

Motivations, Deployment, and Assessment of Taiwan's e-Invoicing System: An Overview

Yuh-Jzer Joung*, Yen-Chung Tseng*, Shih-Chao Cha†, Nai-Wei Lo†, Gary Chung‡, and Chun-Kun Liu§

*Dept. of Information Management, National Taiwan University, Taipei, Taiwan

†Dept. of Information Management, National Taiwan University of Science and Technology, Taipei, Taiwan

‡PricewaterhouseCoopers Taiwan, Taipei, Taiwan

§Fiscal Information Agency, Ministry of Finance, Taipei, Taiwan

Abstract—Taiwan's invoice system is unique in the world in the sense that every invoice must follow the same printed format specified by the government. In addition, an accompanying lottery-like mechanism is implemented to give prizes to some invoice holders periodically as an incentive for citizens to request invoices upon transaction. This allows government to audit business sales, and has proven quite effective in curbing tax-related exploitations and boost tax income.

To increase processing efficiency as well as to reduce paper consumption, the Taiwanese government began its e-invoicing project in the early 2000's. The first generation e-invoicing system targeted B2B and online B2C transactions, which accounted for only a very small portion of all invoices issued. The second generation, initiated in 2010, aimed to promote e-invoices to all physical retail chains. In this paper we survey Taiwan's e-invoicing system and assess its effects and obstacles.

I. INTRODUCTION

Taiwan's *Uniform Invoice (UI)* System was enacted in the 1950s to prevent businesses evading taxation through fraudulent bookkeeping and verification processes. It used a standardized procedure to record monetary transactions so as to unify accounting principles and effectively control government tax sources. The system was unique in the world in the sense that all invoices must follow the same printed format, thus the name "uniform". Each invoice¹ records the date, the item, and the amount of a transaction. In addition, each invoice also records the seller's ID, which was assigned by the government when a company registered its name and business to the government. Every company must register in Taiwan. The seller IDs allow the government to trace transactions so as to collect taxes from sellers.

One possible way to evade the system by sellers is to give buyers some discount if the buyers do not request an invoice of a transaction. As such, sellers could forge their transaction records to minimize profits so as to evade taxes. It is especially difficult to verify a transaction if it occurs at the end of a value chain, as the buyer usually does not need to report the transaction for taxing purpose. To incentivize buyers to request copies of invoices, an accompanying lottery mechanism was implemented to give large cash prizes to some invoice holders periodically. It was reported that tax income increased 75% a year after the UI system was enacted [27].

¹To be precise, an *invoice* in general is like a bill requesting for payment for goods or services, while a *receipt* is a proof of the payment. In this regard, Taiwan's *uniform invoice* should be called *uniform receipt*. However, since the term has been used for decades, we follow the usage and treat "receipt" as "invoice" throughout the paper.

Since the UI system was enacted in the 1950s, numerous revisions were made in response to the changing economy and, in particular, the evolving technology. The first major revision of the UI system was the adoption of Point of Sales (POS) systems in the 1980s, which allowed invoices to be electronically printed instead of handwritten. Cash registers could then automatically produce invoices upon transaction, which in turn reduced human errors and unreported transactions. Still, printed invoices were required for companies to report their sales to the government. Paper-based invoices did not begin to fade away until the implementation of the first generation e-invoicing system in 2006, where an official e-invoicing platform was built for businesses to create, transfer, exchange, and/or store e-invoices. The first generation e-invoicing system targeted mainly on business-to-business (B2B) and online transactions, which accounted for less than 4% of all invoices issued in Taiwan. The second generation e-invoicing system was initiated in 2010, aiming to promote e-invoices to all physical stores and channels, along with an ultimate goal to build a more efficient and environment-friendly invoice system for tax auditing.

In this paper, we survey how the Taiwan's e-invoicing system came to be and assess its effects and possible obstacles. We also compare its motivation and approach with other e-invoicing efforts in the world. Looking at these similarities and differences help understand what the universal goals of e-invoicing are and how specific needs change government's policies in implementing the system. Specifically, we ask the following research questions:

- Why and how should the government promote e-invoice?
- What are the key problems that must be addressed when implementing a national e-invoice system?

II. METHODOLOGY AND THEORETICAL BACKGROUND

A. Methodology

This research is conducted through the case study methodology as defined by [46]. First, we identified the research questions as stated in I. Related researches are also studied to further understand the topic. Then, we collect data via documentations such as protocols, user manuals, and laws. Past statistical records are obtained through information portals hosted by the Taiwanese government and inquiries with officials. Directly observing existing services and related products are also ways to gather data. Next, we analyze data in order to build explanations to the study questions. To ensure

the analysis is not confined to a certain viewpoint, multiple perspectives, including consumer, business, and government, are investigated. Employing established theories or models can further enhance the reliability of interpretations. Lastly we develop recommendations to problems and imply further areas of research.

B. Theoretical Background

Advantages of e-invoicing are recognized by many countries around the globe, and various efforts have been made to implement such systems. Common appeals or goals include but not limit to the following [1], [5], [20], [23]:

- Environment-friendly: reducing on paper consumption for traditional invoices in turn reducing carbon footprint
- Operation cost: eliminating the need to print, transport, and other manual labor
- Business efficiency: faster verification and auditing processes
- Authenticity and integrity: enhancing information security
- Tax compliance: reducing tax-related exploitations

The difficulty of successfully implementing e-invoice is comparable to implementing an information system, thus the study into e-invoice implementation and its success factors are interesting topics. This is a relatively new field of research. Case studies that assess experiences of pioneering countries in e-invoicing exist, but the diversity of which is still limited to countries that are in an advanced stage. A few countries in the EU such as Finland and Denmark are leading the movement and more research is done on their behalf. In Latin America, several countries such as Mexico and Brazil are actively promoting e-invoice. Analyses on these efforts will be explained in Section V. Another kind of study focuses on the factors behind adoption of e-invoice. Some are included in case studies whereas others attempt to generalize and develop theories/models. Next we will first give an overview of selected related theories/models.

To assess the effectiveness of an e-invoice implementation, many methods of measurement are possible, such as amount of cost savings, reduced paper consumption, or adoption rate. In this paper we focus on adoption rate as the major benchmark since its value has direct impact on many other measures. The volume of money involved is also a valid measure but is dependent on the party involved, e.g. business vs. consumer. This is especially true in the B2C sector as a higher adoption rate means e-invoicing has diffused into a larger portion of population.

To investigate factors leading to high or low adoption rate, one may refer to the Diffusion of Innovations theory by Everett M. Rogers [36]. We may apply Rogers' theory on e-invoicing since it can be considered as an innovation in application of information technology, in business process, in electronic service, etc. The perceived attributes of innovation described by the theory determine the speed of adoption. They are relative advantage, compatibility, complexity, trialability, and observability. Relative advantage refers to the degree of perceived superiority of a new innovation versus the current situation. Compatibility can be understood as how a new

innovation fits the existing values, past experiences, and needs. Complexity is the perceived level of difficulty to understand or use a new innovation. Trialability allows a user to try a new innovation before adoption, and observability determines whether a potential user can observe the innovation and be encouraged to adopt it. High measures in all five attributes except complexity (low) imply faster adoption. With e-invoicing, it seems reasonable to expect a higher adoption rate if it promises benefits, compatibility with existing processes, low technological barrier, high trialability, and visibility to its implementation. There are doubts, however, that this theory, while suited to studies concerning adoption of information systems, is applicable to electronic data exchange, e.g. e-invoice [1].

