

**AN AGENDA FOR RESEARCH ABOUT THE VALUE OF  
PAYMENT SYSTEMS FOR TRANSACTIONS IN ELECTRONIC  
COMMERCE**

**KEN PEFFERS, Hong Kong University of Science and Technology**

*Department of Information and Systems Management, School of Business and Management, Clear Water Bay,  
Kowloon, Hong Kong SAR. Tel: +852 9525 1041, Email: [k@peffers.com](mailto:k@peffers.com), URL: <http://peffers.com>*

**WILL MA, Hong Kong University of Science and Technology**

*Department of Information and Systems Management, School of Business and Management, Clear Water Bay,  
Kowloon, Hong Kong SAR. Email: [will@ust.hk](mailto:will@ust.hk)*

**ABSTRACT**

*The growth of electronic commerce (EC) may be impeded because payment systems (PS) designed for offline commerce have been adapted for online use, but without all of the information contained in physical meetings among transaction parties. Resulting problems add costs to transactions and affect profitability for EC transactions. New PS have been developed and are in various stages of implementation and rollout, but none have been widely adopted by users. Here we identify eleven generic PS features and nine of transaction characteristics, the interaction of which is expected to affect the cost of completing online transactions. We use a review of literature, as well as focused group and individual interviews, to develop 35 propositions for how interactions between PS features and transaction characteristics affect transaction costs. Finally, we propose a research agenda to determine the importance of each proposition, the functional form of its impact on cost, and to design effective sets of PS for online transactions.*

---

## INTRODUCTION

Electronic commerce (EC) is expected to continue to grow in volume and importance (Sraeel, 2002), however, there have been suggestions, e.g., (Apicella, 2000), that its adoption by suppliers and customers, consumers and businesses alike, has been hampered by a variety of concerns about how best to pay for goods and services over the Internet. Participants in the automobile manufacturing industries, for example, are holding back on investments in online payment systems (Kisiel, 2002). Observers, like Burns (2000), worry, EC growth may be hindered unless new payment systems (PS) are successfully adopted soon.

In ordinary commerce, both business to consumer and business to business, five major PS, with variations, are used to facilitate almost all transactions, globally: cash, checks, giros, credit cards, and electronic funds transfers (O'Mahony et al., 1997). The specific implementations of these systems matured in an offline commercial world, but these methods have been adapted, *ad hoc*, to the online commercial world in which we have found ourselves over the course of just a half-decade or so.

In the process of adapting these PS for online use, the transactions, ironically, have suffered from lost information. For example, credit cards and their variants (debit cards and charge cards) were designed to be presented in person by the buyer to the seller. Information contained in physical possession of the card, in the magnetic stripe, and in the specimen signature is not conveniently and reliably transmitted to the seller online. Notwithstanding the missing information, credit cards have become the only widely accepted means of payment for purchases in business-to-consumer (B2C) EC. They work, but only at the cost of substantial problems for buyers, sellers and intermediaries.

The adaptation of PS that were developed offline to an online commercial world results in or exacerbates several problems for the transaction parties, including vendor fraud, customer fraud and repudiation, third party fraud, excessive costs, and lost transactions. Recently EC transactions represented 1% of all credit card transactions, but 47% of disputes (Beyer, 1999). Other PS also suffer from limitations when transferred from an offline to an online commercial environment. These problems appear to be serious, representing at least part of the reason

## CONTRIBUTION

To our knowledge, this paper is the first attempt to develop an agenda for research that focuses on the interaction between payment system features and transaction characteristics in electronic commerce and the effect of this interaction on costs for the transaction parties. The article uses a review of literature, as well as group and individual interviews to develop a set of 35 propositions for that can be investigated in future research.

A glance at the reference list for this paper tells part of the story. Hitherto, the discussion of payment systems for e-commerce has been dominated by industry trade journals, business magazines, vendor websites, and engineering and computer science research. The venue of prior discussion is a strength in that it indicates that these issues are very important to business. It is weakness to the extent that it indicates that no one has attempted to develop an overall framework or theory from which to examine the research issues in a systematic manner. This paper addresses the need to do so.

The paper develops a very broad framework and an agenda for research. We identify major payment system features and transaction characteristics that might be expected affect the efficacy and value of payment systems for use in e-commerce and to understand, in qualitative terms, the relationships between these characteristics. This framework and agenda are potentially important bases for future research in this area, in which researchers will investigate parts of the framework.

why profitability has been elusive for B2C vendors (Keen, 2000; Peffers, 2001).

In business-to-business transactions, because of higher transaction values and greater sensitivity to costs, most transactions that have been initiated online have, nonetheless been paid offline (Bowen, 2000), for example, by paper invoice and check. This suggests that, for such transactions, some of the hoped for benefits of supply chain integration from EC are not being realized, placing the hoped for dramatic takeoff for B2B EC at risk.

The financial services industry has developed a number of innovative new payment systems, each designed to address one or more of the limitations of current systems. Although the new systems are generally technically effective, none has yet garnered enough support among users to become commercially viable (Vartanian, 2000). Success of these new systems has been hampered by new costs that they impose on transactions parties and by network externality barriers.

Will flawed PS be an impediment in the development of EC? Early examples of successful EC businesses focused on high-margin, well-specified transactions, such as those in information goods and high value commodities, e.g., software and computer parts. As EC moves forward to include transactions with lower margins and higher transaction expenses, the cost of ineffective PS might be enough of a burden to make some products unprofitable. Consequently, understanding the needs for PS for EC is a serious issue.

It is also a very big issue, one that cannot be addressed seriously in a single paper. Therefore, instead of trying to address these issues directly in this paper, we identify the characteristics of payment systems for EC, identify relevant characteristics of online transactions, develop a broad research framework, develop a series of propositions for how we expect payment systems and transaction characteristics to interact, and propose an agenda for future research.

