

1. INTRODUCTION

Within the framework of the digital transformation of the Colombian tax system, tax compliance is no longer a purely operational process but an integrated, accurate and dynamic strategy. The Directorate of National Taxes and Customs (DIAN), considering the problems of efficiency, transparency and control, has led a process of profound modernization based on the mandatory and massive use of electronic documents, which allows, in real time, to monitor economic operations and improve the integrity and transparency of invoicing processes (Duarte et al., 2024). This advance has given taxpayers and the tax administration the opportunity to access a digital environment that facilitates the reporting, declaration, audit and follow-up processes, encouraging the development of a culture of voluntary compliance and significantly reducing the risk of penalties.
Similarly, electronic invoicing, electronic payroll, support document in acquisitions not required to invoice and electronic reports of exogenous information are important means for the traceability of economic operations. These documents established and regulated by the DIAN through regulations such as Resolution 000042 of 2020 and subsequent regulations, serve to capture tax information online; so much so that guaranteeing formal compliance with taxpayers' obligations becomes an act of cross-control and automatic verification of information. With the application of these technologies in the sense we

have proposed, they have become key to the modernization of tax systems (García & Calijuri, 2023), which sets a milestone in the evolution of tax compliance, displacing it from the usual reactive model to a predictive, preventive model focused on accuracy.

In this sense, one of the benefits that the digitization of tax compliance has provided is the quality of the data reported (Cuello, 2021), given that thanks to the validation mechanisms exhibited by the DIAN's electronic platform, it allows many transcription errors, erroneous calculations or documentary inconsistencies to be reduced. For example, electronic invoicing allows, through online communication that requires going through a contracting system, to detect and remedy abnormalities instantly before the transaction is valid (Duarte et al., 2024), which not only reduces non-compliance, but also guarantees legal certainty for the taxpayer. At the same time, another important aspect is the streamlining of the process of declaring and filing tax obligations (Cuello, 2021). The electronic system allows you to generate pre-filled returns based on the information already sent by the taxpayer through the electronic documents. This reduces the administrative burden and facilitates timely compliance, especially for micro, small and medium-sized enterprises, which often do not have specialized personnel. In addition, the relationship with the DIAN has become more agile, direct, and functional, since through the MUISCA portal and other digital services, balances can be consulted, documents can be sent, errors corrected, and notifications can be received without the need for physical travel or intermediaries (Duarte et al., 2024).

Therefore, the use of electronic documents has also generated positive effects in mitigating the risk of penalties (Ramírez et al., 2022), by having accurate, endorsed and real-time information, taxpayers reduce the chances of falling into sanctionable errors before the tax administration. The automation of processes allows this risk of omissions, duplicates and common errors in reports to be eliminated, thus contributing to the greater accuracy of obligations. Likewise, it facilitates documentary support of costs, deductions and discounts, which is essential during review processes, requirements or audits by the DIAN.

On a different note, and from an audit perspective, electronic documents have strengthened the role of tax auditing as a preventive tool (Moreno et. al., 2023). By handling a large volume of structured data, the DIAN can improve its analysis and its selection patterns to audit the taxpayers who have the most risk signals. Using analytics and/or data mining technologies, the administration can even detect patterns that are statistically considered out of the ordinary, very relevant inconsistencies or evasive behaviors without the need to physically request information from the taxpayer (González, 2022). This makes the tax audit be carried out in a timelier, focused and less invasive way while optimizing State resources and strengthening the perception of tax justice. However, this digitalization process is accompanied by certain problems (García et al., 2023). One of the key points has been the perception of complexity in taxpayers, particularly those who do not have access to technological resources on an ongoing basis or who are included in low digital literacy sectors. The implementation of electronic invoicing software, the training of accounting staff or the adaptation of internal processes has involved making significant investments and organizational modifications that are not always easy to carry out; however, surveys carried out by the DIAN itself have been able to verify that most taxpayers, once the adaptation phase has been overcome, see considerable improvements in the quality of taxation processes, document organization and the relationship with the tax administration (Ramírez et al., 2022). In line with the

above, another notable element indicates the ability of the electronic system to adapt quickly to regulatory changes (Duarte et al. 2024). Unlike manual compliance, which required lengthy processes for interpretation, socialization, and implementation, electronic platforms incorporate regulatory modifications almost immediately, which reduces the possibility of taxpayers making mistakes due to ignorance or outdated regulations (Cuello, 2021). For example, when the DIAN modifies retention parameters or introduces new requirements for supporting documents, developers can incorporate these changes into systems, facilitating automatic compliance by the end user.