One aspect Diffusion of Innovations theory misses is the influence of factors external to the innovation and the adopter. The Technology Acceptance Model [45] addresses this, suggesting that external variables have influence over perceived usefulness and perceived ease of use, which both in turn affect the actual adoption. Nevertheless with technology such as e-invoice, it is observed that adoption may not be a clear-cut yes or no but a partial one. According to [22], a consumer does not necessarily accept e-invoice from all issuers automatically after accepting from just one. The research points out that "implementation intention", specific plans of how, when, and where to execute intended behavior, is an important factor to sequential adoption of consumer.

Aside focusing on businesses and consumers, governmental intervention should also be brought into consideration. In [1], it is found that targeting companies that do business with the government first can help create a ripple effect among their suppliers to adopt e-invoice. An overarching model that explains e-invoice adoption on a governmental level is proposed by Kreuzer et al [25]. The model is a categorization of many factors affecting e-invoice implementation and adoption extracted from numerous articles. These articles are selected from research databases using the search term "electronic invoicing". Adding expert reviews as further data sources, eight factors are then identified: institutional pressure, ecological pressure, political commitment, technological readiness, economic benefits, educational shortcomings, legal uncertainties, and social affordances. Institutional pressure can be summarized as the need to change due to competition, coercion, or professionalization. Educational shortcomings are about the adverse effects of poor training on e-invoice adoption. Social affordances focus on the notion of trust to electronic services such as e-invoice. For detailed information please refer to the original paper.

Kreuzer et al.'s model encompasses a large spectrum of adoption factors specific to e-invoice. On a governmental level, this model is useful in our case study on Taiwanese e-invoice, which is fittingly an analysis of government policy-making. Although the model targets the governmental level, its data sources are diverse enough to include private sectors and citizens. Thus the implications derived may also be valid for business and consumer. We shall broaden the model's target to a national level in order to study the factors' impacts on the many aspects of e-invoice adoption.

III. AN OVERVIEW OF TAIWAN'S E-INVOICING SYSTEM

A. Uniform Invoices

In the early years of Taiwanese government, taxation laws were yet mature and accounting processes were manual. With no standardized principles to regulate, bookkeeping was frequently fraudulent, and verification could be carried out by corrupt government auditors. Taxation based on turnover thus was problematic due to underreported income. In an attempt to remedy the problem, Finance Chief Jen, Hsien-Qun conceptualized the Uniform Invoices in 1950 [27].

The core ideology of the uniform invoices preserves even after numerous rounds of revisions. For example, all printed invoices must follow the formats specified by the government. Until 1990s, all blank invoices were provided by the government to prevent forgery. Although several companies have been granted to print blank invoices, the Printing Plant of the Ministry of Finance still issues around 40 million books, or more than 10 billion sheets, of blank invoices each year and has a revenue of approximately NT\$146 million² from just selling invoices in 2012 [9].

Each invoice must record the seller and the date, item, and amount of the transaction. The seller's information is represented by its Uniform Serial Number (USN), a unique identification number that every listed business organization must apply for to represent them. In addition, there is an alphanumeric code, known as the Uniform Invoice Number (UIN). The code is divided into a 2-leading-alphabet part and an 8-digit serial number. The alphabet part is used to distinguish types of invoices and their issuing period, while the numeric part is used to distinguish individual transactions [19]. Given its fixed length, the same UIN may reoccur every 3 or 4 years. Nevertheless, invoices with identical UIN can be differentiated by the issuance period.

B. Uniform Invoice Lottery

The design of the UIN is largely linked to a mechanism that incentivizes people to request a copy of invoice upon transaction. To see this, observe that a transaction incurs mainly two types of taxes: business income tax and business (sales) tax. The former depends on gross annual revenue minus deductible expenses, while the latter is taxed per transaction, usually on the retail sales of goods such as the value-added tax (VAT). If buyers do not request invoices, a company may forge its transaction records to minimize its income and thus its tax payment. It is also possible to exploit this loophole by falsifying expenses to reduce income tax liability. Indeed, some unworthy sellers did offer buyers a tax³ waiver if the buyers did not request a copy of invoice.

To curb tax fraud, an accompanying system called the *Uniform Invoice Lottery (UI Lottery)* was also introduced in 1950. The lottery randomly draws a set of numbers periodically (now bimonthly). Anyone who holds an invoice with an 8-digit numeric part of the UIN that matches the drawn numbers can claim a cash prize.⁴ The prize is considered quite generous by

the public. For example, before Mar. 2011, the highest prize was NT\$2,000,000, and the new prizing mechanism (effective on Mar. 25, 2011) has increased it to NT\$10,000,000. An estimated 8 winners of the prize will be claimed per 2-month drawing period. To increase the winning odds, any UIN that matches up to certain digits of the drawn numbers can also claim a prize. For example, a match of the last three digits of a drawn numbers can claim the smallest prize NT\$200, with an estimated 3.66 million winners per drawing period [41]. Currently there are 5 drawn numbers of various prizes per period.⁵ The maximum overall winning odds is around 0.3-0.4% [8]. By law [30], the Ministry of Finance can allocate 3% of collected business tax to the UI Lottery prizes. A budget of NT\$8.88 billion has been allocated in the 2012 fiscal year [40].

This high prize and high winning odds have effectively attracted people to request copies of invoices, which then forced businesses to truthfully record sales and thus boosted the government's tax income. For example, when the uniform invoices system was enacted, tax income was boosted to NT\$51 million in the first year (1951) alone, a 75% increase than the previous year's NT\$29 million [27]. The new prizing mechanism effected on 2011.03.25 (that increased the first prize from NT\$2,000,000 to NT\$10,000,000) also boosted a 8% increase of the amount of invoices issued.

C. First Generation E-invoicing System

The electronization of uniform invoices can be dated back to the 1980s, where uniform invoices can be electronically processed and printed by cash registers due to the popularization of Point-Of-Sale (POS) systems. However, exchange and transmit of invoices were still manually based and done via printed hardcopies. Hundreds of workers were employed by the government to key in millions of invoices per month so as to process and verify them electronically within the government's information systems [26].

It was not until the decree of "Provisional Operation Guidelines for Transmitting Uniform Invoices via the Internet" in Nov. 29, 2000 did the government start to pilot e-invoicing in Taiwan. The initial target focused on B2B transactions, as during that time Taiwan's IT industries were building enterprise resource planning (ERP) systems to integrate their supply chains. The e-invoicing project was subsequently expanded in 2005 to include its coverage on online B2C transactions. On Dec. 6th, 2006, the e-invoice platform opened for operations, formally announcing the beginning of paperless invoicing. Businesses can use the platform to create, transfer, exchange, or store e-invoices.