## RESEARCH OBJECTIVES

This is an exploratory study in which we seek to understand the needs of EC participants, buyers and sellers in B2C and B2B, for payments systems. Our objectives are to

1. identify a set of PS features that have the potential to affect the cost of online transactions for participants,
2. identify transaction characteristics that may affect these costs,
3. understand how these characteristics might be expected to interact to affect the cost of transactions and express this as a research framework,
4. identify propositions from the framework to understand how PS and transaction characteristics interact to affect costs, and
5. develop an agenda for research to understand the importance of the characteristics and the propositions, to parameterize the propositions, and to use the parameterized propositions to design effective payment systems.

It should be noted that the PS features and transaction characteristics that we identify here are not exhaustive, but they include all of the features and characteristics that we have identified as relevant to EC transaction costs.

## THE STATE OF ONLINE PAYMENT SYSTEMS

The financial services industry and others have developed a number of adaptations to existing PS, such as e-cash, electronic checks, enhanced credit cards, and specialized EFTs, to address some of the concerns of transaction participants (McHugh, 2002). Indeed, dozens of new PS are now in various stages of development and roll-out (O'Mahony et al., 1997; Winn, 1999). Generally, each of these adaptations attempts to address one or two concerns of transaction parties (M2 Presswire, 2000; O'Brien, 1999). In general, each is an online metaphor for an existing method. Although, in general, these new systems are "efficient and innovative," none of them has garnered enough enthusiasm among users to become very successful commercially

(Vartanian, 2000). Indeed, some technically competent systems have already expired for lack of support, while others lie in vegetative state (Winn, 1999), hoping for miracles.

A quick look at three of these new systems serves as an example to help us understand the current state of online PS. C2it, Yahoo!PayDirect, and PayPal are three similar systems intended to resolve some of the problems that burden the use of traditional PS for online sales.

### THREE INNOVATIVE PAYMENT SYSTEMS FOR ONLINE COMMERCE

**c2it.** Citibank launched c2it (www.c2it.com) in May 2001; it is an online person-to-person money transfer service through which customers can send money to recipients in more than 100 countries. Citibank is one of the few banks to have such a system, which is especially important for people who want to send money to certain countries, such as Mexico and India. Using c2it wire transfers can be accomplished faster and cheaper than has been possible in the past. Money can be sent using a debit or credit card, and arrives either as a direct deposit in the recipient's account or as a mailed check. There is no transaction fee if the sender sends, receives, or transfers cash within the U.S., using a bank account, linked credit card, debit card, or c2it account. There is a flat fee for requests to pay using a check. Transaction fees apply for sending money to someone outside the U.S. There is a flat fee of USD 10 for most international transfers. In addition, the sender's credit card company may assess a financial charge and fee for the transaction (Bruno, 2002; Businessline, 2002b; Citibank, 2003).

**Yahoo!PayDirect.** Yahoo! PayDirect Service is offered by Yahoo! Inc. and HSBC Bank USA. PayDirect is an online payment service that allows users to transfer and receive money over the Internet. PayDirect lets the user send payments as a "sender" and receive payments as a "recipient." It is available on the Yahoo!, via the HSBC's website and or wireless application protocol (WAP) sites. User's money is maintained by the bank in a non-interest bearing deposit account (the "PayDirect Account"). The Bank also provides

all fund transfer and card processing services. There are two types of accounts, PayDirect Personal Accounts and PayDirect Professional Accounts. PayDirect charges Professional accounts to receive payments a fee at a rate of 2.2%-2.5% plus USD 0.30 per transaction. Personal accounts are free, but may not accept credit card payments. Their recent development also shows that Yahoo!PayDirect are trying their best to strive for the balance to provide a simple interface to users, while at the same time, validating and verifying consumer information online in real time to prevent fraud (American Banker, 2002; Yahoo! Inc., 2003).

**PayPal** PayPal is an account-based system that lets anyone with an email address securely send and receive online payments using their credit card or bank account. PayPal charges Premier and Business accounts from 0.7% to 2.9% plus USD 0.30 per transaction to receive payments. Personal accounts are free, but may not receive credit card payments. PayPal claims that it is the easiest and cheapest way for small businesses and websites to accept payments online. It accepts instant, secure payments from anyone with a credit card or checking account. Use of current PayPal account can make or accept payments in U.S. Dollars, Canadian Dollars, Euros, Pounds Sterling, and Yen over 38 countries. It processes 95% to 99% of Internet person-to-person payments and that it has an 11% share of online consumer transactions processed in the United States (Bills, 2002; Gebhardt, 2002; PayPal, 2003).

Collectively these three systems have successfully addressed some of the reported PS related problems that have plagued EC transactions. One or more of the systems attempts to:

1. relieve the buyer from anxiety resulting from the transmission of credit card information to the vendor, e.g., Yahoo!PayDirect,
2. reduce the likelihood that customers can repudiate the sale after the transaction has been consummated, e.g., c2it.
3. allow parties who don't have credit cards to participate in online transactions, e.g., PayPal,

4. allow sellers to pass transaction costs on to buyers, e.g., PayPal.

These features potentially benefit both buyers and sellers in online transactions, but particularly sellers and particularly for person to person (P2P) online sales. Moreover, the benefits come with a cost, in that the systems have several potential disadvantages that are not present in traditional PS, namely (each does not necessarily apply to all of the systems):

1. buyers lose some recourse from fraud and non-performance available to them had they used ordinary credit cards,
2. buyers may have to pay fees hitherto paid by vendors,
3. buyers incur privacy risks by providing personal information to an intermediary, and
4. buyers may incur extra costs from lack of ease of use, convenience and occasional errors by the intermediary.

In these cases attempts to develop innovative payment systems to overcome costs to a set of participants may have shifted the costs to other participants in ways that raise questions about whether the new payment system will be widely adopted. Generally a payment system must be acceptable to both parties to a transaction before it will be adopted.

