

# Overview of an e-Invoice Interoperability Framework

Prepared by the Business Payments Coalition  
e-Invoice Work Group

November 2019



Business Payments Coalition

# Table of Contents

1. Executive Summary .....	3
1.1 Audience .....	5
1.2 Disclaimers, Copyright and Acknowledgments .....	5
2. Introduction .....	6
3. Background .....	8
3.1 Current U.S. Models for Connecting Sellers and Buyers .....	8
3.2 Barriers and Challenges .....	10
3.3 Opportunities .....	11
3.4 Lessons from Other Countries .....	12
3.5 A New Way of Connecting: The Four-Corner Model .....	12
4. What is an e-Invoice Interoperability Framework? .....	15
4.1 Interoperability Layers .....	16
4.1.1 Legal Interoperability .....	16
4.1.2 Business Interoperability .....	16
4.1.3 Semantic Interoperability .....	17
4.1.4 Technical Interoperability .....	17
5. Benefits of an e-Invoice Interoperability Framework.....	19
5.1 Business Benefits .....	19
5.2 Service Provider Benefits .....	19
5.3 Market and Societal Benefits .....	20
6. e-Invoice Interoperability Framework Assessment - Key Findings.....	21
6.1 Technical Assessment .....	21
6.2 Semantic Assessment .....	22
7. The Path Forward .....	23
8. Appendices .....	24
8.1 Appendix A - References.....	24
8.2 Appendix B – Interoperability Framework Assessment Reports .....	25

## List of Figures and Tables

Figure 1 The Three Domains Involved in e-Invoicing.....	8
Figure 2 The Two-Corner and Three-Corner Network Models.....	9
Figure 3 Invoice Processing Variation and Complexity.....	10
Figure 4 The Four-Corner Model .....	13
Figure 5 The Four Corner Model of an e-Delivery Network .....	14
Figure 6 End-to-End Business Process .....	16
Figure 7 Interoperability Framework Initiative Work Group Timelines .....	23
 Table 1 The Four Essential Layers of an Interoperability Framework .....	 15



# 1. Executive Summary

The Business Payments Coalition (BPC)<sup>1</sup> is coordinating a multi-year initiative with industry stakeholders to assess and provide requirements and recommendations for an electronic invoice (e-Invoice) interoperability framework for the U.S. market. The BPC has defined an e-Invoice as an invoice that has been issued by the seller and transmitted and received by the buyer in a structured digital format that allows for automated processing.<sup>2</sup>

In 2018, the BPC initiated two work groups to study existing e-Invoice interoperability frameworks:

- Semantic Model Work Group to assess established e-Invoice semantic models
- Technical Feasibility Work Group to assess the technical architecture of an electronic delivery (e-Delivery) Network (Figure 5).

This report introduces the concept of an e-Invoice interoperability framework as well as market challenges and benefits of addressing them, and a path forward for the BPC work assessing U.S. market needs.

An e-Invoice interoperability framework is a set of policies, standards and guidelines that enables the exchange of e-Invoices, independent of the payment, accounting and enterprise resource planning (ERP) systems.

U.S. businesses are striving to increase the adoption rate of e-Invoicing within their business and supply chains. While there are significant challenges to facilitate broad exchange of e-Invoices, there are promising models emerging from other countries based on the establishment of e-Delivery networks and e-Invoice semantic models. In Europe, and elsewhere, e-Invoice frameworks are using common standards and protocols in a federated network of access points, creating a scalable ecosystem that is easier and more cost effective to implement, enabling broader adoption.

Much like email, which is globally interoperable due to its standards-based format and delivery, the framework will:

- Enable document delivery among an open network of service providers and platforms
- Utilize standards to provide flexibility to preserve existing connections and operations with customers
- Meet a variety of business needs by lowering the cost to establish connections to exchange electronic invoices

<sup>1</sup> Views expressed here are not necessarily those of, and should not be attributed to, any particular Business Payments Coalition participant or organization. They are not intended to provide business or legal advice, nor are they intended to promote or advocate a specific action, payment strategy, or product. Readers should consult with their own business and legal advisors.

<sup>2</sup> *Catalog of Electronic Invoice Technical Standards in the U.S.*, Business Payments Coalition and Federal Reserve Bank, October 2017.

The BPC work is leveraging the learnings and implementation strategies from those frameworks to enable the creation of an interoperable ecosystem of access points in the United States. The ecosystem will enable service providers and accounting technology systems<sup>3</sup> to provide sellers and buyers with services for the seamless exchange of e-Invoices. Utilization of the framework provides efficiencies and benefits including significantly reducing the cost and complexity of sending and receiving invoices.

The goal of this report is to build awareness and facilitate discussion with the broader industry by framing industry challenges and business requirements and suggesting next steps to achieve broader adoption of e-Invoicing and straight-through processing<sup>4</sup>. Additional planned BPC reports documenting the assessment process, findings and recommendations of the e-Invoice work groups can be found in the Appendix section under References.

The United States can be successful in creating a vibrant ecosystem that connects the community of accounting technology systems, service providers, B2B networks and platforms through an interoperability framework. Many of the organizations that service the United States also operate in markets where the frameworks assessed exist. These entities are encouraged to participate as early adopters and play an instrumental role in the initial establishment of a framework in the U.S. marketplace. The BPC looks forward to industry dialogue to refine ideas and gain buy-in for the potential path forward.

For additional information on this initiative or to share ideas, please contact:

Business Payments Coalition

e-Invoice Work Group

Email: [business.payments.smb@mpls.frb.org](mailto:business.payments.smb@mpls.frb.org)

For more information about the BPC, visit the website at <https://businesspaymentscoalition.org/>.

---

<sup>3</sup> The term accounting technology systems is used to describe ERP Systems, invoice/billing software, accounting software, document management systems, workflow systems, office software, and network providers.

<sup>4</sup> Straight-through processing refers to end-to-end automated processing of digitized (electronic) payments with the full exchange of supporting information that effectively connects payments to invoices.

## 1.1 Audience

The BPC *Overview of an e-Invoice Interoperability Framework Report* is intended for business and technology stakeholders in the private and public sector markets involved in the implementation and support of accounting technology systems that process invoices. This report provides business and technology stakeholders with an understanding of an e-Invoice interoperability framework based on existing models.

### Business Stakeholders (Primary Audience)

- Individuals who are responsible for implementing and supporting accounting technology systems from the business domain
- Individuals who are responsible for identifying, defining, and supporting business requirements for accounting technology systems that support accounts receivable, accounts payable and electronic exchange of business documents

### Technology Stakeholders (Secondary Audience)

- Individuals who are responsible for the design, implementation, and support of accounting technology systems and solutions for electronic exchange of business documents
- Individuals who are responsible for the design, integration and operational support of business applications dealing with invoicing

## 1.2 Disclaimers, Copyright and Acknowledgments

Views expressed here are not necessarily those of, and should not be attributed to, any particular Business Payments Coalition participant or organization. They are not intended to provide business or legal advice, nor are they intended to promote or advocate a specific action, payment strategy, or product. Readers should consult with their own business and legal advisors.

Readers are free to republish this report in whole or in part without further permission, as long as the work is attributed to the BPC, and in no way suggests the BPC sponsors, endorses or recommends any organization or its services or products. Other product names and company names referenced within this document may be either trademarks or service marks of their respective owners.