At this stage, only B2B and virtual B2C channels utilized e-invoices, which accounted for less than 4% of all invoices issued during the year 2009. The Ministry of Finance therefore initiated a three-year project entitled "Comprehensive Promotion of the e-Invoice Application Project" in May 2010 to promote e-invoices to all physical stores and channels. The project also planed to build a new generation of e-invoicing system to cope with the unprecedented volume of invoice data using emerging technology such as cloud computing.

²The currency exchange rate is around US\$1 to NT\$29 at present.

³Currently Taiwan's value-added tax (VAT) is 5%.

⁴To prevent fraud, all UINs are distributed by the government, and unused UINs in a given period must be recalled.

⁵See "Uniform-Invoice Prize Winning Numbers", <http://www.etax.nat.gov.tw/etwmain/front/ETW183W6?site=en>

D. Second Generation E-invoicing System

The second generation e-invoicing system circles around the e-invoice platform⁶, which houses all hardware and software services to enable the creation, transfer, exchange, storage, and processing of e-invoices. Based on its usage the system can be described from two perspectives: B2C and B2B.

1) *B2C Transactions*: The life cycle of a B2C e-invoice is depicted in Fig. 1. There are several ways for a customer to engage in the platform. For ease of understanding, similar actions will be labeled the same number or alphabet. From a customer's standpoint, s/he should register (1 in the figure) with the e-invoice platform to create a profile that includes citizenship information such as name, national ID number, bank account, etc. Once done the customer can import (2) his e-invoice carriers into his account so that the platform knows whom these carriers belong to. Conceptually, an *e-invoice carrier* (or simply a *carrier*) is an identifiable container for carrying e-invoices, but in essence it is just an identification that is used to associate e-invoice data to an entity. For instance, loyalty or membership card can be used as a carrier. During a transaction at a POS counter, if a customer presents his card and requests an e-invoice (3), a binding of the e-invoice to the card holder can be established (A) so that the customer may use the card to inquire (4) the e-invoice later on. The e-invoice is also uploaded to the business's information system and to the e-invoice platform (B) for storage and processing. The customer may also present his card at the POS counter to check if he has won the UI Lottery, or be informed automatically by the system next time when he presents the card (5).

Registration, carrier import, and e-invoice inquiry can also be done at a kiosk, which is commonly available in most retail chain stores in Taiwan. Should a customer win the UI Lottery, he can use his carrier to claim the prize and perform fund transfer to a delegated bank account, or convert the prize as store credits in his loyalty/membership card (6). Performing this task at a portal of the e-invoice platform, at a POS counter or at a kiosk saves the customer a trip to the national post office to claim a lottery prize via a printed invoice copy. A customer can also configure his profile in the e-invoice platform for automatic notification of any UI Lottery winning e-invoice and the subsequent prizes transfer to a delegated bank account.

Because each invoice has a potential to win a cash prize in the UI Lottery, many customers simply donate invoices to philanthropic organizations.⁷ Traditionally, there is often a box at the cashier counter that collects customers' invoices. Each organization has its own box to collect invoices. Due to space limitation, however, only one or two boxes can be placed at each store, so not many philanthropic organizations may benefit from invoice donations. With e-invoices, each organization can apply for a universal carrier (dubbed "Love and Care" serial code). The serial code can be requested or presented by a customer and then scanned at the cashier counter to transfer an e-invoice to the corresponding organization. A customer may also donate his e-invoices to an organization at a kiosk (7)

⁶<https://www.einvoice.nat.gov.tw/wSite/dp?mp=2>

⁷On average about 3% of all issued invoices are donated, suggesting that an equal percentage of lottery prizes will go to charity.

or through the e-invoice platform. Therefore, the technology evolution also helps philanthropic organizations raise their funds through invoice donations.

2) *B2B Transactions*: The e-invoice platform also has a pivotal role in B2B transactions. For companies with ERP systems, they need to connect their systems to the platform through given software dubbed AP2AP Gateway "Turnkey" [12], [2]. Through Turnkey, invoice data are uploaded to the platform, as shown in Fig. 2. During a transaction, the buyer must present his USN for the seller to create an invoice, which is either stored on a carrier or, if requested, printed on paper. Either way, a copy of the data is uploaded to the platform and then classified according to USNs. The two parties then begin verifying the transaction with information retrieved from the platform through the gateway. Both will report sales and the resulting taxes to the Financial Data Center (recently renamed to Fiscal Information Agency), which is responsible for auditing and cross-checking. Information will then be passed on to the National Tax Administration, which searches for anomalies and provides access to verification results.

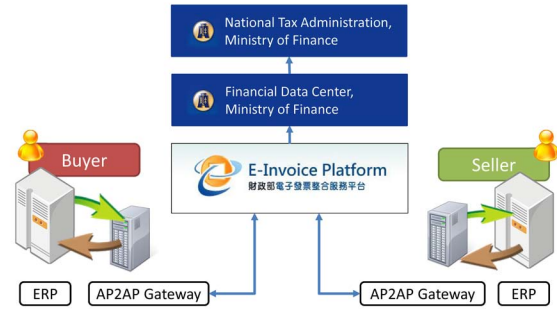


Fig. 2. B2B Flow.

IV. ASSESSMENT

In this section we assess Taiwan's e-invoicing service and discuss possible obstacles from the perspectives of three different parties: consumers, businesses, and the government.

A. Consumers

The second generation e-invoice system has put much effort in getting the public's attention and in persuading them to adopt e-invoices. Convenience is a major appeal, and the UI Lottery process would be the most appropriate example. With paper invoices, people have to keep stacks of receipts (typically hundreds of invoices per household) until the bimonthly lottery, and then manually match each UIN against the winning ones. To further complicate the process, there is not just one winning number but five, and a match of the last three to seven digits of some of the winning numbers can also claim a small prize. People either have to manually check each invoice against the winning numbers, or to give up the potential prize. Besides, prizes must be claimed within three months, and with a physical copy of the receipt. As people sometimes misplace their receipts or even have lost them, it is not surprising to