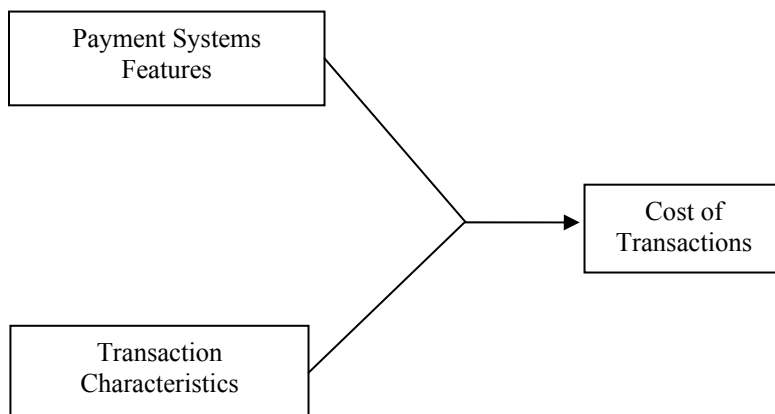
Industry observers note that there are many complaints about innovative PS, about such matters as frozen accounts, lack of recourse when things go wrong, and poor customer service (Keizer, 2001a; 2001b). For example, class-action suits have been filed accusing payment system operators of having “inaccessible customer service and a trigger-happy antifraud system that locks customers out of their own accounts with little recourse (Radcliff, 2002).” What’s probably worse for the such firms, at least five anti-payment systems websites have been published to post thousands of complaints against firms by their detractors (Radcliff, 2002).” Indeed, a report from Adams (2002) commented that, “bank-based person-to-person payments [are] presently almost dead in the water...”

For all of innovative PS there is the “network externality” problem. Since systems are not cross compatible and none of the systems has achieved mass acceptance, to use these systems parties must incur the cost of registering with several such systems with little likelihood that many corresponding transaction parties will use any particular one (Lyons, 2002).

Despite the importance of these issues or perhaps, in part, because of the obvious importance of the problem, research on these issues has largely been product and technology driven. It has focused on specific solutions, either from the perspective of the solution inventor, e.g., (Hwang et al., 2001) or the financial services industry, e.g., (Kiesnoski & Curley, 1999; Radecki & Wenninger, 1999). Wright (2002) focused on six generic PS, in terms of six features that, he argued, were of concern to transaction parties. Little research, e.g., (Mann et al., 2000; Winn, 1999), however, has focused on systematically investigating what is important to participants. In consequence, new systems, intended to address one or two concerns of a particular audience, are likely to have unintended consequences and to increase costs for others. Unless new PS are designed based on an overall view of what is important to the transaction parties, none of the systems seems likely to be able to allay their overall concerns (Burnett, 2001).

Figure 1. shows our research model graphically. Payment systems features and transaction characteristics jointly affect the cost of online transactions. Only by identifying the interactions, the functional form of each interaction, its importance, and its affect on the cost of online transactions, can we create the basis for the design of new payment systems for EC that will overcome the limitations of traditional PS for this new commercial environment. Here our objectives are limited. We seek to identify the PS features and transaction characteristics and to identify alleged affects on transactions costs in the form of 35 propositions. We leave it to subsequent research to empirically test these propositions to identify their importance and form.





**Figure 1. A Framework for the impact of payment system features and transaction characteristics on the cost of transactions**

**RESEARCH METHODS**

We gathered data from EC participants and potential participants to identify PS and transaction characteristics, the participants preferences for PS characteristics, and their attitudes about conducting transactions of various types in EC. We used this data to check and extend the information that we had obtained from literature to model cost relationships between PS and transaction types to determine the efficacy of PS features under conditions of a variety of transaction types.

We conducted focused group and individual interviews in order to ascertain whether the PS features and transaction characteristics that we had identified from literature were exhaustive and each effective in influencing the effectiveness of the PS for online transactions. To insure that participants all had informed views about paying for goods and services online, participants were screened to insure that each had either participated in EC transactions or had visited EC websites to consider doing so, but had deferred or avoided completing a transaction.

We conducted focused group sessions in December 2001, using a series of questions derived from PS literature to stimulate discussion. The first participants were all young business professionals in their twenties and thirties. The later group included a mixed

group of professionals, managers and other consumers. Each of the sessions lasted for about one and a half hours. Participants in each session were provided with token compensation. In addition, we conducted an individual interview with an industry expert, the CIO of one of the world’s ten largest banks. Focused group and individual interviews are an excellent research method when the objective of data collection is to collect qualitative information about issues and problems in a domain without determining their importance, frequency, or representativeness.

The interviews provided support for the idea that PS features and transaction characteristics that we had identified through our review of literature were complete and effective.

Next we use this data to develop a set of eleven payment system characteristics, nine transaction characteristics, and 35 propositions to explain how PS and transaction characteristic interact to affect the cost of transactions in EC.

**ONLINE PAYMENT SYSTEMS AND TRANSACTIONS CHARACTERISTICS**

Traditionally, PS have had a number of features, including susceptibility to fraud, liquidity or transaction cost, finality,

transaction risk, systemic risk, privacy and anonymity, convenience, timing, and compatibility or open architecture (Crocker & Stevenson, 1998; Winn, 1999). These features vary among payment systems and make some PS more attractive for particular transactions. Transactions also have characteristics that affect which payment systems most suit them.

Through our review of literature and participant interviews we have identified eleven generic online payment system features and nine transactions characteristics that appear to be important for creating value and costs in transactions for buyers and sellers in e-commerce. We have organized them into tables 1 and 2.