The BPC would like to acknowledge the work of e-Invoice work groups<sup>5</sup> and other contributors including, the Pan European Public Procurement Online (PEPPOL) and the European e-Invoice Service Provider Association (EESPA), for their contributions during the assessment process.

---

<sup>5</sup> Members of the BPC Technical and Semantics work groups can be found in the e-Invoice Interoperability Framework: e-Delivery network Feasibility Assessment Report, November 2019; and the e-Invoice Interoperability Framework: Semantic Model Assessment Report, planned to be published by year-end 2019, respectively.

## 2. Introduction

The purpose of this report is to set the context in which an interoperability framework can address the challenges and barriers U.S. businesses face with electronically exchanging invoices and associated business documents. In addition to summarizing the benefits of addressing these challenges, this report describes the layers of interoperability needed to increase adoption of the exchange of secure, electronic, structured e-Invoice data between trading partners.

The BPC is midway through a multi-year initiative to identify and assess existing e-Invoice interoperability frameworks from other countries. The overall objective of the initiative is to assess the feasibility of, and provide recommendations for, establishing an e-Invoice interoperability framework in the United States. The assessments specifically focused on two of the four layers, **semantic and technical delivery**, of an interoperability framework (Table 1). The desired outcome is to increase B2B payment efficiency and straight-through processing by increasing the adoption of e-Invoicing in the United States.

Globally, countries with similar adoption barriers and challenges (Section 3.2) have successfully connected the community of service providers, platforms and networks through e-Invoice interoperability frameworks designed to complement, rather than supplant, existing investments in technology infrastructure and service relationships. In the United States, approximately 75 percent of invoices submitted to buyers are paper-based.<sup>6</sup> Although direct connection of electronic data interchange (EDI), value-added networks (VAN), and B2B networks between sellers and buyers are successfully delivering e-Invoices, they currently suffer from limited market reach and interoperability. This prevents greater adoption of e-Invoices. An evolution toward an interoperable ecosystem of service providers, platforms and networks is required for sellers and buyers to cost effectively exchange e-Invoices and related documents.

The Business Payments Coalition (BPC) is a volunteer group of organizations and individuals working together to promote greater adoption of electronic business-to-business (B2B) invoices, payments, and remittance data.

The BPC and Federal Reserve Bank e-Invoicing publications to date include<sup>7</sup>:

- *U.S. Adoption of Electronic Invoicing: Challenges and Opportunities*<sup>8</sup>, a Federal Reserve Bank white paper study of the business environment and e-Invoicing adoption in the United States and internationally.
- *Catalog of Electronic Invoice Technical Standards in the U.S.*<sup>9</sup>, a BPC workgroup report that documents e-Invoice technical standards that exist in the U.S. market. The report describes the current fragmentation in the U.S. market usage of e-Invoices and the interoperability challenges among the standards.

<sup>6</sup> *U.S. Adoption of Electronic Invoicing: Challenges and Opportunities*, Payments, Standards and Outreach Group, Federal Reserve Bank of Minneapolis, June 2016.

<sup>7</sup> Documents cited here are available at [businesspaymentscoalition.org](https://businesspaymentscoalition.org), in the e-Invoicing section.

<sup>8</sup> *U.S. Adoption of Electronic Invoicing: Challenges and Opportunities*, Payments, Standards and Outreach Group, Federal Reserve Bank of Minneapolis, June 2016.

<sup>9</sup> *Catalog of Electronic Invoice Technical Standards in the U.S.*, Business Payments Coalition and Federal Reserve Bank October 2017.

- *Summary Report from the e-Invoice Interoperability Framework Preliminary Assessment Work Group*<sup>10</sup>, a 2018 BPC report that reviewed interoperability framework concepts and assessed the appropriateness of developing a similar framework for the United States.
- *e-Invoice Interoperability Framework: e-Delivery Network Feasibility Assessment Report*<sup>11</sup>, a 2019 BPC report that provides business and technology stakeholders with an understanding of the high-level requirements and standards required to establish a federated open network of access points for the U.S. market.

The BPC has completed an assessment of existing interoperability frameworks for the U.S. market. The focus of the assessments was to understand the e-Invoicing standards, processes and common automated tools that support:

1. Originating and receiving e-Invoice information based on standardized and uniform semantic models, using one or more technical syntaxes that easily integrate into existing software including, enterprise resource planning (ERP) systems, platforms and service-provider systems.
2. Identifying electronic document exchange and delivery methods and processes for transmitting B2B documents to support technical interoperability while using accepted industry standard security methods and protocols.

---

<sup>10</sup> *Summary Report from the e-Invoice Interoperability Framework Preliminary Assessment Work Group*, Business Payments Coalition, June 2018.

<sup>11</sup> *e-Invoice Interoperability Framework: e-Delivery Network Feasibility Assessment Report*, Business Payments Coalition, November 2019



## 3. Background

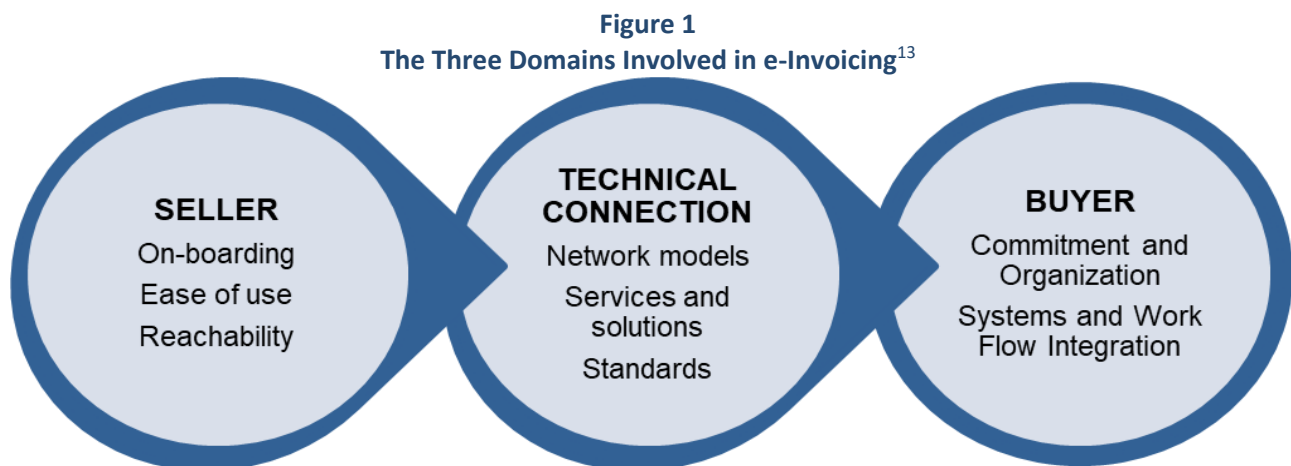
To fully grasp the context surrounding the interoperability framework in the United States, it is first important to explore existing U.S. delivery models, the barriers and challenges hindering widespread adoption, opportunities for growth, lessons learned from other countries and the components of a model that offers a new way of connecting U.S. sellers and buyers.