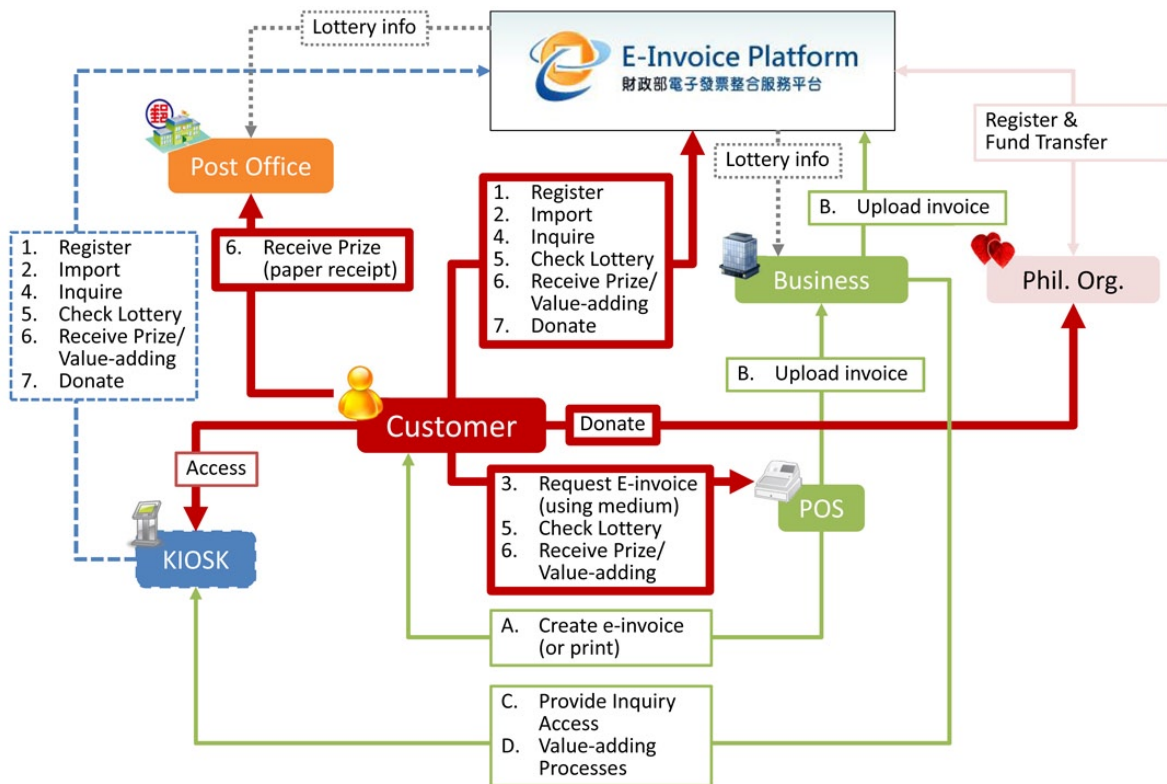


Fig. 1. B2C Data Flow

learn that in between Sept. 2008 to Dec. 2010, 137 Grand Prizes were unclaimed, with an amount exceeding NT\$274 million [28]. (All the unclaimed prizes go to the national treasury.)

In contrast, with the new e-invoice platform, UIN matching becomes automatic. People may also opt for an automatic fund transfer to a bank account or use a certified, printed copy to pick up the cash in an old-fashioned way (i.e. post office). The platform can also provide services for registered users to monitor personal expenditures and help in accounting, as well as to track family spending and verify purchase details.

Although the above benefits sound appealing, they may not be enough to attract most consumers to adopt e-invoices. In fact, on average, over 8 billion paper invoices were produced per year, and almost all were B2C invoices (there were only 300 to 400 million B2B invoices). However, the total amount of B2C e-invoices produced in 2011 only summed up to around 194 million. Moreover, according to internal information, even though the number of B2C e-invoices in between 2012.01-2012.09 has reached 1.5 billion, but only 5% of them are issued through carriers.

According to an empirical study sponsored by the Taiwanese government [15], the low carrier adoption rate may generally be attributed to two issues: acceptance of e-invoice carriers

and security and privacy concerns. Below we address them in more detail.

1) *Acceptance of e-Invoice Carriers:* The concept of carrier is crucial to paperless B2C transactions (see Section III-D1), as there is typically no buyer's identification in a B2C transaction invoice, so a carrier is needed to determine the ownership of the e-invoice. At first thought, a unique and universal carrier for each consumer might be an appealing solution, as then a consumer would be able to use the carrier to collect all his e-invoices in every store and manage them accordingly. Several nontrivial problems arise, however. For example, given the potential huge profit in operating the universal carriers, it would be considerably difficult to conciliate the opinions of which organization should have the authority to issue the carriers. Besides, the universal carriers may also appear to be redundant if some other cards (membership, loyalty, stored-value, etc.) are already used in shopping. The stores would also need to spend extra IT cost to integrate the universal carriers into their information systems. Security and privacy is also a concern, as the lost of such carriers may expose a consumer's all purchase records. As a result, the e-invoicing platform has opened the specification of carriers and allowed each store to issue their own carriers.

On the other hand, the variety of carriers could also mean

chaos. First, a consumer must apply for a store's membership card. According to the Personal Information Protection Act [29], each store must also obtain permission from their consumers if they will collect their customers' e-invoices. It is virtually impossible to use one store's carrier at another store, unless they belong to the same company; yet it is hectic if a consumer has to apply for a membership card for every store he shops and carry them around. Promoting a widely used card to be a carrier might help resolve the chaos.

The Taiwanese government therefore proposed the concept of "General Carriers", which is simply an 8-character serial code generated from a cellular phone number. Anyone with a cellular phone along with an email address can apply for a general carrier from the e-invoice platform. The serial code is presented as a bar code that can be scanned at a POS counter so as to bind an e-invoice to the serial code, as well as to retrieve e-invoices associated with the code. The concept was proposed to allow one to use a single carrier that most POS systems can read to collect e-invoices, yet still has the possibility of possessing several different such carriers to avoid from being tracked using a single "universal" carrier. This is because each general carrier is tied to a cell phone number and an email address, so one may apply a number of general carriers.

2) *Security and Privacy*: Convenience and security/privacy often conflict with each other. This is also the case in e-invoicing. An obvious security concern is on the carriers, as they are used to collect e-invoices. The problem is especially crucial for the type of "universal" carriers that aim to link all transaction records of a customer to a single identification. A lost or stolen of such carriers could result in a total exposure of a customer's purchase history. Thus, extra security mechanisms must be enforced to protect user's e-invoices when the carriers are lost. The barcode-like general carriers have an additional passcode for a user to access his e-invoices in the platform so that the exposure of the barcode does not pose any threat to the e-invoices data it links to. For carriers issued by stores (e.g., membership and loyalty cards), the stores must have a security mechanism to manage the carriers and to protect the e-invoice data in their databases.

The e-invoice platform is another security focus. Due to its role, the platform's information security level has been set to grade-A by the National Security Council of Taiwan, meaning that it must meet the highest information security management standard of the government. The platform indeed has implemented many layers of information security modules to meet the standard. The accompanying UI Lottery has also implemented several mechanisms to enhance its security. For example, to prevent duplicate invoice prints to claim a winning prize as well as to authenticate an e-invoice print, a QR Code is printed on a paper copy to ensure that only the owner has the authentic copy to claim a UI Lottery prize [18].

Although the tight security measures suggest that consumer's private information is well protected, consumers may not be confident with the fact that their purchase records are kept somewhere and may be used by other people someday. Thus, consumers might end up abandoning carriers or opting for more anonymous solutions.

