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## Summary of the methodology for assessing the dynamics and impacts of electronic commerce

### 1. Introduction

This paper proposes some ways forward in stimulating and structuring interdisciplinary research on business-to-business electronic commerce. A ‘commerce-centred’ perspective is proposed that is grounded in concepts of commerce as a complex socio-economic institution. On this basis, a conceptual framework is developed for assessing the dynamics and impacts of electronic commerce in the value chains of products (goods and services).

The approach focuses on examining technical change in *transaction structures*, and how this relates to the evolution of electronically-mediated business relationships in the rapidly developing Internet environment. The approach is oriented towards *critical* research questions concerning the effects of electronic commerce on the ways various market participants exercise and/or respond to control over the organisation and operation of value chains, and the implications for business and policy. A separate study plan describes implementation of the methodology.

### 2. Conceptual Framework

*Electronic commerce* can be defined as the application of information and communication technology to any of the activities involved in making commercial transactions.<sup>1</sup> The basic concept underlying the transaction structure approach is that actors position themselves strategically in the market through the control of *transaction points* where various types of exchanges occur that relate to the acquisition of goods and services. A *transaction* is defined for present purposes as any exchange between participants in a market that is directly or indirectly related to the acquisition of goods and services, irrespective of whether these goods or services are finally acquired.

All economic transactions consist of two related types of operations: ‘preparation’ and ‘completion’.

- *Transaction preparation* involves placing information about products and services in the market, and retrieval of this information by market participants. These activities are perceived most commonly in terms of marketing and advertising. But in practice, transaction preparation involves all information exchanges that are related to a transaction – including negotiation.
- *Transaction completion* comprises two components: settlement and logistics. ‘Settlement’ refers to ordering, billing and the transfer of payments. ‘Logistics’ refers to the transfer of products and services from sellers to buyers both within supply chains and with final customers.

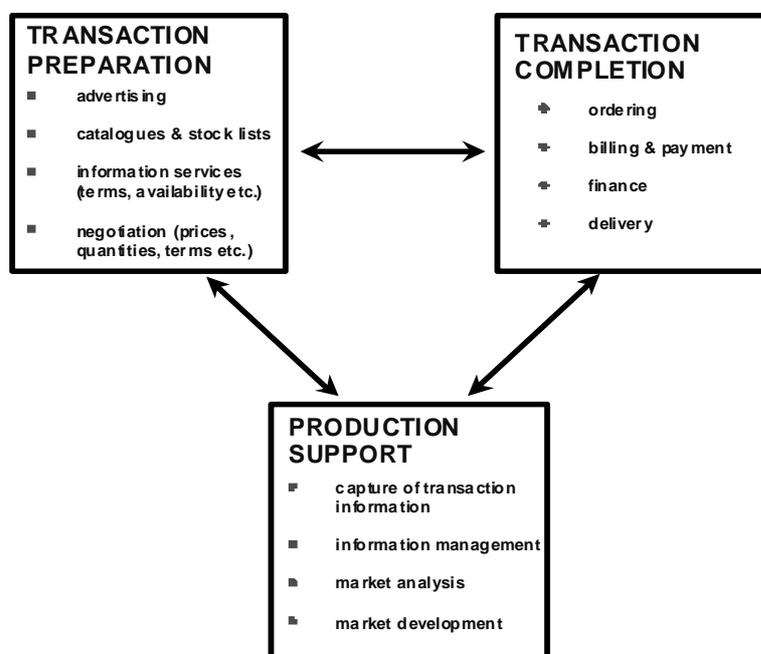
However, in electronic commerce, it is necessary to take special account of a third transaction component - *production support*. Production support involves competencies in information ‘capture’ and ‘management’ - i.e. the capability to acquire transaction-related information, and the capability to organise, process and apply it. Also involved are competencies in market ‘analysis’ and ‘development’ - i.e. using transaction-

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<sup>1</sup> The Information, Computer and Communications Policy (ICCP) Committee approved the following official definition of electronic transactions in September 2000: “An *electronic transaction* is the sale or purchase of goods or services, whether between businesses, households, individuals, governments, and other public or private organisations, conducted over *computer-mediated* networks. The goods and services are ordered over those networks, but the payment and the ultimate delivery of the good or service may be conducted on or off-line.”

generated information to assess market performance and trends, and applying this knowledge to support the development and marketing of new products (goods and services).

Figure 1  
Relationships between business functions in the transaction structure



## 2.1. Transaction structures in the marketplace

Our conceptual framework distinguishes in the first instance between the generic context of the 'market' and the specific context of the 'marketplace'. The 'market' is an allocation mechanism. However, this concept is abstract and of limited use in identifying the characteristics of specific transaction structures. These must be situated in a marketplace - a concrete social and economic milieu in which actual transactions take place. A 'marketplace' can be defined in the present context as a specific environment in which the characteristics and dynamics of actual transaction points can be observed through qualitative and/or quantitative research.

The types of interactions between buyers and sellers in any given marketplace vary according to the characteristics of the transaction points. Some marketplaces are 'physical' in that the transaction points require the co-location of buyers and sellers before the exchange of value in goods or services can take place. Others are 'virtual' in that co-location is not a necessary condition - transaction points are designed to accommodate logical rather than physical interactions between buyers and sellers.