### 3.1 Current U.S. Models for Connecting Sellers and Buyers

The e-Invoicing landscape has two business domains, the seller and the buyer. Connecting these domains requires coordination and system integration to orchestrate the data exchange. A third domain, the technical connection, exists to bridge the two business domains. Below is additional information about each of the domains:

- **Buyer domain** – The procurement and accounting organizations that issue and process the purchase order, validate the invoice, integrate and account for the transaction and make the payment.
- **Seller domain** – The seller of goods and services that processes an order, creates and renders the invoice in expectation of payment.
- **Technical connection domain** – The technical connection layer where the exchange occurs between the seller and buyer. This layer creates and delivers properly formatted digital documents preserving authenticity, integrity and avoiding non-repudiation<sup>12</sup>.

Figure 1 illustrates key functionality associated with the three business domains.



<sup>12</sup> The term “nonrepudiation” means that one party of a transaction cannot deny having received a transaction nor can the other party deny having sent a transaction.

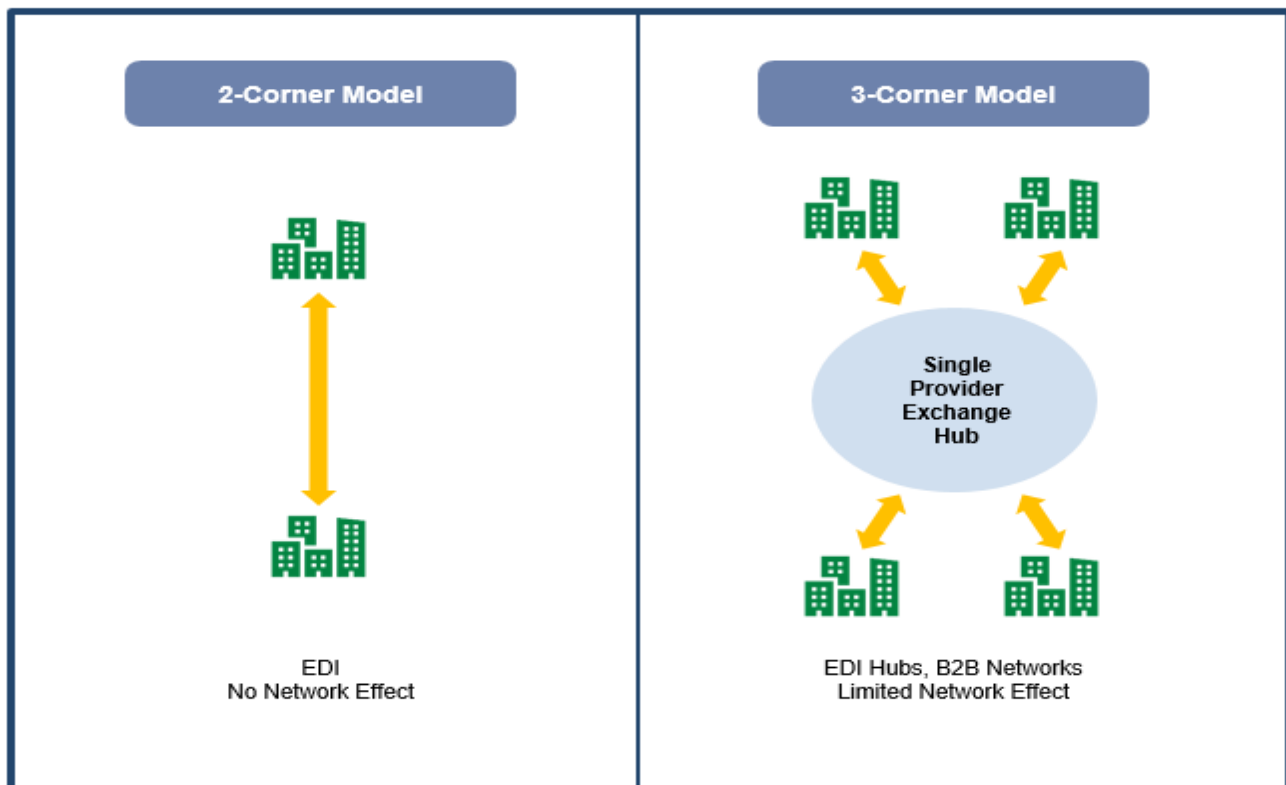
<sup>13</sup> Adapted from *The adoption of e-Invoicing in public procurement – Guidance for EU public administrations*, Activity Group of the European Multi-Stakeholder Forum on e-Invoicing (EMSFEI), 21 March 2016

In the United States to date, two network models, the two-corner and three-corner, are used to create the technical connection domain.

1. In a **two-corner model**, two trading parties connect one-to-one in a direct, bilateral fashion. This approach is popular for high volume electronic data interchange (EDI) relationships in specific industries such as manufacturing and retail. The direct model has no network effect or evident scalability due to its one-to-one nature.
2. In a **three-corner model**, sellers and buyers use a single platform exchange hub to support interoperability. This has been the growth model in the early stages of e-Invoicing and supply chain automation, however, it has had limited network effect in overall e-Invoicing adoption. A healthy market and critical mass for these service provider platforms is an essential precursor to the four-corner model (Section 3.5).

Figure 2 illustrates the Two-Corner and Three-Corner models.

**Figure 2**  
**The Two-Corner and Three-Corner Network Models**



Source: Business Payments Coalition

Using the connection models described above, U.S. business practitioners are working to increase the adoption rate of e-Invoicing for both their own business and within their supply chains. The pace of adoption in the United States, however, is forecast to be slow for the foreseeable future relying on these models.<sup>14</sup>

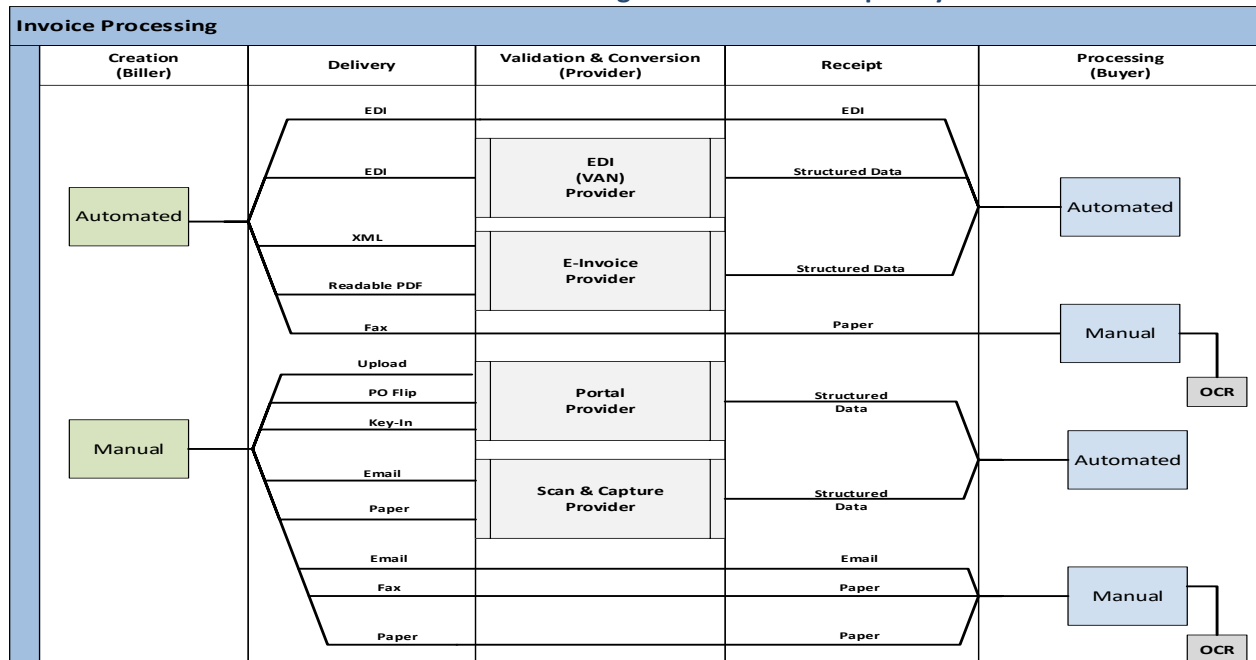
<sup>14</sup> e-Invoicing growth in the U.S. is forecast to lag behind other markets, rising from 25% currently to 38% by 2024. *2014 Global Invoicing Report*, PayStream Advisors, 2014