From a more general perspective, the electronic system helps to reduce levels of tax evasion and close the information gaps that for years hid tax control in Colombia (Moreno et al. 2023). By centralizing information and presenting truthful data in a timely manner, the DIAN can identify anomalous behavior, trace evasion networks, and build more efficient control strategies to close these gaps. This new response capacity on the part of the State also improves tax equity, since it limits the possibility for some economic actors to evade their responsibilities while others comply with tax regulations.

Finally, it should be noted that the Colombian experience in terms of smart tax compliance has been internationally recognized as an example of the progressive transition towards tax digitalization (Duarte et al. 2024). Although there is still a long way to go in terms of coverage, connectivity or interoperability between systems, the achievements in terms of accuracy, reduction of penalties, automatic controls and improvement in the taxpayer relationship channel become a firm step towards modern, efficient and reliable administration (Moreno et al. 2023).

In short, intelligent tax compliance based on electronic documents not only transforms the way taxpayers report and comply with their obligations but also redefines the very structure of auditing in the country (Trujillo, 2023). This evolution implies a cultural change that demands adaptation, training and commitment, both on the part of citizens and institutions (Arguelles, 2024). To the extent that Colombia continues to strengthen its technological capacities, promoting equity in access to these tools and guaranteeing a stable and clear regulatory environment, the country will move towards a fairer, more transparent and effective tax system, where compliance is not a burden, but an efficient and automated practice at the service of the common good (González, 2022).

2. METHODOLOGY

This study was developed under a quantitative, descriptive-correlational approach, appropriate to analyze relationships between observable variables without direct manipulation of environmental conditions. The design was non-experimental and cross-sectional, which made it possible to observe the phenomena as they manifest themselves in their natural context at a specific time (Vasilachis de Gialdino, 2006).

The technique used for information collection was a structured questionnaire, composed of 20 items, constructed with a five-point Likert scale (1 = Strongly disagree; 5 = Strongly agree), recognized for its effectiveness in measuring perceptions and attitudes in social research (Muñiz, 2018; Likert, 1932). The questions were organized into two analytical dimensions: Digital Accounting -Cd and Tax Compliance - Cf, based on recent theoretical developments on digital transformation in the accounting field and its relationship with tax compliance in Colombia (Pilatasig & Tituaña, 2024; Alvarado, 2023).

The instrument was subjected to validation by experts in accounting, auditing, and quantitative methods, ensuring the validity of the content (Escobar & Cuervo, 2008). Subsequently, a pilot test was applied to 15 professionals in the accounting area, the results of which allowed semantic and technical elements to be adjusted. Cronbach's alpha reliability coefficient was calculated, which yielded a value of 0.89, considered highly acceptable (Nunnally and Bernstein, 1994).

The target population was made up of professionals from the accounting and tax area of Colombian private sector companies. Non-probabilistic convenience sampling was applied; a technique commonly used in applied studies where accessibility to participants is a key factor (Otzen & Manterola, 2017). The final phase of the research consisted of 350 respondents who submitted to the questionnaire voluntarily. The data collection phase was carried out between the months of January and June 2025, and the collection technique was disseminated through a digital form sent by institutional mail and professional networks.

The final phase of observation and the data collection phase was carried out between January and June 2025, and the collection technique performed the function of observation prior to the application of the data collection instrument, with which their informed consent was requested, based on the ethical foundations of research in social sciences (CIOMS, 2016), guaranteeing the principle of confidentiality and anonymity of the responses. Participation was entirely voluntary.

The information was processed using the IBM SPSS Statistics version 31 statistical software. In a first phase, univariate descriptive analyses were carried out, using frequencies, measures of central tendency (mean) and measures of dispersion (standard deviation), with the aim of characterizing the responses obtained. A second phase consisted of applying an exploratory factor analysis (EFA) in which the principal component extraction method was chosen with the intention of discovering the underlying structure of the instrument and empirically validating the grouping of the items into factors, following the model indicated by Hair (2011).