**Table 1. Online payment systems features**

Features	Description
Susceptibility to fraud	Susceptibility to buyer or seller behavior to obtain goods or payment by deception.
Authentication	Whether the payment system can establish that the identity of the buyer or the seller is genuine or that an account is valid and belongs to the transaction participant.
Ease of use	The degree to which the buyer finds using the system to be easy to understand how to use.
Convenience	The degree to which the buyer finds using the system to complete a transaction can be completed quickly and with few steps.
Float	The time delay between when transactions become final and when money is actually paid.
Portability	The degree to which the seller or the buyer can complete the transaction from any location.
Fixed transaction costs	Fixed costs for each transaction born by the seller.
Variable transaction costs	Costs to the seller that vary by the value of the transaction.
Buyer transaction costs	Fixed and variable costs born by the buyer for the PS.
Privacy and anonymity	The control of personal information to be used or disclosed for other purposes than is necessary to the completion of a transaction.
Network externality	The value that accrues to participants as the number of users of a payment system increases.

**Table 2. Online transaction characteristics**

Characteristics	Description
Transaction size	The monetary value of the transaction.
Margin size	The monetary value of the contribution margin for the transaction.
Margin percentage	The value of the contribution margin relative to transaction size.
Routine transactions	The extent to which parties have completed a number of transactions with each other.
International transactions	Transactions conducted between parties who are located in different countries.
Buyer/seller expertise	The degree of experience of buyer and seller in using the payment system.
Culture, risk averse	The degree of risk aversion typical in the culture toward potential losses from the use of online payment systems.
Buyer recourse	The right to reverse the transaction later if the seller fails to perform satisfactorily.
Low PS penetration	The transaction uses a payment system that few potential transaction partners have adopted.

In the next section we use these characteristics to develop a set of 35 propositions for how PS and transaction characteristics interact to affect transaction costs.

## THE PROPOSITIONS

From our literature and the group and individual interviews, we have developed 35 propositions in which we propose as the basis for research on the joint effects of PS features and transaction characteristics on the cost and feasibility of online transactions. We have organized these propositions and the justifying discussion by the eleven PS characteristics. Of course, these propositions aren't proven. They are, however, suggested by our review of literature and supported by our interviews. Consequently, they rise to be proposed for testing in future empirical research.

### Susceptibility to Fraud

Buyers and vendors are potential sources of fraud. The vendor to an online sale is concerned about the likelihood that the buyer may try to acquire goods without paying for them (Blank, 2002). Vendor fraud includes the misrepresentation of goods and services, the failure to deliver goods, and over-billing. For the buyer the risk is that the seller will try to be paid for goods that aren't then delivered or aren't merchantable. Much customer fraud is associated with abuse of consumer protection. In some jurisdictions, particularly in the US, merchants think that they have little recourse when customers claim that charges to their cards were unauthorized or that goods or services weren't delivered as promised. The cost of such abuse adds a substantial and, it is feared, increasing cost to doing business online (Kahn, 2002).

The larger the transaction, the more buyers have an incentive to defraud and the higher the risk to the buyer from seller fraud (P1; P7). Hence, transaction size is related to the potential cost of such fraud. On the other hand, if margins are sufficiently large, the seller's risk is mitigated for a portfolio of transactions (P4). Fraud risk is high for early transaction between a particular buyer and seller because they don't know each other. As transactions become routine between them, the

risk of such fraud is reduced because of learned trust (P2). For international transactions risk is higher because of impediments to information and recourse (P3). Overall concern with fraud is dependent upon culture to the extent that risk aversion varies among cultures. In more risk-averse cultures, buyers and sellers have a higher concerns about fraud because losses are perceived with greater acuity (P5). This may result in greater reluctance to engage in transactions or more precautions, either of which increase transaction costs. In political entities with strong buyer recourse to transactions, the risk of buyer fraud is increased, while the risk of seller fraud is decreased (P6). As buyers become more experienced with online transactions, they may be able to better evaluate fraud risks, thus effectively reducing them through the exercise of experienced judgment (P8). Thus, we propose

- P1 Seller risk from buyer incentive to fraud increases with transaction size.
- P2 When transactions become routine fraud risk decreases.
- P3 For international transactions fraud risk is higher.
- P4 Higher margin percentages mitigate risks of buyer fraud.
- P5 In a risk-averse culture the concern with fraud is higher.
- P6 When there is strong buyer recourse to the transaction buyer (seller) fraud risk is increased (decreased).
- P7 As the size of the transaction increases, seller fraud risk is increased.
- P8 For experienced buyers, anxiety about seller fraud is less.

### Authentication

Transaction parties are more confident about completing transactions when they have sufficient information to evaluate both the goods and the parties. Buyers face higher risk when paying online because they aren't able to use clues from direct observation of the vendor's appearance and behavior to authenticate the seller as well as they can when the parties are face-to-face (Punch, 2002). This



risk also applies to the seller, particularly with respect to payment. A seller is taking a higher risk selling to a customer about whom he has no knowledge and who is likely to live far away. These risks increase with transaction size (P9). This risk is mitigated when transaction margins are high and the seller can more quickly recoup losses from margins on a portfolio of transactions (P12). Each party's risk is reduced as trust develops when transactions become routine between a particular set of parties (P10). Authentication risk is higher for international transactions as each party has less information about the other and less recourse should something go wrong (P11). Thus, we propose

- P9 Concern with authentication of the other party increases with transaction size.
- P10 When transactions between a set of parties become routine, concern with authentication decreases.
- P11 For international transactions, concern with authentication is higher.
- P12 Seller concern for authentication is mitigated by large margins.

#### **Ease of use**

Other than a small number of technological enthusiasts, most parties to EC transactions are reluctant to learn about complex processes or applications (Liu et al., 2001). Consequently, any hint of apparent complexity can be fatal for PS that target users broadly. Katerattanakul (2002) found ease of use an important factor for online business design. For new users, not familiar with online transaction processes, the fixed costs of setting up and learning how to use online PS may affect users' willingness to adopt such systems.