## 3.2 Barriers and Challenges

This section summarizes the barriers and challenges to widespread e-Invoicing adoption facing the United States.

1. e-Invoicing approaches are diverse and complex. The wide array of e-Invoicing definitions, syntaxes, formats and technical standards may be daunting to potential adopters. Figure 3 depicts the variation and complexity involved in data translation, data formatting, transmission protocols and transmission channels in the current U.S. market.

**Figure 3**  
**Invoice Processing Variation and Complexity<sup>15</sup>**



2. Larger businesses and public sector entities have voluntarily adopted e-Invoicing to garner benefits such as efficiency gains, cost savings, transparency, error reduction and data accuracy. Though some small and medium size businesses (SMBs) participate in e-Invoicing as required by their larger trading partners, many still lack a compelling business case to participate on their own accord.
3. SMBs may lack financial and technology resources and subject matter expertise to implement e-Invoicing solutions, despite the positive returns. SMB sellers may require support to join the ecosystem. If only large sellers participate, potential whole economy benefits will be lost.
4. While there are no formal legal barriers to the adoption of e-Invoicing, there are a variety of federal and state laws and regulations to consider and address in order to meet compliance requirements.
5. As a result of a lack of unifying standards and semantic models, service providers operate in isolated islands of e-Invoicing, limiting their reach.

<sup>15</sup> *Catalog of Electronic Invoice Technical Standards in the U.S.*, Business Payments Coalition and Federal Reserve Bank, October 2017.

6. Adopting a common unifying structured standard requires cooperation in order to achieve interoperability and market integration. At the same time, a competitive environment is important to ensure businesses have choice of providers and solutions.
7. It is easy and common to email invoices in the U.S. marketplace. An invoice emailed in pdf format is not in a readable format and requires additional manual effort for the receiver to process.
8. Larger businesses have invested in proprietary e-Invoicing standards, creating market fragmentation.
9. There is an absence of industry-led coordination, collaboration and leadership to develop strategies, policies and support for the implementation of change.

### 3.3 Opportunities

This section summarizes the opportunities to be gained by addressing the barriers to widespread adoption in the United States.

1. e-Invoicing is a necessary first step to achieve automated end-to-end straight-through processing in B2B and business-to-government (B2G) transactions. The adoption of electronic payments could be substantially increased if accompanied by the automation of related processes such as invoicing.
2. e-Invoicing experts and business practitioners of all types and sizes see significant opportunities to gain efficiencies and reduce costs by broader adoption of e-Invoicing in the United States.

Broad e-Invoice adoption could save:

- \$4 to \$8 per invoice for businesses<sup>16</sup>
  - \$45 to \$150 billion annually in the United States<sup>17</sup>
  - \$266 million annually for the U.S. federal government<sup>18,19</sup>
3. e-Invoicing provides the opportunity for a business to automate other areas of the financial supply chain, including procurement and workflow automation.

---

<sup>16</sup> *U.S. Adoption of Electronic Invoicing: Challenges and Opportunities*, Payments, Standards and Outreach Group, Federal Reserve Bank of Minneapolis, June 2016.

<sup>17</sup> *U.S. Adoption of Electronic Invoicing: Challenges and Opportunities*, Payments, Standards and Outreach Group, Federal Reserve Bank of Minneapolis, June 2016.

<sup>18</sup> *IPP: Smart Government Invoicing. Electronic Invoicing: Why it Matters*, Bureau of the Fiscal Services, 2015.

<sup>19</sup> The Office of Management and Budget (OMB) of the U.S. Federal government directed certain federal agencies to transition appropriate business-to-government (B2G) procurement to e-Invoicing by end of fiscal year 2018 to improve government effectiveness and transparency while reducing administrative work and costs. The OMB did not define an electronic invoice, nor did it mandate specific invoice format(s). Invoices can be submitted by email, pdf, or other formats. The OMB definition does not conform to the definition of e-Invoice used throughout this paper.

4. e-Invoicing can enable working capital improvements such as early payment discount programs and trade financing.
5. e-Invoicing can reduce payment risk and late payment fees. For example, while only 45% of paper invoices are paid on time, 92% of e-Invoices are paid on time.<sup>20</sup>

### 3.4 Lessons from Other Countries

Countries facing barriers and challenges comparable to the United States have successfully implemented interoperability frameworks that are accelerating adoption. This section explores the lessons learned from those implementations to support establishing a framework in the United States.

1. Substantial evidence from countries and industries that have developed e-Invoicing frameworks show that benefits are achievable at a reasonable cost. The United States could emulate these results. Many U.S. multinationals lead the world in e-Invoicing adoption and their lessons learned offer useful insights to increasing U.S. domestic adoption.
2. Recently, countries with the highest level of e-Invoicing adoption rates include those with government mandates put in place to improve collection of value added taxes (VAT). Outside this fiscal motive, the European Union (EU) has recognized the efficiency gains that can arise from e-Invoicing. It is requiring all public sector entities to be able to receive a standardized core invoice by 2019 for larger public contracting entities and by 2020 for smaller contracting entities. The EU also encourages its member states to mandate e-Invoicing for sellers.
3. Similar to Europe, markets such as Singapore, Australia and New Zealand have recognized the efficiency gains that can be achieved in both the private and public sector through use of an e-Invoicing interoperability framework. They view e-Invoicing as an important component to modernize business processes in this digital age.

### 3.5 A New Way of Connecting: The Four-Corner Model

Given the barriers and challenges facing the United States, and the lessons learned from interoperability frameworks implemented in other countries, the BPC believes that a strong business case exists for implementing a four-corner e-Delivery network model in the United States.