Based on the factors that were obtained, composite indices were constructed and possible nonlinear relationships between the variables were explored. The cross-sectional approach chosen was a second-order polynomial regression model that incorporates the mean indices with their quadratic polynomial terms, so that it allows capturing the curvilinear effects between the dimensions of digital accounting, mixed digital-fiscal dimension and perceived tax compliance. The validity of the model was contrasted by an analysis of variance (ANOVA) that showed a statistically significant fit of the model.

3. RESULTS

The current section details the most relevant results that have been obtained from the treatment of the information collected from a survey carried out on 350 participants. The analysis carried out presents two levels of analysis; firstly, the treatment of descriptive results that characterize the general perceptions of the survey participants in terms of digital accounting and tax compliance; and, secondly, inferential analyses, insofar as they allow the study of the statistical relationship between the variables that have been considered, in line with the objectives of the study. Certainly, the results generated here serve as empirical evidence on the level of implementation of digital tools applied to the accounting field and the possible effect that this could have on the improvement of tax

compliance. It also contains results that allow the identification of relevant patterns of perception that support the practical and theoretical implications that will be dealt with in the following sections.

Table 1 Descriptive statistics of digital accounting and tax compliance composite indices

	N	Minimal	Maximum	Stocking	Desv. standard
CD	350	2	4	3.07	.452
Cf	350	2	4	2.99	.499
N valid (per list)	350				

The descriptive examination of the information, see **Table 1**, contains the Digital Accounting (CD) variable with an average of 3.07 (within a Likert scale of 1 to 5) and the Tax Compliance variable has a somewhat lower average, 2.99, and can show that respondents more clearly understand the adoption and use of technology instruments in accounting processes than their impact or execution on compliance with tax obligations. The two variables showed a slight dispersion (standard deviation 0.452 digital accounting and 0.499 tax compliance) that shows a certain stability in the perceptions of the subjects participating in the study, and therefore, the range of response in both dimensions ranged from 2 (disagreement) to 4 (agreement) without reaching extremes of the scale (1 or 5). which shows inclinations towards moderate and stable perceptions, without any polarization. This result allows us to declare that, although the advances in accounting digitalization are accepted among most of the participants, the direct advances experienced by this technological transformation in the tax field are not yet supported with the same forcefulness, in particular with regard to precision, reduction of errors and communication with the tax administration; which justifies the development of complementary inferential analyses to assess whether digital accounting has a significant effect on tax compliance.

Table 2 Total variance explained by the components extracted in the exploratory factor analysis

Component	Initial eigenvalues			Sums of charges squared from extraction			Sums of Charges Squared of Rotation		
	Total	% variance	Cumulative %	Total	% variance	Cumulative %	Total	% variance	Cumulative %
1	1.466	7.328	7.328	1.466	7.328	7.328	1.280	6.401	6.401
2	1.368	6.840	14.168	1.368	6.840	14.168	1.272	6.361	12.762
3	1.349	6.745	20.913	1.349	6.745	20.913	1.248	6.241	19.003
4	1.263	6.315	27.228	1.263	6.315	27.228	1.246	6.228	25.231
5	1.185	5.926	33.154	1.185	5.926	33.154	1.243	6.213	31.444

6	1.162	5.809	38.962	1.162	5.809	38.962	1.234	6.170	37.614
7	1.112	5.560	44.522	1.112	5.560	44.522	1.215	6.074	43.688
8	1.066	5.330	49.852	1.066	5.330	49.852	1.118	5.592	49.279
9	1.051	5.256	55.107	1.051	5.256	55.107	1.089	5.447	54.726
10	1.005	5.023	60.130	1.005	5.023	60.130	1.081	5.404	60.130
11	.950	4.750	64.880						
12	.922	4.611	69.491						
13	.914	4.572	74.063						
14	.843	4.215	78.278						
15	.817	4.083	82.360						
16	.794	3.969	86.329						
17	.775	3.874	90.203						
18	.703	3.515	93.719						
19	.665	3.323	97.041						
20	.592	2.959	100.000						

Note. The eigenvalues, the percentage of variance explained, and the cumulative variance before and after rotation are presented. According to Kaiser's criterion (eigenvalue > 1), the retention of three factors that explain the largest proportion of the instrument's variance is justified.