Indeed, past researches [21], [31], [32], [43], [44] have

shown that consumers are not always open to share information with websites, for fearing that private data may be tracked and analyzed by unknown parties. They do realize that some information is required for better services and experiences, but at the same time they want to know how and where this information will go. If a company has a clear and acceptable privacy policy and with a good reputation, then consumers are more willing to provide information. Namely, trust can be considered as the ultimate factor that determines consumers' willingness to share information with businesses, or, in the case of Taiwan's e-invoices, the government. For businesses, they not only need to enforce standard privacy policies, but must also give consumers more freedom in choosing what information to share [21]. The government does not have such option for e-invoices, hence top officials must build trust by showing active commitment and support [39].

3) *Summary*: The concept of data carriers introduces a new technology to consumers that greatly affects purchase patterns. Consumers not only face a large number of choices of carriers, creating complexity in understanding system, they also have to accept the incompatibility among them. In Kreuzer et al.'s model these factors fall into the technological category. On the other hand in the social category, consumers are concerned with security and privacy of data. Besides strengthening information security, an element of trust is required. These two categories of factors overpower the economical and ecological benefits of e-invoice and thus are of prime importance.

B. Businesses

E-invoicing in Taiwan emerged in 2000, much earlier than the formal enactment of the first generation e-invoice system in 2006. By 2005 over half of Taiwan's businesses have implemented ERP or MIS systems, meaning that most of them were conducting e-business and were ready to use e-invoices. E-invoices let these companies get rid of paper invoices, which in turn helps speed up transactions and reduce processing cost as well as human errors. An approximate 50% cost reduction in invoice processing had been recorded [15]. The companies that have implemented ERP systems were mostly large companies in the IT sector. Their adoptions of e-invoices could push e-invoices upward to their supply chains, thus causing a ripple effect to increase the penetration.

However, around three-quarters of the businesses in Taiwan were not yet willing to adopt e-invoices, mainly due to incompatibility with upstream or downstream companies which were still issuing invoices in the traditional way [15]. Several other dissuasive factors existed, such as incomplete government policies at that time. For example, directives were given but lacked implementation procedures, compensation plans, compulsive laws, etc. Cost-effectiveness were also a concern for smaller businesses, since the cost of implementation and training might outweigh any benefit if they did not issue many invoices per year.

In the online B2C sector, even though e-invoices were not used until 2006, concerns similar to B2B businesses still existed. According to the policies back then, only a handful of companies were eligible to use e-invoices due to restrictions on minimum revenue and an NT \$3 million bond of guarantee for using the e-invoicing system [15]. Moreover,

most businesses needed time to examine e-invoicing's cost-effectiveness. Consumer's acceptance of e-invoices was also a crucial factor, with convenience being the top concern. For example, consumers still preferred to have a paper invoice as proof of purchase for returning goods and for checking the UI Lottery winning numbers. As such, paper invoices were still delivered along with packages. Similar situation existed for TV shopping industry [16]. In short, due to the fact that e-invoices could not instantly replace traditional paper invoices, businesses must have the ability to issue both paper and paperless e-invoices, which turned out to be quite a cumbersome procedure to them.

In hope to further encourage businesses to use e-invoice, the government thus urged physical retail chains to join e-invoicing to rapidly increase the penetration rate among their buyers and suppliers. Three large retail chains pioneered the movement in 2010. New updates in tool also aimed to solve technological problems that dissuade adoption. For example, the second version of the Turnkey software provides higher compatibility and better features, as described in Section ???. Multiple instances of the software can now run in parallel to speed up processing. The new Turnkey not only supports more operating systems but also more types of databases, making integration into existing MIS easier. There are many improvements on efficiency and security as well. The e-invoice platform has received many feature upgrades over the years, such as a better UIN distribution system [10]. Businesses can apply for a range of UIN numbers on the platform bimonthly and use them directly on e-invoices. A software-based certificate generation tool is also released [11] to allow businesses to acquire certificates online to authenticate invoice upload. In contrast, before the release of the tool businesses must apply for an IC card from the MOEACA (Ministry of Economy Affairs Certificate Authority) and use a card reader to read the certificate in the IC card to authenticate e-invoices.

1) *Summary:* In terms of Kreuzer et al.'s model, we again see institutional pressure a crucial factor in e-invoice adoption. Without competitors or partners' adoption of e-invoice, businesses feel less pressure to follow suit, since there is no fear of losing competitive advantages such as economical, ecological benefits. The Taiwanese government plans to overcome the inertia by targeting businesses that affect the largest population possible. Apparently educating the consumers will aid in the adoption process. Legal uncertainties in the early stages have hindered progress of adoption, but as policies mature businesses should feel more at ease.

C. Government

Since the birth of e-invoice's concept in 2000, Taiwanese government had gone through a number of iterations to complete the complex project. The result is a more accurate database of transactions in Taiwan, which allows the government to curb fraudulently issued invoices and have better control over tax sources. Although there is no official data to show e-invoice's effect on Taiwanese government's tax income, results from other countries may provide some clue. For example, Argentina's e-invoice movement showed a 15% decrease in VAT breach since 2002 to 2007 [24].

The reduction in VAT breach would not be possible without a wide adoption of e-invoices. However, as previously described, reports dating back to the first generation e-invoice system had shown that adoption rate was always an issue. The Taiwanese government has taken several actions to improve the adoption rate. For example, it has lifted restrictions such as the aforementioned guaranteed bond for companies joining the e-invoicing system. Businesses are now automatically eligible to use e-invoices once they receive business permits; no extra registration is required. Aside from businesses with extensive supply chains, the government has urged state enterprises to use e-invoices due to their large influences over many industries.

The Taiwanese government has put much effort in promoting e-invoices for businesses, but limited attention in B2G transactions. As long as the government continues to perform auditing and verification of its expenses by paper, e-invoices would appear to be redundant. Policy changes in accounting and auditing laws are thus crucial. In this regard, on Aug. 3, 2012, amendments for a law on business-related tax collection⁸ have been announced. These changes specifically addressed e-invoices, such as allowing e-invoices to legally replace traditional paper invoices in certain procedures. In short, constructing a fully digitized tax-related process and environment is the last mile for e-invoicing, but is the first step for a new wave of tax reforms [17].

1) *Summary:* Aside from economical and ecological benefits, a committed strategy to enable e-government drives the political aspect of e-invoicing. Policies to lift legal restrictions and reduce technological barriers are all parts of this strategy. However as we can see from previous sections, governmental intervention in other factors are also indispensable.

V. COMPARISON WITH OTHER E-INVOCING EFFORTS

Similar to other countries that decide to adopt e-invoice, Taiwan's implementation follows the same reasons as outlined in section II. Nevertheless, across the globe, different focuses on e-invoicing can be observed. For example, in Asia, country-wide projects were launched by tax authorities mainly for the purpose of eradicating tax evasion through better validation and auditing mechanisms [24]. A number of countries in Latin America share the same mission but with only stricter regulations. In contrast, European Union's e-invoicing is enabled by many e-invoicing service providers that comply with a myriad of legislations.