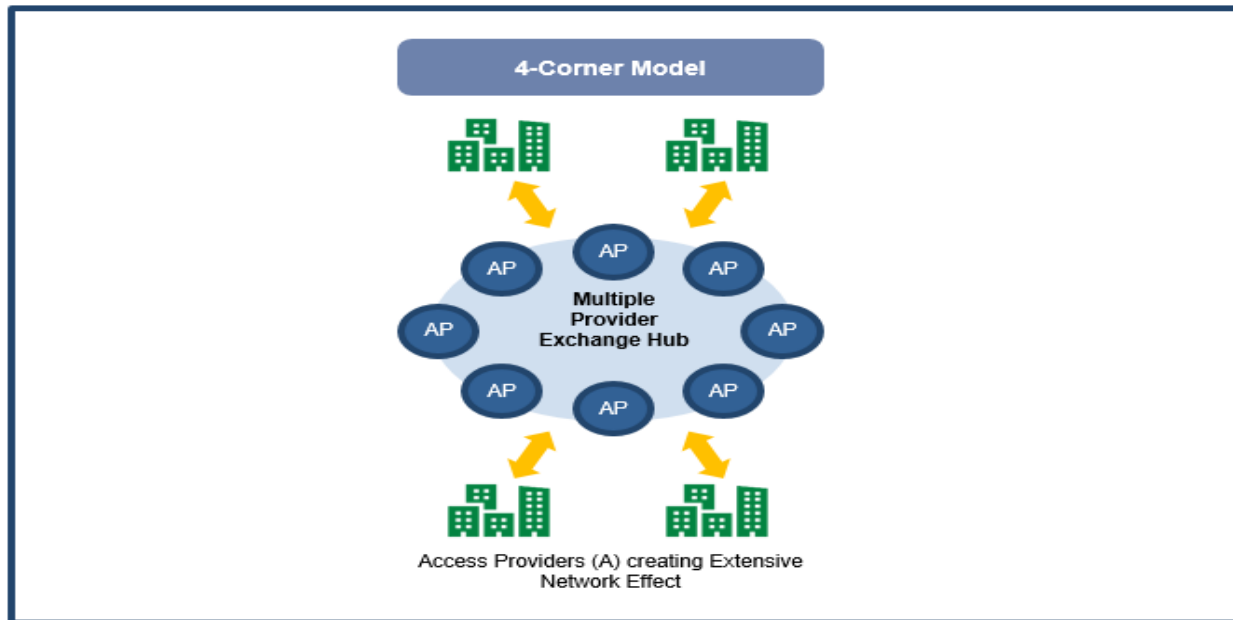
In a four-corner model (Figure 4), a seller on one platform may easily reach a buyer on another platform. Connecting platforms and solutions in a common way supports pervasive interoperability, generating a wide network effect. The ecosystem requires a collective effort to define or adopt standards and common rules.

---

<sup>20</sup> 2016 Data Capture and Mailroom Technology Insight Report, PayStream Advisors



**Figure 4**  
**The Four-Corner Model**



Source: Business Payments Coalition

An e-Invoicing interoperability framework based on a four-corner model is analogous to the phone network in that it allows multiple providers to connect using common messaging standards. In the phone network, people own landlines or cell phones that have a unique identifier, the phone number. The phones connect to the phone carrier, and the carrier delivers calls over a network utilizing standards that enable interoperability regardless of the type of phone or the carrier. The calls are routed over the phone network from the carrier of the call initiator to the carrier of the call receiver.

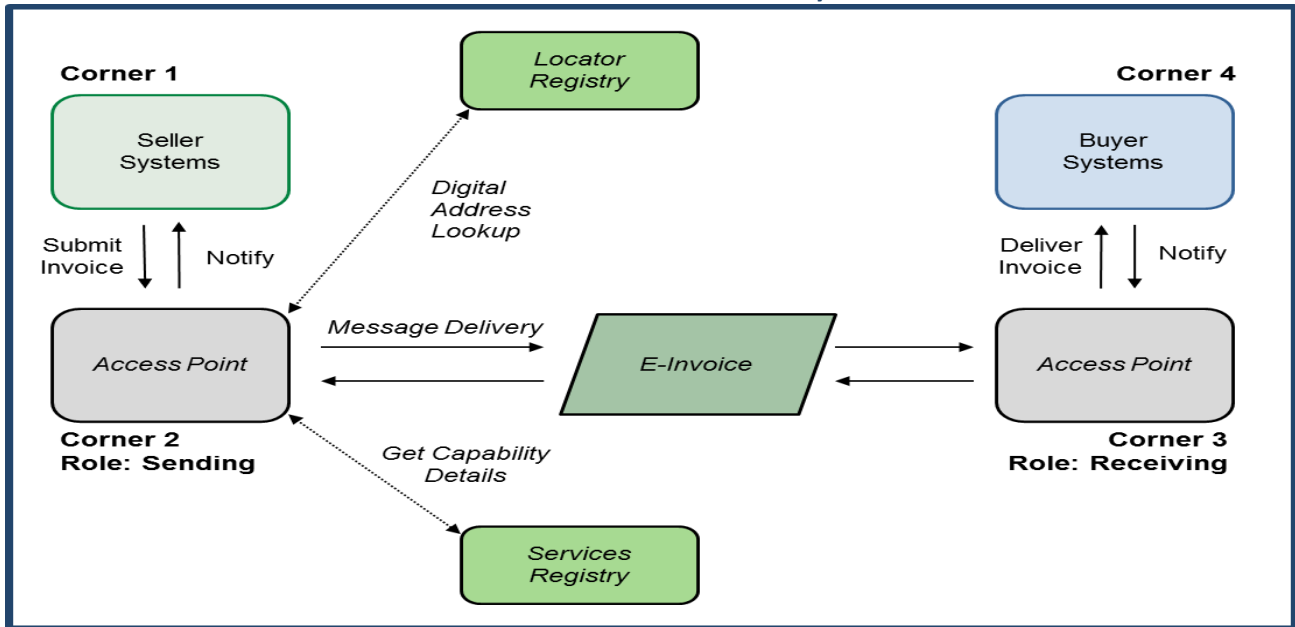
As with phone network interoperability, senders and receivers of e-Invoices only need to concern themselves with the identifiers of their trading partners (Business Entity Identifier and Electronic Address Identifiers), leaving service providers to use discovery services through registries and directories to route information between end users.

The four-corner model achieves interoperability for the e-Invoice senders and receivers who use different service provider platforms. Senders usually connect to one service provider solution to send all e-Invoices. Some of these e-Invoices may be directed to receivers present on the same platform (three-corner models<sup>21</sup>), but many will be directed to other platforms used by other receivers. Under interoperability agreements, two service providers become access points and connect to each other and transmit or accept invoices on behalf of their customers. Three-corner and four-corner models co-exist within the same e-Delivery network. The interoperability framework does not preclude corporates from becoming an access point in an e-Delivery network, but it is the exception rather than the norm. It is usually more efficient and cost-effective for corporates to connect into the e-Delivery network through a service provider rather than setting up and maintaining their own access point.

The four-corner model depicted in Figure 5 delivers the essential architecture for pervasive reach for all parties.

<sup>21</sup>A connection mode where a single service provider or platform connects both the seller and the buyer to its platform to offer and coordinate e-Invoicing and other supply chain services.

Figure 5  
The Four-Corner Model of an e-Delivery Network<sup>22</sup>



For more information regarding the four-corner model, refer to the *e-Invoice Interoperability Framework: e-Delivery Network Assessment Report*, Business Payments Coalition, November 2019.

<sup>22</sup>Adapted from the *eInvoice Interoperability Framework*, Digital Business Council, version 1.0, July 27, 2016.