Experienced and frequent users are less concerned with the ease of use because past experience provides them with analogies and mental models that they can use to guide themselves (P14; P16), even when they are not familiar with the particular system. For transactions with small value the concern with ease of use is greater, relative to a party's willingness to invest in the transaction process. For larger transactions the buyer's concern with ease of use is decreased as he/she is more

cautious and more willing to spend time to process the transaction (P13). For international transactions, concern with ease of use increases for the buyer because he/she is less likely to have knowledge about, the seller and the goods (P15). Thus, we propose

- P13 The buyer's need for ease of use decreases with larger transactions.
- P14 As transactions become routine the buyer's concern for ease of use decreases.
- P15 For international transactions, the buyer's concern for ease of use is higher.
- P16 For an experienced buyer, concern about ease of use is less.

#### **Convenience**

Most users expect shopping online to be faster and more convenient (Whaley, 2002). For example, Hurley (2002) found that 83.2% of respondents stated that convenience is their most compelling reason to purchase items online. However, experience proves to be just the opposite, in many cases (Kahn, 2002). This can inhibit users from continuing EC transactions and from repeated transactions.

Concern about convenience may be low if the transaction is expected to be a unique or seldom repeated event and increases with the expectation that it will be repeated often (P17). For new users, everything online requires much attention. As users become more experienced, their concern for ease of use (understanding how) becomes less while concern for convenience (completing the process quickly and with few steps) increases (P18). Thus, we propose

- P17 For routine transactions, the buyer's concern about convenience is higher.
- P18 As buyers gain experience, concern about convenience increases.

#### **Float**

Buyers using credit cards, accustomed to a 30 to 45 day float before they have to pay for transactions or incur fees and before transactions become final, won't willingly give up these features without compensation (Milling, 2000; Norman, 1999). Merchants,

who indirectly pay for this float, view it as a cost that they are eager to avoid. Varied sensitivity to the costs associated with this float explains part of the differences among regions in adoption of B2C efforts.

For small transactions, the availability of float becomes less important for buyers. For large purchases, the possibility to “buy now, pay later” may motivate buyers to purchase immediately. Hence, the value of the float to buyers increases with transaction size (P19). For routine purchases the value of the buyer float accumulates (Businessline, 2002) as the buyer is able to continuously defer payment and to take advantage of other opportunities to use the cash (P20). Thus, we propose

P19 The value of the buyer’s float increases with transaction size.

P20 For routine purchases the value of float to the buyer is higher.

### **Portability**

Portability is important not only in payment system adoption; but also in affecting the profitable future of merchants (Jenkins, 2002). However, solving this issue is not easy task and inherent risks will continue to be central (Kuttner & McAndrews, 2001). For some kinds of transactions, the ability to carry an electronic analog to the credit card would be desirable. The U.S. government is considering legislation on interoperability and portability to payment systems (Murphy, 2000a).

For some kinds of transactions, the ability to carry an electronic analog to the credit card would be desirable. The desire for such portability is greater for small purchases (P21) and is greater for routine purchases (P22). Thus, we propose

P21 The value of portability to the buyer is greater for small purchases.

P22 The value of portability to the buyer is greater for routine purchases.

### **Fixed transaction fees and charges**

Vendors often bear fixed fees, payable to intermediaries, such as banks, for each transaction that is processed through a payment system. These fees are in addition to

any variable fee and are unrelated to transaction size. In addition to per-transaction fees, buyers usually incur expenses to maintain accounts and to transfer funds between accounts (Businessline, 2001; Murphy, 2000b).

These fees may be high enough to make some transactions unprofitable, including small transactions (P23) and transactions with small margins (P25) (American Banker, 2000). For routine transactions, these fixed costs accumulate, creating an increasing incentive for concern to reduce or eliminate them (P24) (Penelope, 2001). Thus,

P23 The relative cost of fixed transaction fees is higher for small transactions.

P24 The incentive to avoid fixed transaction fees increases as transactions become routine.

P25 For transactions with smaller contribution margins, the relative cost of fixed transaction fees is larger.

### **Variable transaction fees and charges**

PS intermediaries generally charge fees that vary with the amount of the transaction, often two percent or more. The larger the transaction, the greater the fee and the greater is the incentive for sellers to avoid it (P26). The vendor’s concern about these fees is relatively more where the contribution margin from the transaction is small (P27). Thus,

P26 For larger transactions, sellers have more incentive to avoid variable transaction fees.

P27 For transactions with smaller margins, the relative cost of variable transaction fees is higher.

### **Buyer transaction costs**

Although generally buyers are not charged transaction fees for online purchases, some PS do impose fixed and variable transaction fees on the buyer. The smaller the transaction, the more these fees affect the transaction value for the buyer (P28). This is also particularly important to buyers who need to make frequent purchases, as costs accumulate from multiple transactions (P29). Thus,

- P28 The smaller the transaction size, the higher the relative transaction costs to the buyer.
- P29 For routine transactions buyer is more concerned about the cost of the transaction.

### Privacy and anonymity

Buyers are inundated with unwanted sales solicitation and worried about personal safety and the possibility of identity related crime. No well-accepted online PS provides the privacy equivalent of cash (Wright, 2002) and it is hard to balance needs to protect the seller and to control use of personal information (Graabosky et al., 2001; Holthusen, 2001).

For all transactions, there is some buyer risk from exposing personal data to unexpected use (Lucas, 2002; Wright, 2002). For routine transactions (P30) and experienced buyers (P32), this risk is likely to be reduced as the buyers exercise informed judgment about sharing information. In international transactions buyers incur more risk, since they have less control over information use and less recourse for misuse (P31). Thus, we propose

- P30 In routine purchases buyer concern about privacy and anonymity is reduced.
- P31 In international transactions, buyer concern about privacy and anonymity is increased.
- P32 For an experienced buyer, risks from loss of privacy and anonymity are reduced.

### Network externality

Network externality is the extent to which the number of users of a system affects its value to each user. For PS, network externality (Ende, 2001) affects user costs. As the number of potential transaction partners who use a PS increases, the likelihood that a buyer or seller will be able to make repeated use of it increases (P35) (Stavins, 2001). A high penetration makes a PS more useful and convenient to users, while a low penetration increase transaction costs to parties because

the fixed costs of using several PS are spread among few transactions (Hills, 2000).