In this section we explore similarities and differences caused by requirements that may be specific to a certain region or country. We select the European Union and Latin America for analysis due to that leading countries in e-invoicing are concentrated in these two regions. Following a brief description for each region, Finland and Brazil will be selected for a more detailed look and compared with Taiwan's e-invoice since they have long experiences and advanced implementations.

A. European Union (EU)

In 2001, the European Commission issued the EC Directive on Invoicing (2001/115/EC, hereon referred to as E-invoicing

⁸Regulations for the Management of Profit-Seeking Enterprise Account Books and Receipts by Tax Collection Agencies.

Directive) as an amendment to the existing rules on VAT invoicing to provide a universal standard for invoice content and to enable e-invoicing. However, the directives were written in a way that resembles a compromise among many regulations. Depending on the government, member states could arrive at various levels of compliance. Similarities did exist, such as the use of EDI, but for most the differences created inefficiencies in both domestic and cross-border transactions [42]. For instance, there was no clear standard for invoice storage, data format, and transfer protocols [13], [35].

One of the major conflicts concerns how the authenticity and integrity of e-invoice could be guaranteed. The E-invoicing Directive stated that the authenticity of origin and integrity of content of invoices should be guaranteed by “advanced electronic signature” (AES) or EDI. It was also stated that countries could opt for AES “based on a qualified certificate and created by a secure-signature-creation device”. This type of AES was coined “Qualified Electronic Signature” (QES) and could be considered as a high-level requirement. In contrast, a low-level requirement accepted any “other electronic means subject to acceptance by the member state(s)”. Due to such differences, companies based in countries with high-level requirements might not accept invoices from those of lower levels and vice versa.

As a result, most countries came up with their own e-invoicing implementations, with Northern European countries such as Denmark and Finland leading the trend. Denmark abolished paper invoices in 2005 and required all invoices to follow a particular format called “OIOXML electronic invoice”, which was based on the OASIS⁹ standard Universal Business Language [3]. In Finland, banks launched “Finvoice”, which used an XML syntax named ebXML, a joint effort by OASIS and UN/CEFACT¹⁰, to format invoices [23].

Nevertheless, when the European Commission incorporated the E-invoicing Directive into the VAT Directive (2006/112/EC), disharmony persisted [34]. With recommendations [33] from businesses and expert study groups in mind, the Second Directive on VAT Invoicing (2010/45/EU) was adopted on Jul. 13, 2010. The legislation, aimed to further remove burdens and barriers, will be in effect on Jan. 1, 2013. Several issues were clarified, such as Article 219a that describes which member state’s invoicing rules to apply during a cross-border transaction. Efforts to consolidate the massive matrix of implementations were also constantly made. An expert group launched by the European Committee developed the European Electronic Invoicing Framework (EEIF) to combat fragmentation and improve interoperability across Europe. Another ongoing project named PEPPOL¹¹ also aims to align business processes and expand connectivity of businesses in Europe [37]. Instead of competing for market share, collaboration between the government and service providers is preferred to create a more unified Europe.

The Finnish Bankers’ Association (FBA) originally developed Finvoice, which is now maintained by The Federation

of Finnish Financial Services (FFFS). Finvoice is a popular choice for e-invoicing in Finland due to the banks’ full support and resulting advantages in using their online services. It has gone through several revisions and is now in version 2.0.

The Finvoice file format, coded in ebXML syntax, is an envelope file that contains a header, or XML-Transmission frame, that describes the sender and receiver, and the actual invoice data. The XML elements are defined in Finvoice Implementation Guidelines published by the FFFS [14], similar to Taiwan’s MIG. To use Finvoice, users must sign an agreement with their service providers to use the forwarding service. Namely, e-invoices are routed among service providers to reach recipients that may belong to different service providers. For businesses, they can view the invoices in their systems or through a browser. In case of consumers, they can access the invoices through online bank or web payment services.

We can use the “direct payment” scenario as an example to understand how banks function as service providers in Finvoice. In direct payment scenario, the bank credits consumer’s account according to the invoice received from the invoicer. First, the invoicer sends an Invoicer Notification through its service provider to consumer’s service provider. The consumer then agrees to use direct payment and return a Reception Notification. Upon receiving the notification, the invoicer sends the invoice in an agreed manner, while an electronic copy of Finvoice is routed to consumer’s service provider. Consumer’s service provider will execute the fund transfer in accordance with the invoice.

B. Latin America

Some of the strictest e-invoicing regulations are enacted in Latin America, including Mexico, Brazil, and Chile [24]. The government of each of these countries plays a strong role in initiating and pushing the e-invoice movement, usually for benefits such as reducing tax evasion and real-time auditing. Typical characteristics of e-invoicing in Latin America include permanent and unique invoice numbers, stringent invoice format, and the use of digital signatures/certificates.

For example, in Mexico, national tax authority Servicio de Administracin Tributaria (SAT) decreed that any company whose annual revenue is larger than two million pesos must use e-invoices [38]. Mexican e-invoicing, or “Comprobante Fiscal Digital” (CFDI), features clear standards for XML schema, processing, storage, integration, and even printing of invoices [4]. Under CFDI, companies must sign up with a government-approved service provider, acquire various electronic tokens, and comply with strict validation rules. Other countries of Latin America follow a similar approach, such as Brazil’s Nota Fiscal Electronica, which claims a market penetration of 90%[24]. Such outstanding results invite us for a closer look.

Brazil’s e-invoice system, Nota Fiscal Electronica (NF-e), is based on the Chilean experience of “Factura Electronica”. Initiated in 2005, it was meant to be a part of the Public Digital Bookkeeping System (SPED), which aimed at modernizing tax bookkeeping, accounting bookkeeping, and management of tax documents from businesses [5]. Similar to Taiwan, NF-e constructed a central solution to e-invoicing that was applicable throughout the country.

⁹Organization for the Advancement of Structure Information Standards (<http://www.oasis-open.org>)

¹⁰United Nations Centre for Trade Facilitation and Electronic Business

¹¹Pan-European Public Procurement On-Line

Any company can register for issuing NF-e, and a typical flow starts with the issuing company generating an XML document that adheres to the NF-e format and includes its digital signature [6]. This document is then transmitted through the Internet via secure channels to tax authority, which validates it against NF-e standards and returns authorization to use the file. Simultaneously a copy of the document is sent to the national repository of electronic documents, Federal Revenue Service. Note that the previous steps are all performed in real-time. When the company receives the authorization, it should make the NF-e available to the purchaser or print a simplified graphic representation of the NF-e called Auxiliary NF-e Document (DANFE) that will accompany the transferred goods. DANFE contains an access key to the actual invoice online and a one-dimension barcode that encodes the same information. This barcode is for verification purposes, for instance, by inspectors of state borders. Once the addressee receives the goods, it should check the validity and authenticity of NF-e or DANFE on tax authority's website.