## 4. What is an e-Invoice Interoperability Framework?

An e-Invoice interoperability framework supports the interconnections between trading parties through an overarching set of policies, standards and guidelines that enable the exchange of e-Invoices, documents, and messages independent of the payment, accounting, and enterprise resource planning (ERP) system.

The framework addresses the following three key concepts:

1. **Interoperability** – The framework enables sellers and buyers to exchange e-Invoices and related documents required by trading parties in a compliant form. Interoperability should be present irrespective of the information technology environment, e-Invoicing solution or service used by each party. Electronic network addresses used by the parties should be easily discoverable.
2. **Security** – The framework secures the exchange of information between the seller and buyer and cannot be intercepted or altered during transit. To maintain credibility and security, communications within the framework should be limited to authenticated participants (seller, buyer, and service provider, if applicable.)
3. **Standards** – The framework defines semantic level standards that collectively constitute a core set of e-Invoice data elements suitable for most B2B and B2G transactions. e-Invoices should be expressed in the required technical syntax and delivered through established standards for message transport protocols. e-Invoice delivery and processing should be made possible using a variety of implementation practices and models.

As described in Table 1, the framework addresses four layers of interoperability required to support the business function of e-Invoicing.

**Table 1**  
**The Four Essential Layers of an Interoperability Framework**

Layer	Description
<b>Legal</b>	Addresses the requirements at the business, network, and legislative and policy levels
<b>Business</b>	Describes the business processes, capabilities and discovery process to facilitate the exchange of a document
<b>Semantic</b>	Standardizes the meaning of the data to ensure common understanding among all trading parties involved
<b>Technical</b>	Defines the delivery standards and protocols enabling secure and reliable exchange of documents between trading partners via a federated network

## 4.1 Interoperability Layers

### 4.1.1 Legal Interoperability

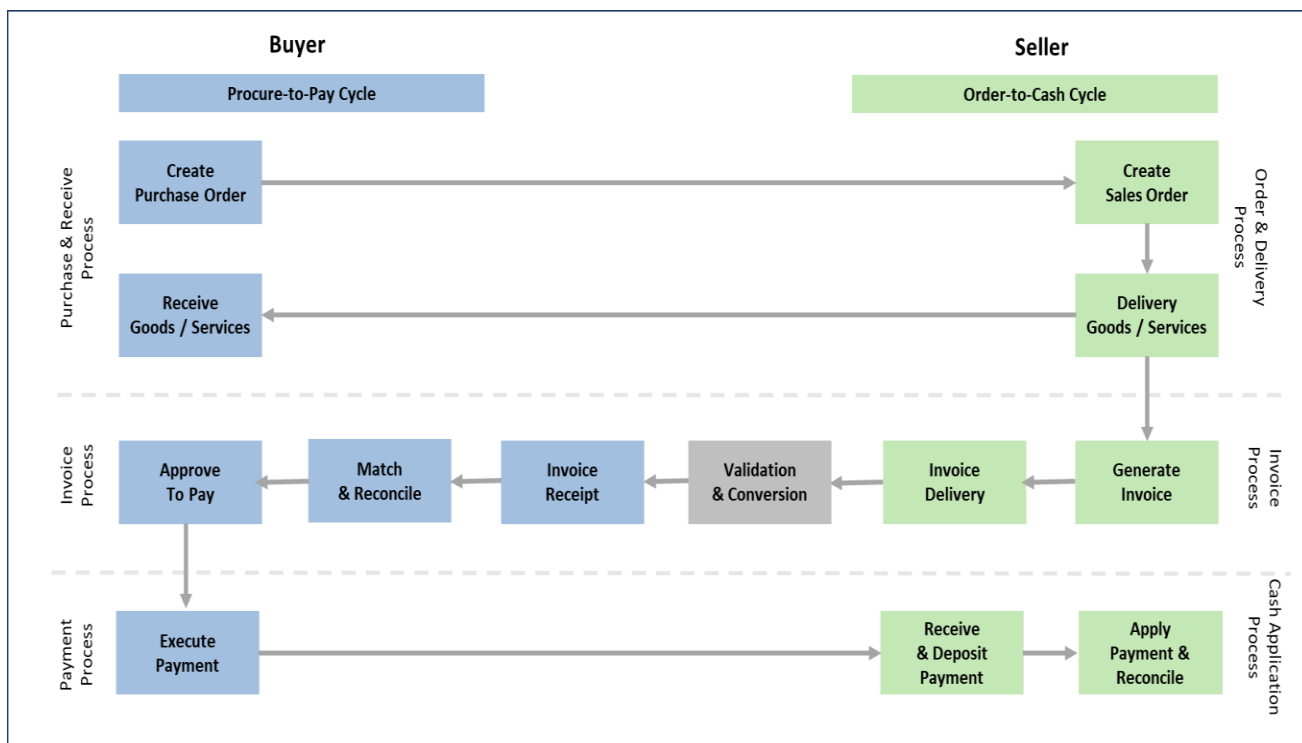
Legal interoperability addresses the contractual, policy and legislative requirements for private and public sector parties involved in the exchange of electronic invoices.

- The businesses, service platforms and providers enter into a contractual agreement to adhere to the legal aspect of the requirements to exchange data across an open, federated network. These agreements are implemented by a governance organization overseeing the framework.
- If applicable, legal agreements comply with legislative requirements regarding electronic document exchange, and include policy decisions by governmental bodies at the federal, state and local levels.

### 4.1.2 Business Interoperability

Business interoperability addresses the business processes, business identifiers and discovery mechanisms required for private and public sector parties involved in the exchange of electronic invoices. Establishing business interoperability is foundational to exchanging data between trading parties. In the end-to-end business process (Figure 6), the invoice is the core element bridging the buyer and seller in the financial supply chain.

**Figure 6**  
**End-to-End Business Process<sup>23</sup>**



Source: Business Payments Coalition

<sup>23</sup>*Catalog of Electronic Invoice Technical Standards in the U.S.*, Business Payments Coalition and Federal Reserve Bank, October 2017.

#### 4.1.2.1 *Business Processes*

Business processes are the capabilities of the receiver (buyer) and are identified by the sender (seller) during the discovery process to enable e-Invoice data exchange.

#### 4.1.2.2 *Business Identifiers*

Business identifiers are informational elements that uniquely identify a business, and are used by the sender and receiver in business discovery and message exchange.

#### 4.1.2.3 *Business Discovery*

Business discovery refers to the processes and technology used to determine trading party capabilities (i.e. business processes); how to send electronic invoices or other messages; and how to authenticate credentials.

### 4.1.3 *Semantic Interoperability*

Semantic interoperability enables all trading parties to understand the information they exchange. A semantic model facilitates common understanding between sellers and buyers in the data exchange in a framework. By doing so, the integration and data exchange becomes less complex and costly.

#### 4.1.3.1 *Semantic Model*

The semantic model defines the parties and roles; the business functions, processes, terms and rules; and the data type for the invoice information. Using open, non-proprietary standards, the semantic model becomes vendor neutral.

#### 4.1.3.2 *Syntax*

Syntax is a set of rules that define how semantic model data elements are structured for use in transferring data between sellers and buyers through the access points.

### 4.1.4 *Technical Interoperability*

Technical interoperability enables the concept of an open, federated network of access points where sellers and buyers can connect once, and trade with anyone across the network. To achieve technical interoperability, the framework must establish how access points perform the business discovery process, message delivery and security to enable trust.