The frequency with which a user expects to make payments to a given seller affects the importance of network externality. As the frequency of transactions between two parties increases, concern for network externalities decreases, (P33) as the value of the PS for use between the two users increases. As the contribution margin for a particular transaction or class of transactions increases, concern with network externalities decreases (P34).

- P33 For routine transactions the importance of the number of potential transaction partners using a payment system decreases.
- P34 The importance of the number of buyers using a payment system decreases as margin increases.
- P35 The value of a payment system is related to the number of potential transaction partners who use that system.

We have organized the 35 propositions into a matrix of the eleven payment characteristics and nine transaction characteristics. The results are shown in Figure 2. The PS characteristics are shown on the vertical axis, while the transaction characteristics are shown on the horizontal axis. A boxed cell at the intersection of the row and column indicates that the interaction is the subject of one of the propositions. The proposition number is indicated in the cell and an annotation indicates the general effect of the transaction characteristic on the cost impact of the payment system characteristic.

## AN AGENDA FOR PAYMENT SYSTEMS RESEARCH

These eleven payment system features, nine transaction characteristics, and 35 joint propositions were all suggested by our search of literature and supported in our group and individual interviews. Consequently, we think that they are likely to represent a fairly complete set of important features, characteristics and propositions applying payment system features to transaction

characteristics in EC, although clearly it is possible that subsequent researchers will identify additional important characteristics.

This is only the first step. The qualitative methods that we used to identify payment system and transaction characteristics and to understand how they might interact to affect the transaction costs are well understood to be effective for these purposes. Nothing in our research methods, however, allows us to draw inferences about which of the characteristics are most important or at what levels they might affect transactions. For example, we expect that fraud becomes a more important issue to buyers when the value of the transaction is high. We confirmed that this is true in our focus groups. Nothing in our focus group data, however, allows us to infer neither the level at which this becomes important nor the level of its importance. Such conclusions await a series of studies to quantify the variables developed in this study.

The results of this subsequent research are of tremendous potential value. Today, intermediaries are able to design PS to increase the value of transactions for one or more of these parameters, however, without considering the whole system of interactions, they are likely to develop systems that are suboptimal because design features based on one or two interactions are likely to have unforeseen consequences resulting from other of the interactions. When many of the propositions have been investigated and parameterized, it will be feasible to consider the importance of PS features under various levels of transaction characteristics and to model a system of payment systems that together can optimize the value of transactions.

The research agenda includes studies to determine the importance of the payment system features and transaction characteristics, to parameterize them, and to propose sets of payment systems to effectively facilitate e-commerce.

1. **Importance of features and characteristics.** The qualitative studies that we did allow us to list and define the payment system features and transaction characteristics, but they don't allow us to say much about their importance, either

relatively or absolutely. Followup studies should examine the importance of these parameters using such data gathering methods as surveys and choice stimulus, where a subject might be given a choice about whether to purchase a good through alternate venues. Alternately, user surveys are a well-accepted methodology for the study of perceived level of importance or perceived value.

2. **Parameterizing the propositions.** The propositions are currently phrased in qualitative terms. The next step requires studies to determine levels at which the costs identified in the propositions become important. This is likely to require a variety of research methods because the functional form for the importance of variables identified in the propositions is likely to vary. For example, the cost impact of some of the interactions may be nearly dichotomous, so that at a low level there is no effect, while at a high level there is a strong effect. In the case of another interaction, the impact may be well represented as a linear, exponential or step function. Marketing research methods that have been used to establish customers' utility for goods and the customers' price sensitivity for goods may be well suited to the purpose of discovering the forms of these impacts.
3. **An effective set of payment systems.** This last step may be the most exciting or satisfying for this stream of research. This would be design research to use the parameterized propositions to develop effective sets of payment systems that would be broadly effective for a wide range of transactions in EC. This will involve satisficing compromises, of course. A large number of different payment systems could most closely match the desired characteristics for every situation, but users are unlikely to be willing to adopt more than a small number of new systems. Intuition suggests that users wouldn't want to use many more PS online than they use offline. PS that adapt to different transactions, depending on their characteristics, might be the answer.

PAYMENT SYSTEM FEATURES	TRANSACTION CHARACTERISTICS								
	Transaction Size	Frequency Routine	Location Int'l	High Margin %	High Margin Size	Expertise	Risk-Averse Culture	Buyer Recourse	Low PS Penetration
	\$1↔\$5K								
Fraud	S	Incentive VL↔→H (P1)	↓(P2)	↑(P3)	↓(P4)			↑(P5)	↑(P6)
	B	VL↔→H (P7)							
Authentication	S	VL↔→H (P9)	↓(P10)	H(P11)		↓(P12)			
	B								
Ease of Use	B	VH↔→L (P13)	↓(P14)	H(P15)			↓(P16)		
Convenience	B		↑(P17)				↑(P18)		
Float	B	VL↔→H (P19)	↑(P20)						
Portability	B	H↔→L (P21)	↑(P22)						
Fixed Transaction Cost	S	VH↔→L (P23)	↑(P24)		↓(P25)				
Variable Transaction Cost	S	L↔→H (P26)			L (P27)				
Buyer Transaction Cost	B	H↔→L (P28)	↑(P29)						
Privacy & Anonymity	B		↓(P30)	↑(P31)			↓(P32)		
Network Externality	S		↓(P33)			↓(P34)			H(P35)
	B								

VL/L Very Low / Low Transaction Cost     
 ↑ Increases Transaction Cost     
 S Seller  
VH/H Very High / High Transaction Cost     
 ↓ Reduce Transaction Cost     
 B Buyer

**Figure 2. Impacts of relationships between payment system features and transaction characteristics on transaction cost.**

**CONCLUSION**

We have had a very small number of payment systems in the physical world for centuries; however, the first on-line payment systems were created by ecommerce firms and banks beginning in 1999. Whether we adapt the present off-line system to cater to online transactions or develop new online payment systems, we will probably not have an effective solution to PS limitations unless we treat all of the dimensions of the problem as one system and use these dimensions to create value for all of the transaction parties. New payment systems are likely to continue to fail if innovative systems continue to be driven by technological innovation or the interests of one transaction party.