The exploratory factor analysis carried out using the principal component method allowed the identification of the underlying structure of the applied instrument. As can be seen in **Table 2**, the first three components have eigenvalues greater than 1 (1,466, 1,368 and 1,349), which, according to Kaiser's criteria, justifies their retention in the factor model. These three components together explain 20.91% of the total variance before rotation. After applying the varimax rotation, the values of explained variance are slightly redistributed, maintaining the three main factors with a cumulative variance of 19.00 %. This distribution suggests a three-dimensional factor structure, consistent with the initial theoretical proposal of the study, in which the existence of dimensions related to: The adoption of digital accounting tools, the impact on tax compliance, and a mixed dimension where both are functionally related in the Colombian business context. This finding supports the structural validity of the questionnaire and justifies its use for subsequent inferential analyses, such as multiple linear regression based on composite indices per dimension.

Table 3 Analysis of Variance (ANOVA) of the Second-Order Polynomial Regression Model for Tax Compliance

Dependent variable						
Model		Sum of squares	Gl	Quadratic mean	F	Gis.
1	Regression	32.159	4	8.040	73.779	<.001a
	Residue	37.595	345	.109		

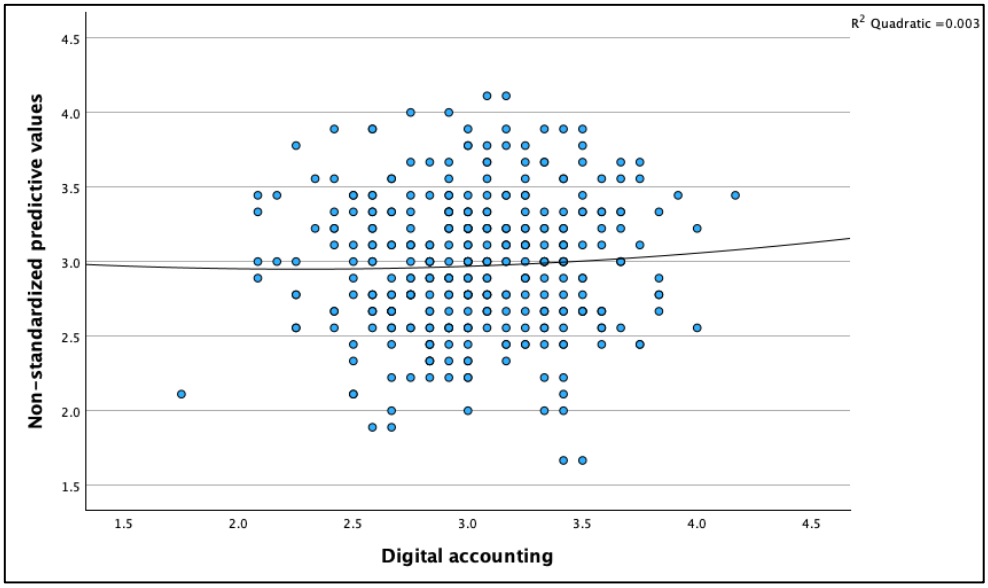
	Total	69.754	349			
a. Predictors: (Constant), MI_CUAD, Prom V.I., Mixed, CD_CUAD						

The analysis of variance (ANOVA) see **Table 3** applied to the second-order polynomial regression model confirmed the statistical validity of the model as a whole. The results yielded a statistic $F = 73.779$ with a significance value $p < .001$, indicating that the predictors included, i.e., the digital accounting (DC), mixed-dimension (MI) indexes and their corresponding quadratic terms (CD^2 and MI^2) explain a significant proportion of the variance in tax compliance reported by the respondents.

This result robustly supports the relevance of the selected nonlinear model and shows that the interaction and level of maturity of digital accounting and regulatory tools have a statistically verifiable effect on the degree of tax compliance. Consequently, it is confirmed that the proposed model has substantial explanatory capacity, and that digital transformation in tax contexts must be analyzed under complex and not necessarily proportional relationships.

Figure **1** is a representation of the second-order model, the polynomial regression model, which attempts to establish a relationship between the digital accounting (DC) index as a predictor of tax compliance, and tax compliance as a dependent variable. In this figure, you present a collection of points representing the predicted values of tax compliance respectively along and across the adjusted curve that shows the quadratic behavior of the adjusted model. This curve allows us to observe the general trend of the data, as well as the existing nonlinear relationship.

Figure 1 Polynomial Regression Curve Between Digital Accounting and Tax Compliance



The quadratic coefficient of determination obtained is low ($R^2 = 0.003$) see **Figure 1**, but this result does not invalidate the model, since the ANOVA analysis of the quadratic regression confirms that the global fit is significant ($F = 73.779$; $p < .001$). This type of result is common in social studies, where different factors interact and where the effects of a single operation tend to be limited, but at the same time important.