#### 4.1.4.1 *Access Points*

Access points are the critical component of the e-Delivery network that enable sellers and buyers to exchange e-Invoices. Access points have two primary functions:

1. Integration to the seller and buyer business application systems (Corner 1, Corner 4)
2. Integration to the e-Delivery network through a set of message delivery standards (Corner 2, Corner 3)

Access Point services can be provided by either a service platform, provider or the business itself.

#### 4.1.4.2 *Message Delivery Standards*

Message delivery standards are the set of technical capabilities and protocols that enable interoperability, security, reliability and trust between access points in the e-Delivery network. Utilization of these standards ensures integrity through:

- Tamper resistant transmission
- Encryption safeguarding confidentiality
- Maintaining trust between sending and receiving end points
- Asynchronous, non-duplicative document delivery
- Non-repudiation of the receipt and origin of the document exchange
- Scaling, high throughput message exchange and capacity to support large messages (50 MB)



#### 4.1.4.3 *Security*

The framework provides both technical security within the e-Delivery network and supporting business agreements between all stakeholders. Trust is established through a variety of mechanisms including:

- Leveraging established approaches that scale well and use proven technology for secure communication protocols.
- Using x.509 public key infrastructure (PKI) certificates to provide authentication of senders and receivers.
- Registering participants into the network using a controlled process to ensure accurate discovery and document transport.

## 5. Benefits of an e-Invoice Interoperability Framework

The intent of the framework initiative is to create a catalyst to accelerate the adoption of e-Invoices in the United States. Establishing market standards will enable interoperability resulting in a positive network effect for adoption. e-Invoicing reduces business costs by an estimated \$4 to \$8 per invoice, which could result in potential aggregate annual savings of over one hundred billion dollars<sup>24</sup> if e-Invoicing becomes ubiquitous in the United States. The benefits of such an approach are widespread for all stakeholders including businesses and service providers. Additionally, market and societal gains as a result of ubiquitous e-Invoicing are numerous as outlined below.

### 5.1 Business Benefits

Ubiquitous e-Invoicing provides businesses the following benefits:

- Enables sellers and buyers to connect once and seamlessly exchange e-Invoices with anyone across a federated network.
- Reduces the number of external connections businesses need to maintain, resulting in decreased operational costs and security risks.
- Replaces manual processes and automates the data exchange in the end-to-end invoice process, which provides the opportunities for significant performance improvements in the accounts payable function.
- Improves data quality by reducing errors through automation of data entry, enables earlier error detection, and accelerates invoice approval.
- Improves likelihood of on-time payments and creates the opportunity for businesses to develop working capital strategies.
- Provides reliable delivery and receipt of invoices, resulting in reduced operational risk of duplicate and fraudulent invoices.
- Leads to improved business relationships between sellers and buyers as both benefit from overall efficiencies in the procure-to-pay cycle.
- Reduces technical and implementation barriers for SMBs where adoption of e-Invoicing solutions to date has been cost prohibitive.

### 5.2 Service Provider Benefits

Widespread e-Invoicing affords service providers the following benefits:

- Provides assurance and lowers risk to invest in the development of e-Invoicing solutions, allowing service providers to innovate and offer value added services to customers.
- Reduces the operational and maintenance cost and technical burden required to facilitate the exchange between the numerous accounting solutions, platforms and systems through a set of standards that support e-Invoice exchange.
- Provides a potential catalyst for new markets, business models, and products and services to emerge to enable the exchange of data between SMBs.

---

<sup>24</sup> *U.S. Adoption of Electronic Invoicing: Challenges and Opportunities*, Payments, Standards and Outreach Group, Federal Reserve Bank of Minneapolis, June 2016.

## 5.3 Market and Societal Benefits

Ubiquitous adoption of e-Invoicing offers the market and society the following benefits:

- Reduces the negative effects of inefficiencies caused by market fragmentation through establishing and adopting a common set of standards supporting e-Invoice exchange.
- Provides a cost effective approach for the market to address the SMB barriers to participating in digital trade.
- Provides societal benefits, such as reduced payment fraud, better allocation of resources through efficiencies of automation and reduction of carbon based products and greenhouse gas emissions due to printing of paper invoices.<sup>25</sup>

---

<sup>25</sup>As an example, a reduction of 10 billion paper invoices annually in the U.S. could eliminate close to 200 tons of paper; save over one million trees; and reduce greenhouse gas emissions by 360 tons. Environmental Impact of Electronic Invoicing: Go Green. Save Green. Koka, Sushmitha, PayStream Advisors, 2009

## 6. e-Invoice Interoperability Framework Assessment - Key Findings

This section provides information on the key findings from the assessments performed by the Technical Feasibility and Semantic Model Work Groups.

### 6.1 Technical Assessment

- Establishing interoperability standards between access points significantly reduces typical integration efforts required to support e-Invoicing.
- Many service providers and networks in the United States also operate in global regions where frameworks exist, which could ease adoption of a U.S. e-Invoice interoperability framework.
- The frameworks assessed are based on a four-corner model architecture creating a network through a series of federated access points securely connecting the community of service provider platforms and networks. The access points bring together standardized components of the e-Delivery network architectural design, which leverages, rather than supplants, existing investments in technology infrastructure and service relationships between sellers and buyers.
- Access points leverage proven technologies and tools readily available that provide the necessary security and scalability for the U.S. market.
- An e-Delivery network can reside outside of payment systems; is payment method agnostic; and does not hold sensitive payment and account information.
- The recommendation for the message transport protocol calls for supporting both Applicability Statement 2 (AS2) and Applicability Statement 4 (AS4). AS4 is the standard message transport protocol used by the frameworks assessed, however AS2 is widely used currently in the United States amongst EDI service providers. Over time, AS4 should become more widely used within the e-Delivery network because of the flexibility and advantages it offers service provider platforms and networks over AS2. Initially, this may add a level of complexity for service providers and networks as they establish access points. However, the tradeoff of flexibility for service providers and networks to establish access points and join the e-Delivery network outweigh initial complexity.
- The frameworks use registries to enable dynamic discovery of a trading party's<sup>26</sup> electronic capabilities and delivery addressing. The registry does not contain confidential information, such as payment information, nor will businesses be required to disclose information about their customer base or competitive data.
- The frameworks assessed rely upon business entity identifiers within the registries and support multiple identifiers. The entity identifiers used by U.S. businesses are very diverse and complex. The framework will need to support multiple entity identifiers; a single entity identifier would be preferred over time.
- The open standards used in the e-Delivery network meet the necessary technical security requirements for creating a secure and trusted environment for exchanging e-Invoices. Additionally, the use of these standards does not require any licensing and are royalty free.
- A governance body will need to determine the business requirements for managing a federated registry and decentralized model, and the issuance of digital security certificates.

<sup>26</sup>Trading parties refer to any parties involved in exchanging invoices between sellers and buyers.