This agenda paper proposes a whole new stream of research, one that has very important potential applications to business. Successfully completing this agenda would help the world’s financial services industry to design payment systems that do more than to address one or two payment system problems at the behest of one of the transaction parties, as though they were independent of every other interaction. Instead, it would give product designers the tools to design new payment systems that addressed many of the interactions for both parties. It could, as a result, have a substantial positive impact on the viability of online transactions and, in turn, on e-commerce.



## REFERENCES

- Adams, J. (2002). Payments: P2P Takes Its Best Shot North of the Border; There's still some doubt, but Canada does look like a better bet, *Bank Technology News*, pg. 1.
- American Banker (2000). Stored Value Payment Is Worth a Second Chance; *American Banker*, New York, N.Y.; Aug 18, 2000; pg. 8.
- American Banker (2002). In brief: HSBC, Yahoo will use Experian software, *American Banker*: NY, Oct 31, 2002, Vol. 167, Issue 209, pg. 7.
- Apicella, M. "Worry-free payment processing keeps the customer satisfied," *Infoworld*, 11/13/00, 22:46, pp. 63-6.
- Beyer, L. (1999). "The internet revolution," *Credit Card Management*, Nov 1999 12:8 pp. 50-63.
- Bills, S. (2002). PayPal is first client of Wells Processing Services, *American Banker*: NY., Nov 19, 2002; Vol. 167, Issue 222, pg. 7.
- Blank, C. (2002). At Grocery Checkout, No Wallet Needed, *New York Times*, New York, N.Y.; Jul 25, 2002; Late Edition (East Coast); pg. G.3.
- Bowen, C. (2000). "The B2B payment challenge," *Credit Card Management*, May 2000 13:2 pp 24-28.
- Bruno, M. (2002). C2IT's Mexican connection, *USBanker*: NY, Aug 2002, Vol 112, Issue 8, pg. 17.
- Burnett, R. (2001). As Internet Sales Rise, So Do Shoppers' Complaints, *Knight Ridder Tribune Business News*, pg. 1.
- Burns, S.(2000). "How companies use the internet," *Far Eastern Economic Review* HK Nov 30 2000 163:48 pp. 56-62.
- Businessline (2001). India: Reforms have improved FIs' efficiency: RBI; *Businessline*, Islamabad; Jan 30, 2001; pg. 1.
- Businessline (2002a). India: The monetary policy issues; *Businessline*, Islamabad; Jan 1, 2002; pg. 1.
- Businessline (2002b). India: Sending the greenbacks home; *Businessline*, Islamabad; Aug 8, 2002; pg. 1.
- Citibank (2003). C2it by Citibank, *Citibank*, accessed at <https://www.c2it.com/> on January 10, 2003.
- Crocker, S. D. and R. B Stevenson, Jr. (1998). "Paying up: payment systems for digital commerce," in *The future of the electronic marketplace*, D. Leebaert, ed., Cambridge MA : MIT Press, 1998, 383 pp.
- Ende, J. (2001). The organization of innovation in the presence of networks and bandwagons in the new economy, *International Studies of Management & Organization*, 31(1), pg.30-48.
- Gebhardt, M. (2002). Use PayPal to sell your goods online without a financial investment, *Inside the Internet*: Louisville, Nov 2002, Vol. 9, Issue 11, pg. 7.
- Graabosky, P., Russel, G.S., and Gillian, D. (2001). *Electronic Theft: Unlawful Acquisition in CyberSpace*, Cambridge University Press, Victoria.
- Hills, B. (2000). Common message standards for electronic commerce in wholesale financial markets, *Bank of England. Quarterly Bulletin*, 40(3), pg. 274-286.
- Holthusen, S. (2001) Electronic Theft: Unlawful Acquisition in Cyberspace, *University of Queensland Law Journal*, 21(2), pg. 251-6.
- Hurley, N. (2002). An empirical analysis of the security aspects of E-business payment systems; *South Dakota Business Review*, 60(4), p. 1.
- Hwang, M.S., I.C. Lin, and L.H. Li (2001). "A simple micro-payment scheme," *The Journal of Systems and Software*, 55:3, pp. 221-229.
- Jenkins, R.S. (2002). Making the move to interoperability, *Hoosier Banker*, 86(6), pg. 8-10.
- Kahn, C.M. (2002). The economics of payment finality; *Economic Review* - Federal Reserve Bank of Atlanta, Atlanta; Second Quarter, Vol. 87, Iss. 2.
- Keen, P. (2000). "Relationships: The Electronic Commerce Imperative," in *Information Technology and the Future Enterprise: New Models for Managers*, Dickson G.W. and G DeSanctis, eds, Prentice Hall: Upper Saddle River NJ, 2000, pp. 163-185.