The estimated curve shows a slight trend of improvement in tax compliance as the levels of digital accounting increase, that is, it can be concluded that as the digitization of accounting increases, tax compliance increases, albeit discontinuously or slowly, in the sense that it seems to require a certain consolidation of the use of technology so that the benefits are appreciable in taxation according to the best tax practice. Under conditions of high DC pollution, tax compliance is also low, however, as the company implements digital tools, a small but sustained increase is appreciated.

This result supports one of the hypotheses of the study, that is, the existence of a functional relationship between digital transformation and tax behavior. The shape of the curve also allows us to infer a saturation effect from which tax compliance derived from digitalization has been reduced. Therefore, the positive impact of digital accounting on tax compliance depends not only on technological adoption, but also on its strategic integration with training, auditing, and institutional support processes.

DISCUSSION

What the data show us from a quantitative point of view, confirms the correspondence between accounting digitalization and the tax compliance expressed by the surveyed companies. Even though the degree of proof of the polynomial model is low (R^2 = 0.006), the effects of the analysis of variance (ANOVA) indicate that the model shows significance ($F = 73.779$; $p < .001$), which strengthens the credibility of the adaptation of the model used. This situation is common in social studies, where there are many factors that affect the behavior of organizations and where the individual effects of a single variable, although significant, are usually moderate, in this case it is concluded that digital accounting has a real, although not linear, effect on the improvement of tax compliance. One of the important aspects that should be underlined is that the results are a small growing trend for tax compliance as the use of digital instruments increases. This trend is non-linear in nature, which raises the question of whether the benefits of digital transformation are immediate and automatic, or whether they occur to the extent that a certain capacity for technological consolidation, organizational adaptation, and development of internal capabilities is generated. In other words, digitalization alone does not ensure a significant increase in tax compliance if it is not carried out hand in hand with training processes, periodic audits and a strategic appropriation of digital tools.

These results are also consistent with the theoretical formulations of authors such as Duarte et al. (2024) and García and Calijuri (2023), who indicate that the massive and mandatory use of electronic documents, namely electronic invoicing and electronic payroll, is one of the pillars in the modernization of tax systems. These implemented mechanisms promote the automatic validation of transactions, reduce typical errors in the presentation of tax obligations and, finally, promote the traceability of economic operations and enhance the transparency of economic operations. Likewise, the results of this study enrich what Cuello (2021) reported when pointing out data quality as one of the most tangible benefits of fiscal digitalization and also mentioning the reduction of the administrative burden, particularly for micro and small enterprises.

But, on the other hand, tax compliance through digital transformation also entails significant challenges, given that, as presented in the theoretical section, some taxpayers suffer from structural barriers such as low access to technology, poor digital literacy or lack of trained personnel. Reading these limitations, it can be inferred that the average

tax compliance reported by the participants (M = 2.99) is lower than the average use of accounting technologies (M = 3.07), which indicates that digitalization has not yet been translated into a tangible improvement towards better compliance. The gap also shows the need to implement policies that promote equality in the use of digital tools and active training processes in tax and technological matters.

From a practical point of view, the findings of this research allow us to propose some recommendations. First, state entities, especially the DIAN, must continue to develop technical assistance and support channels for companies in the initial digitization process. On the other hand, universities and accounting training centers will have to include digital and tax skills in a transversal way in curricular programmers, making future professionals find an increasingly automated tax environment. Finally, the solutions of the computer systems in which information is obtained must be eradicated, tending towards interoperable systems that encourage the eradication of duplication of information, while collecting accounting, financial and tax processes on a single platform, thus increasing efficiency without neglecting institutional trust.

That said, this research has some limitations that must be recognized. The sample was obtained from a non-probabilistic convenience sampling, which limits the possibility of making generalizations of the results with respect to the entire population of accounting professionals in Colombia. Thus, once again, the cross-sectional nature of the study prevents definitive causal relationships from being established, so longitudinal studies should be promoted to check the effect of time on tax digitalization. On the other hand, the explanatory model focused on the relationship with quantifiable variables and left aside qualitative variables such as the perception of tax justice, institutional trust or organizational culture, which could enrich the understanding of the phenomenon.