## 6.2 Semantic Assessment

- The most significant difference between the European Committee for Standardization (CEN) European Norm (EN) 16931 standard on eInvoicing and U.S. requirements are the business rules for handling tax.
- There are no unique invoice requirements for cross border invoicing between the United States, Canada and Mexico.
- Without a legal definition of an invoice in the United States, continuous market input and validation of the semantic model is required.
- There is a need for a cross-industry, multi-stakeholder forum to monitor and provide input into the development and maintenance of the semantic model.
- Additional information elements were identified for a U.S. semantic model. These should be shared with the European Committee for Standardization (CEN) Technical Committee (TC 434), who is responsible for managing EN-16931 for consideration in future updates of the standard.
- The U.S. semantic model should take into considerations the approach that OpenPEPPOL is taking to address international invoicing.
- Implementation guides should be created to help the market adopt the semantic model.
- The re-use of the standards identified from EN-16931 is strongly recommended for the U.S. semantic model.
- Initially, the semantic model should use only one syntax.



## 7. The Path Forward

An e-Invoice interoperability framework paves the way for digital transformation in B2B transaction efficiency in the United States. As demonstrated in Europe and elsewhere, the existing frameworks are positioned well to enable widespread e-Invoice adoption. The United States has an opportunity to achieve similar results by leveraging the learnings, standards, policies and guidelines developed by those frameworks and customizing them for this market.

Given the scope of the U.S. market, a framework will need to meet a diverse set of business needs and be complementary to and link easily with existing processes and solutions. An e-Invoice interoperability framework should not displace or disrupt existing models or implementations. As a result, current stakeholders will have opportunities to innovate and develop new products and services.

The BPC will continue to coordinate the e-Invoice interoperability framework initiative with industry stakeholders. The BPC next steps (Figure 7) include:

- Continuing the assessment work by creating specifications for the U.S. semantic model. This work will be valuable beyond supporting the Interoperability framework.
- Continuing the assessment work by conducting a validation exercise of a registration model most likely suitable for the United States and document considerations for adoption in the United States.
- Conducting an assessment of existing governance models and organizations and provide recommendations for governance in the United States.

**Figure 7**  
**Interoperability Framework Initiative Work Group Timelines**

Activity	Q2 2019	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021
Semantic Model Work Group	Complete e-Invoice Semantic Model Assessment and Publish Report							
			Complete Semantic Model Requirements and Publish Report					
Technical Work Group								
	Complete e-Delivery Technical Feasibility Assessment and Publish Report							
				Complete Technical Validation Assessment and Publish Report				
Governance Framework Assessment Work Group				Conduct Governance Framework Assessment and Publish Report				

Source: Business Payments Coalition

The BPC welcomes additional dialogue and broad participation from the industry on these efforts.

## 8. Appendices

### 8.1 Appendix A - References

*The adoption of e-Invoicing in public procurement – Guidance for EU public administrations*, Activity Group of the European Multi-Stakeholder Forum on e-Invoicing (EMSFEI), 21 March 2016.

<https://eespa.eu/wp-content/uploads/downloads/2017/09/Guidance-Paper-for-EU-public-administrations-16-06-2016.pdf>

*Catalog of Electronic Invoice Technical Standards in the U.S.*, Business Payments Coalition and Federal Reserve Bank, October 2017.

<https://fedpaymentsimprovement.org/wp-content/uploads/catalog-electronic-invoice-standards.pdf>

*e-Invoice Interoperability Framework: e-Delivery Network Feasibility Assessment Report*, Business Payments Coalition, November 2019.

<https://businesspaymentscoalition.org/wp-content/uploads/20191031-bpc-e-delivery-network-feasibility-assessment.pdf>

*eInvoicing Interoperability Framework, Version 1.0*, Digital Business Council, July 27, 2016.

[http://www.icb.org.au/out/130497/eInvoicing\\_Interoperability\\_Report.pdf](http://www.icb.org.au/out/130497/eInvoicing_Interoperability_Report.pdf)

*Environmental Impact of Electronic Invoicing: Go Green. Save Green.*, Koka, Sushmitha, PayStream Advisors, 2009.

*IPP: Smart Government Invoicing. Electronic Invoicing: Why it Matters*, Bureau of the Fiscal Services, 2015.

<https://www.ipp.gov/agencies/electronic-invoicing-why-it-matters-part2.pdf>

*Strategies for Improving the U.S. Payment System (SIPS)*: Federal Reserve System, January 2015.

<https://fedpaymentsimprovement.org/wp-content/uploads/strategies-improving-us-payment-system.pdf>

*Summary Report from the e-Invoice Interoperability Framework Preliminary Assessment Work Group*, Business Payments Coalition, June 2018.

<https://fedpaymentsimprovement.org/wp-content/uploads/bpc-e-Invoice-if-assessment-report-june-2018.pdf>

*2014 Global eInvoicing Report*, PayStream Advisors (Note: Report no longer available online.)

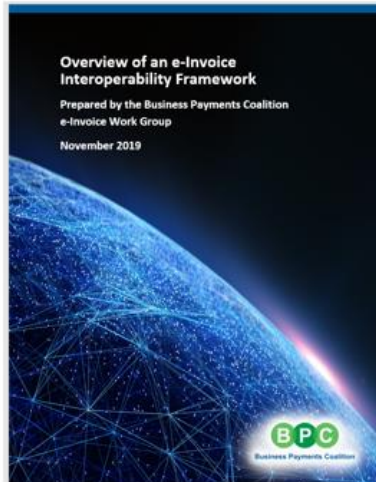
*2016 Data Capture and Mailroom Technology Insight Report*, PayStream Advisors (Note: Report no longer available online.)

*U.S. Adoption of Electronic Invoicing: Challenges and Opportunities*, Payments, Standards and Outreach Group, Federal Reserve Bank of Minneapolis, June 2016.

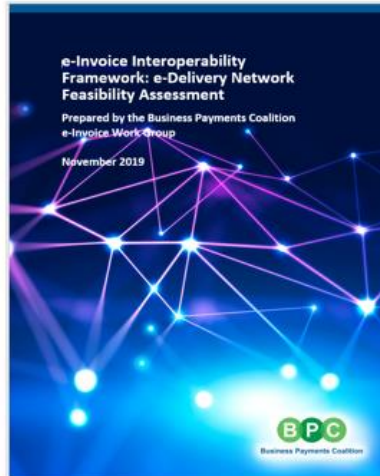
<https://fedpaymentsimprovement.org/wp-content/uploads/e-Invoicing-white-paper.pdf>

## 8.2 Appendix B – Interoperability Framework Assessment Reports

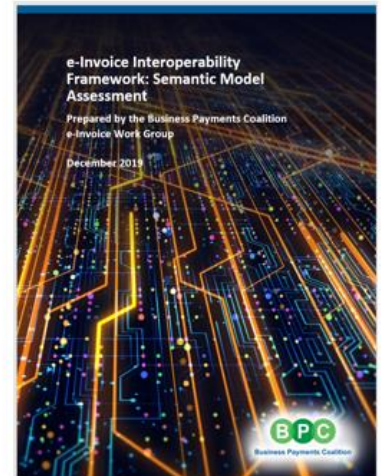
The *Overview of an e-Invoice Interoperability Framework* report is the first report as part of a three part series of the Business Payments Coalition e-Invoice Work Group e-Invoice Interoperability Framework assessments.



Overview of an e-Invoice Interoperability Framework



e-Invoice Interoperability Framework: e-Delivery Network Feasibility Assessment



e-Invoice Interoperability Framework: Semantic Model Assessment