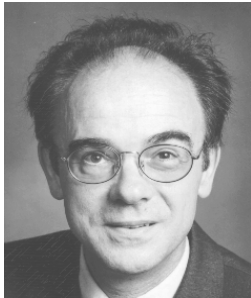
- Keizer, G. (2001a). "CNET Recommends...None of the above", *Pay it safe – Software Reviews – CNET.com*, June 5, 2001d, accessed at <http://www.cnet.com/software/0-3227836-8-6335860-2.html?tag=st.sw.3227836-8-6335860-13.MORE.3227836-8-6335860-2> on May 13, 2002.
- Keizer, G. (2001b). "Net Payment Nightmares – 5 online transaction terrors and how to avoid them", *Net Payment Nightmares - Software Reviews – CNET.com*, June 5, 2001e, accessed at <http://www.cnet.com/software/0-352105-8-6044511-1.html?tag=txt> on May 13, 2002.
- Katerattanakul, P. (2002). Framework of effective web site design for business-to-consumer Internet commerce; *INFOR*, Ottawa; Vol. 40, Iss. 1; pg. 57.
- Kiesnoski, K and B. Curley (1999). "Digital wallets: card issuers seek to ease web shopping" *Bank Systems & Technology*, New York Oct 1999 36:10 pp. 26-34.
- Kisiel, R. (2002). Study: Smaller suppliers lag Tier 1s in e-business, *Automotive News*, 76(5999), pg. 22B.
- Kuttner, K.N. & McAndrews, J.J. (2001). Personal on-line payments, *Economic Policy Review - Federal Reserve Bank of New York*, New York; Dec 2001; Vol. 7, Iss. 3; pg. 35-51.
- Liu, C. Arnett, K.P., Capella, L.M., and Taulor, R.D. (2001). Key dimensions of Web design quality as related to consumer response, *The Journal of Computer Information Systems*, Stillwater; 42(1), p.70.
- Lucas, P. (2002). E-fraud alert, *Collections & Credit Risk*, New York; Jul 2002; Vol. 7, Iss. 7; pg. 24, 3 pgs
- Lyons, D. (2002). Rule of Thumb, *Forbes*, Mar 18, pg. 162.
- M2 Presswire (2000) "FaceTime Communications: FaceTime brings human interaction to the net; FaceTime Technology supports customers and increases online sales," *M2 Presswire*, 2000, pg. 1.
- Mann, C.L., S.E. Eckert, and S.C. Knight (2000). *Global Electronic Commerce, A Policy Primer*, Washington DC: Institute for International Economics, 2000, 213 pp.
- McHugh, T. (2002). The growth of person-to-person electronic payments, *Chicago Fed Letter*, Iss. 180, pg. 1-5.
- Milling, B.E. (2000). Prepare for the Internet credit crunch; *High Volume*, 18(5), pg. 22-23.
- Murphy, P.A. (2000a). High costs, red tape weaken case for EBT, *Bank Technology News*, 13(1), pg. 37-40.
- Murphy, P.A. (2000b). Building An Internet Payments Platform; *Bank Technology News*, New York; Sep 2000; pg. 43.
- Norman, J. (1999). Teeter-totter effect, *Independent Banker*, 49(7), pg. 17-18.
- O'Brien, J.M. (1999). Aastra moves ATMs from bank machines to bedrooms, *Computer Dealer News*, 15(11), pg. 44.
- O'Mahony, D., M. Peirce, and H. Tewari (1997). *Electronic Payment Systems*, Boston: Artech House, 1997, pp. 254.
- PayPal (2003). PayPal – Welcome, *PayPal*, accessed at <http://www.paypal.com/> on January 10, 2003.
- Peppers, K (2001). "The future of electronic commerce: a shift from the EC channel to strategic electronic commerce, *The Journal of Information Technology Theory and Application (JITTA)*, 3:4, 2001, pp. 7-16.
- Penelope, O. (2001). New ways to connect with customers on the move, *Financial*, London (UK); Mar 7, 2001; pg. 16.
- Punch, L. (2002). Authentication's tentative gains; *Credit Card Management*, 15(2).
- Radcliff, D. (2002). Lawsuits highlight PayPal's growing pains, *Computerworld*, 36(14), pg. 12.
- Radecki, L. J. and J. Wenninger (1999). "Paying electronic bills electronically," *Current Issues in Economics and Finance*, 1999, 5:1, pp 1-6.
- Sraeel, H. (2002). EBP&P: Competing for Consumers ; Demand is certain to grow, and players are ready, *Bank Technology News*, pg. 1.
- Stavins, J. (2001). Effect of consumer characteristics on the use of payment instruments, *New England Economic Review*, Issue 3, pg. 19-32.
- Vartanian, T. P. (2000). "The future of electronic payments: roadblocks and emerging practices" *Payments System Report*, Dec 2000 15:5, pp 2-8.
- Whaley, C. (2002). E-payment: A 'world bank' for the connected, *Computing Canada*, 28(2), p.9.

Winn, J. K. (1999). "Clash of The Titans: Regulating the Competition Between Established and Emerging Electronic Payment Systems," *Berkely Technology Law Journal*, Spring 1999, 14:2, 35.

Wright, D. (2002). Comparative evaluation of electronic payment systems, *INFOR*, 40(1), pg. 71-86.

Yahoo! Inc. (2003). Yahoo! PayDirect, accessed at <https://paydirect.yahoo.com/> on January 10, 2003.

## THE AUTHORS



**Ken Peffers**, Ph.D. (Purdue, 1991) is an Associate Professor of MIS at the Hong Kong University of Science and Technology. His current research focuses on making the right IS investments

for the firm by using better methods for IS planning and requirements analysis. His research articles on evaluating new IS projects and the business impacts of IS investments have been published in such journals as *Information Systems Research*, *IEEE Transactions on Engineering Management*, *Organization Science*, and *Information & Management*. Recent research about IS planning and about research has been published in the *Communications of the ACM* and the *Communications of the AIS*. Dr.

Peffers is a member of the Sault Ste. Marie Tribe of Chippewa Indians of Michigan. He is Editor-in-Chief of the IS journal, *JITTA (Journal of Information Technology Theory and Application)*, accessible at <http://www.jitta.org/>.

Dr. Peffers is also a visiting professor at the Helsinki School of Economics. Beginning in fall 2003 he will begin an appointment as Associate Professor of MIS at the University of Nevada at Las Vegas.



**Will Ma**, is a PhD student at the Hong Kong University of Science and Technology (HKUST). He holds an MSc in Information Systems from the HKUST. His area of research includes Web-

based Learning & Teaching. He has publication in the *Journal of Technology and Teacher Education*.