Brazil's strategy to promote NF-e was vigorous. Companies that opted for NF-e were forbidden to use paper tax document. Customer who received paper tax documents from such company must also refuse the goods sent. By 2010, all industries and wholesalers in Brazil must issue NF-e. This did not mean small and medium enterprises were disadvantaged: a free program for issuing NF-e was available to these companies. Over 40% of NF-e's are issued in this way. With the success of NF-e, digitalization of other tax documents are under way, further advancing the SPED project.

C. Comparisons

From the information above, similarities among all three systems, Finvoice, NF-e, and Taiwanese e-invoice, are mostly technological. The usage of XML or derivatives of the language is suited to describe e-invoice data in human-readable format and easy to process by information systems. Digital signatures or other variants of security devices are also present in order to guarantee authenticity of e-invoice. All implementations use the Internet (portals and websites) as a medium to transfer data.

Between Finland and Taiwan, one large difference is in the infrastructure. Finvoice is powered by service providers in a distributed network, whereas Taiwan e-invoice has a centralized platform hosted by government. The reason why Taiwanese e-invoice is centralized may have to do with its roots in the UI and UIL. At first the purpose of centralization is to enact a national standard to fight tax evasion. As UI and UIL become integral to economic activities, too much cost and risk would be involved if e-invoice demanded a total reform of tax policies. Brazil shared a similar motive when building NF-e, but its cause to fight tax evasion is strongly valid even today [6]. From here we can conclude that tax-related requirements have high influence on the infrastructure of e-invoice system.

Although Brazil and Taiwan share similar motives, its invoicing process is apparently stricter and more real-time than Taiwan's. With NF-e, generated XML documents have to be validated in real-time before they can be used and sent. In Taiwan the e-invoices can be batch-uploaded to the E-invoice

Platform 48 hours after transaction at the latest. The degree of flexibility given to Taiwanese businesses may constitute as a strategy to encourage adoption. However, in the case of NF-e, coercive laws do not mean low adoption rate. One can say Brazil uses force to quickly achieve adoption, and Taiwan uses incentives to persuade adoption. Again, this difference could be due to the pressing need to reform bookkeeping processes in Brazil, which affects numerous types of tax documents. The issue of B2C e-invoicing may also determine which kind of change is preferred: a clear-cut point when traditional invoice is legal or not can result in confusion among consumers, negatively impacting the economy. In the case of Taiwan, a gradual introduction that is compatible with previous systems is required. In conclusion, a national effort of implementing e-invoice can be coercive or gradual, depending on the political agenda and target population.

VI. CONCLUSIONS AND FUTURE WORK

Taiwan's Uniform Invoice system is worth studying because, thanks to the accompanying lottery mechanism that incentivizes people to request invoices upon transaction, the system has proven quite effective in curbing tax-related exploitations. The system can thus be adopted by other countries to combat tax evasion and boost tax income. For instance, Brazil has incorporated a similar incentive program using casting of lots to increase consumer requests for invoices in 2007 [7].

Migrating from conventional paper invoices to e-invoices, however, is not a simple task, as it involves many changes in procedures, regulations, and consumer behaviours. While some of the changes are common to other e-invoicing projects around the globe, some of them are unique to Taiwan's e-invoicing system due to its *uniform* nature in invoice format and the accompanying lottery mechanism. For example, with paper invoices, anyone who possesses a B2C invoice that won a UI Lottery prize can claim the prize. For e-invoice, some mechanism is needed to associate an e-invoice to a person, and this is why the concept of carriers was introduced. Although the concept of carriers eases the UI Lottery process and helps consumers manage their transaction records, it also brings changes to transactions and raises some security and privacy concerns. Therefore, we discussed the benefits, obstacles, and potential solutions to the problem.

Adoption of e-invoice is not a problem limited to only consumers; rather, businesses and government all have their own concerns. Kreuzer et al.'s model of e-invoice adoption has outlined the 8 major categories of factors involved in the decision process. We have incorporated these factors into our assessment and found different parties have different emphases. Consumers, according to this case study on Taiwan, are influenced more strongly by technological and social factors. Businesses pay closer attention to institutional, legal, and educational factors. The government, as the one implementing e-invoice, has to consider all the above factors and commit to a political strategy. This model echoes well with our empirical findings and we expect to see more vigorous analysis and experiment in future research.