Regarding the projections, it is proposed that subsequent studies reinforce the comparative analysis between economic sectors or regions or business sizes in order to determine if there are differentiated patterns in the relationship between digital accounting and tax compliance, as well as in the interaction between digital transformation and other institutional variables such as the level of oversight, the structure of incentives or the existence of citizen control mechanisms.

Finally, it should be noted that the Colombian experience in terms of tax digitalization has been recognized as a model for the region (Moreno et al., 2023; Trujillo, 2023), but that its consolidation as a successful model will depend on the balance achieved between technological innovation, access to such technology, and tax governance. Smart tax compliance is an operational breakthrough and a cultural shift that involves redefining relationships between the state, taxpayers, and information systems. In this sense, digital transformation must be seen as a resource at the service of fairer, more transparent and more effective taxation where compliance is not a bureaucratic imposition but an automatism, modest and socially acceptable.

CONCLUSIONS

The analysis developed in the study allows us to conclude that the changes that the digital transformation of the Colombian tax system has undergone has had a considerable impact on the implementation of tax compliance, since the journey from a manual, fragmented and inconsistent system to a digital, integrated and homogeneous system has

transformed the way in which taxpayers report, declare and validate their tax obligations in the same way as the control and verification of the tax administration.

This new context, in which intensive use is made of electronic documents and platforms linked to compliance with the tax obligation, represents in itself an important component in the process of transformation of tax systems but also leads to a system more focused on agility, prevention and accurate information. One of the main results of this study indicates the existence of a statistically significant relationship between the level of implementation of digital accounting tools and the perception of tax compliance. Although the explanatory power of the model is modest, the results obtained from the analysis of variance allow us to conclude that the variables that have been considered have a real and measurable impact on tax behavior; a reality that is especially important in contexts where digital transformation is still at a very incipient stage, and where the benefits of digitalization require strategic integration with other organizational processes. In this sense, the results suggest that the application of digital technologies is not understood as a single solution but as part of a broader transformation that entails cultural, organizational and training changes. The improvement in the degree of tax compliance cannot be explained solely by the existence of electronic platforms, but by the ability of taxpayers to know how to use these platforms well and to know how to correctly interpret regulatory modifications and interaction with the tax administration. Therefore, digital transformation must be accompanied by training programs, investment in technological infrastructure, and digital inclusion strategies that reduce the gaps between different economic sectors and regions of the country.

Likewise, the study showed that the use of tools such as electronic invoicing, electronic payroll and digital reports has contributed to reducing errors, improving the traceability of operations and reducing the administrative burden on taxpayers. These operational improvements result in less exposure to sanctions risk and greater efficiency in audit and control processes. From the perspective of the tax administration, the availability of structured, real-time information will allow for a more focused and less invasive audit, optimizing public resources and improving the perception of equity in the tax system.

However, important limitations are also identified that should be considered when designing future strategies. Among them, the persistence of problems of access to technology stands out, especially in small companies or in areas with low connectivity, and the perception of complexity faced by some taxpayers in the adaptation of their internal processes to the requirements of the digital environment. These problems reduce the effectiveness of the model and show the need for public policies that seek technological democratization, technical assistance and regulatory simplification.

From a more global perspective, smart tax compliance represents a new opportunity to improve tax governance, grow the State-taxpayer relationship, and inscribe this commitment around the formation of a tax system that is increasingly transparent, more efficient and more focused on achieving the common good. It is not only reduced to the improvement of technical processes but is to enhance the framework of trust and regulatory certainty, linked to automation, to make tax obligations easier and discourage evasive attitudes.

Ultimately, smart tax compliance is an achievable goal to the extent that institutional, technical, and pedagogical efforts are made. Colombia has taken important steps in this direction, but its consolidation will depend on the sustained commitment of all the actors

involved, and only in this way will it be possible to build a modern, fair and problem-solving tax system of an increasingly digitized economic environment.

Author Contributions

D.H., and W.C. designed the study, collected data, and curated and analyzed the dataset. D.H., and W.C. wrote the first version of the manuscript. D.H., and W.C. supervised the project. Both authors arranged funding. Both authors read, reviewed and approved the final version of the manuscript

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Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author, upon reasonable request.

Ethical Statement

The study was carried out in accordance with the guidelines of the Declaration of Helsinki for compliance with the ethical, methodological, and legal aspects of this study, as well as the informed consent for the processing of personal data.

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