REFERENCES

- [1] R. Arendsen and L. van de Wijngaert, "Government as a Launching Customer for eInvoicing," in *Electronic Government*. Springer, 2011, pp. 122–133.
- [2] Y.-S. Chang, "Guide on using and integrating with e-invoice platform (in Chinese)," in *Conference on E-invoice Platform Applications and Promotion at Ministry of Finance 2007 (in Chinese)*, Taiwan, 2007. [Online]. Available: <https://www.einvoice.nat.gov.tw/wSite/public/Data/f1218620453306.pdf>
- [3] R. Cimander, H. Kubicek, and M. H. Brun, "eInvoicing in Denmark," eGovernment Unit, Information Society and Media Directorate-General, European Commission, Tech. Rep., 2007.
- [4] F. M. Coss, "E-invoicing in Mexico," in *EXPP Summit*. Barcelona, Spain: SAT, 2011.
- [5] N. O. De Mello, E. M. Dias, C. F. Fontana, and M. L. A. Fernandez, "The evolution of the electronic tax documents in Latin America," in *Proceedings of the 8th WSEAS international conference on System science and simulation in engineering*. World Scientific and Engineering Academy and Society (WSEAS), 2009, pp. 294–301.
- [6] —, "The implementation of the electronic tax documents in Brazil as a tool to fight tax evasion," in *Proceedings of the 13th WSEAS international conference on Systems*. World Scientific and Engineering Academy and Society (WSEAS), 2009, pp. 449–456.
- [7] N. O. De Mello, M. L. A. Fernandez, V. A. Z. C. Melo, E. M. Dias, and C. F. Fontana, "New technologies for Nota Fiscal Paulista (São Paulo tax invoice): automation of the tax documents issue process in the retail of the state of São Paulo-Brazil," in *Proceedings of the 8th WSEAS international conference on System science and simulation in engineering*. World Scientific and Engineering Academy and Society (WSEAS), 2009, pp. 251–258.
- [8] Department of Statistics, Ministry of Finance, R.O.C., "Winning the uniform invoice lottery is no daydream (in Chinese)," 2012. [Online]. Available: <http://www.mof.gov.tw/public/Attachment/15101456533.pdf>
- [9] Directorate-General of Budget, Accounting and Statistics, Executive Yuan, R.O.C., "The printing plant, ministry of finance, R.O.C. - analysis and explanation (in Chinese)," Executive Yuan, R.O.C., 2011. [Online]. Available: <http://win.dgbas.gov.tw/dgbas02/seg2/101/BAA261018701.pdf>
- [10] E-Invoice Platform, Ministry of Finance, R.O.C., "Guide on acquiring uniform invoice numbers for e-invoices (in Chinese)," 2011. [Online]. Available: <https://www.einvoice.nat.gov.tw/wSite/public/Attachment/f1355445145728.pdf>
- [11] —, "Guide on applying software-based certificates (in Chinese)," 2011. [Online]. Available: <https://www.einvoice.nat.gov.tw/wSite/public/Attachment/f1336721421881.pdf>
- [12] —, "For business - guide on installing the new turnkey client (second generation e-invoice) (in Chinese)," 2012. [Online]. Available: <https://www.einvoice.nat.gov.tw/wSite/ct?xItem=1354062&ctNode=44489&mp=1>
- [13] S. Engel-Flehsig, "E-invoicing and new VAT directive—challenges for cross border transactions," in *Securing Electronic Business Processes: Highlights Of The Information Security Solutions Europe 2003 Conference*. Springer-Verlag New York Incorporated, 2004, p. 131.
- [14] *Finvoice Implementation Guidelines Version 2.0*, Federation of Finnish Financial Services Std. [Online]. Available: <http://www.finvoice.info/>
- [15] Fiscal Information Agency, Ministry of Finance, R.O.C., "Outsourcing project on the planning and assessment of e-invoice: Survey and report of current status on demands for e-invoicing (2005) (in Chinese)," 2005.
- [16] —, "Outsourcing project on the planning and assessment of e-invoice: Survey and report of current status on demands for e-invoicing (2007) (in Chinese)," 2007.
- [17] —, "Fiscal Informatoin Agency, Ministry of Finance: Special report on e-invoice (in Chinese)," *Government IT Report (in Chinese)*, vol. 285, 2011.
- [18] —, "Advancement on e-invoicing systems (in Chinese)," 2012.
- [19] —, "Directions on electronically filing business tax (in Chinese)," 2012. [Online]. Available: <http://www.fia.gov.tw/public/Attachment/28101762171.pdf>
- [20] S. Henao Restrepo, "Analysis of the adoption level and behavior of electronic invoicing in European countries," Ph.D. dissertation, Polytechnic University of Milan, 2011.
- [21] D. L. Hoffman, T. P. Novak, and M. Peralta, "Building consumer trust online," *Communications of the ACM*, vol. 42, no. 4, pp. 80–85, 1999.
- [22] M. Juntumaa and A. Oorni, "Partial Adoption of E-Invoice: An Unexpected Phenomenon within IS Adoption," in *System Sciences (HICSS)*, 2011 44th Hawaii International Conference on. IEEE, 2011, pp. 1–10.
- [23] S. Karlsson, "Research and development of a cost efficient Finvoice B2C billing solution," Ph.D. dissertation, Uppsala University, 2008.
- [24] B. Koch, "E-invoicing/e-billing opportunities in a challenging market environment," Billentis, Switzerland, Tech. Rep., 2012.
- [25] S. Kreuzer, A. Eckhardt, S. Bernius, and J. Kronung, "A Unified View of Electronic Invoicing Adoption: Developing a Meta-Model on the Governmental Level," in *System Sciences (HICSS)*, 2013 46th Hawaii International Conference on. IEEE, 2013, pp. 1943–1952.
- [26] C. Lin, "An appraisal of business tax reform in taiwan: The case of value-added taxation," in *The Political Economy of Tax Reform, NBER-EASE*, T. Ito, A. O. Krueger, and editors, Eds. University of Chicago Press, 1992, vol. 1, pp. 137–155.
- [27] Ministry of Finance, R.O.C., "Related historical data on uniform invoice (in Chinese)," 2009. [Online]. Available: <http://www.mof.gov.tw/museum/ct.asp?xItem=3693&ctNode=35&mp=1>
- [28] —, "307 millionaires have born since uniform invoice top prize increased to 3 serials per drawing period (in Chinese)," 2010. [Online]. Available: <http://www.mof.gov.tw/ct.asp?xItem=62504&ctNode=657&mp=1>
- [29] Ministry of Justice, R.O.C., "Personal Information Protection Act," Laws & Regulations Database of the Republic of China, 2010.
- [30] —, "Value-added and Non-value-added Business Tax Act," Laws & Regulations Database of the Republic of China, 2011.
- [31] N. Olivero and P. Lunt, "Privacy versus willingness to disclose in e-commerce exchanges: The effect of risk awareness on the relative role of trust and control," *Journal of Economic Psychology*, vol. 25, no. 2, pp. 243–262, 2004.
- [32] J. E. Phelps, G. D'Souza, and G. J. Nowak, "Antecedents and consequences of consumer privacy concerns: An empirical investigation," *Journal of Interactive Marketing*, vol. 15, no. 4, pp. 2–17, 2001.
- [33] PricewaterhouseCoopers, "A study on the invoicing directive (2001/115/EC) now incorporated into the VAT directive (2006/112/EC) final report," PricewaterhouseCoopers, European Commission, Tech. Rep., 2008.
- [34] —, "A study on the invoicing directive (2001/115/EC) now incorporated into the VAT directive (2006/112/EC) phase 2: Evaluation of legislation," PricewaterhouseCoopers, European Commission, Tech. Rep., 2008.
- [35] T. Rautajoki, "A comparison of electronic invoicing solutions in the EU and the effects of the EU directives," Ph.D. dissertation, Swedish Schools of Economics and Business Administration, 2003.
- [36] E. M. Rogers, *Diffusion of innovations*. Simon and Schuster, 2010.
- [37] M. Salmony and B. Harald, "E-invoicing in europe: Now and the future," *Journal of Payments Strategy & Systems*, vol. 4, no. 4, pp. 371–380, 2010.
- [38] S. Sprague, "Latin America eInvoicing vs. European Union eInvoicing," 2012. [Online]. Available: <http://www.finextra.com/community/fullblog.aspx?blogid=6317>
- [39] S. C. Srivastava and T. S. Teo, "Citizen trust development for e-government adoption and usage: Insights from young adults in Singapore," *Communications of the Association for Information Systems*, vol. 25, 2009.
- [40] Taxation Agency, Ministry of Finance, R.O.C., "Central Government General Budget Proposal, Fiscal Year 2012: Taxation Agency, Ministry of Finance (in Chinese)," 2012.
- [41] Taxation and Tariff Committee, Ministry of Finance, R.O.C., "Taxation," 2012.
- [42] The Computing Technology Industry Association, "Electronic invoicing challenges in Europe," The Computing Technology Industry Association E-ESCB, Tech. Rep., 2005.
- [43] G. Udo, "Privacy and security concerns as major barriers for e-commerce: a survey study," *Information Management & Computer Security*, vol. 9, no. 4, pp. 165–174, 2001.
- [44] T. Van Dyke, V. Midha, and H. Nemati, "The effect of consumer privacy empowerment on trust and privacy concerns in e-commerce," *Electronic Markets*, vol. 17, no. 1, pp. 68–81, 2007.
- [45] V. Venkatesh and F. D. Davis, "A theoretical extension of the technology acceptance model: four longitudinal field studies," *Management science*, vol. 46, no. 2, pp. 186–204, 2000.
- [46] R. K. Yin, *Case study research: Design and methods*. SAGE Publications, 2003, vol. 5.