## 2.2. Mapping the evolution of transaction structures: innovations in transaction structures

Innovations can be radical or incremental. Each innovation in the transaction structure can have a variety of intended and unintended outcomes. Some outcomes will appear in the transaction structure itself in the form of reduced (absolute) transaction costs, increased speed, flexibility or reliability. Other outcomes will appear in the form of further innovation outside of the transaction structure as such.

- Electronic commerce may support and/or stimulate *product innovation* - i.e. it may facilitate the development of new products and/or new features of existing products (goods and services).
- It may lead also to *process innovation*, related to how goods and services are designed and made.

- Finally, it may facilitate *relational innovation* - new modalities and methods for buyer-seller interactions in the marketplace. Some indicative examples of these are given in Table 1.

**Table 1**  
**Potential outcomes of electronic commerce innovations**

<b>product innovation</b>	<ul style="list-style-type: none"> <li>• diversification - developing new product and service lines</li> <li>• differentiation - developing new features for products and services;</li> <li>• customisation - developing new ways to configure products and services to the needs of individual customers</li> <li>• product-service bundling - developing new ways to link products/services to support/maintenance functions</li> </ul>
<b>process innovation</b>	<ul style="list-style-type: none"> <li>• design - gearing design processes dynamically to customer feedback</li> <li>• logistics - increasing the flexibility and/or quick response of supply and distribution chains</li> <li>• production lines - increasing the flexibility and/or quick response of production and assembly processes</li> <li>• co-ordination and integration - creating new linkages between administration and production functions</li> </ul>
<b>relational innovation</b>	<ul style="list-style-type: none"> <li>• geographical expansion – broadening the spatial distribution of commercial partners</li> <li>• market segmentation – increasing the ability to access/target new groups of customers/suppliers</li> <li>• trust – improving the quality of relations with commercial partners</li> <li>• loyalty – increasing the possibilities to retain commercial partners</li> </ul>

Mapping electronic commerce impacts at firm level is a matter of showing the links between innovations in the transaction structure - i.e. in transaction preparation, transaction completion and production support - and product, process, and relational innovations. A conceptual map for linking these observations is illustrated in Figure 2.

**Figure 2**  
**Mapping the impacts of electronic commerce**

	<b>Electronic Commerce Innovations</b>		
	<b>Transaction Preparation</b>	<b>Transaction Completion</b>	<b>Production Support</b>
<b>Product innovation</b>			
<b>Process innovation</b>			
<b>Relational innovation</b>			

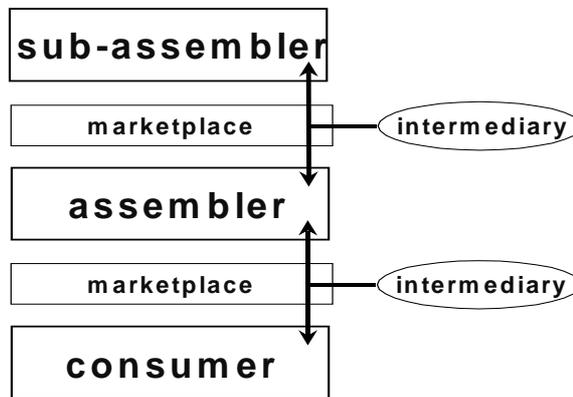
**2.3. Focusing on value chains**

Product, process and relational innovation are key drivers of market development. These developments may lead to simple cost reduction or to more profound effects on industry structure. Changes in one industry may also affect connected industries, particularly those industries that are interconnected through a shared transaction system. In addition, changes in the structure of the transaction system of a particular industry may affect other industries. The value chain approach allows charting these interdependencies.

The value chain is defined very simply as a series of production tiers, each tier producing items that are substitutable in terms of the function they assume in a final product or service. This chain culminates in a specific product or service in which all of the value of components and processes has accumulated. The units of production in each tier of our value chain formulation are firms and organisations.

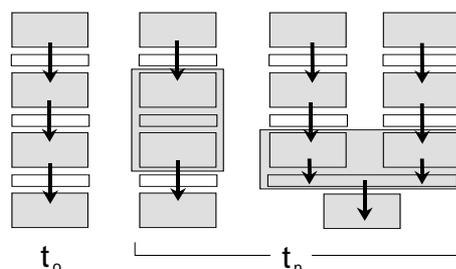
A stylised model of value chain dynamics is presented in Figure 3. The model illustrates the various ways and means by which value is added to goods and services. In an actual study, the generic characteristics of the model would have to be ‘fleshed-out’ to reflect the real structure of the value chain for a specific good or service.

**Figure 3**  
Stylised value-chain



Evolution in the transaction structure is a promising indicator of changes in the structure of the value chain. Figure 4 gives illustrations of how changes might be observed in a value chain over time as a result of the implementation of electronic commerce. The value chain representation on the left-hand side of the diagram is at a specific point in time  $t_0$ . The other representations in Figure 4 depict the possible effects of electronic commerce on this value chain at a future point in time  $t_n$ . The example in the centre demonstrates how electronic commerce may result at time  $t_n$  in greater vertical integration, whereas the example on the right illustrates the possibility of greater horizontal integration.

**Figure 4** Evolving value chains

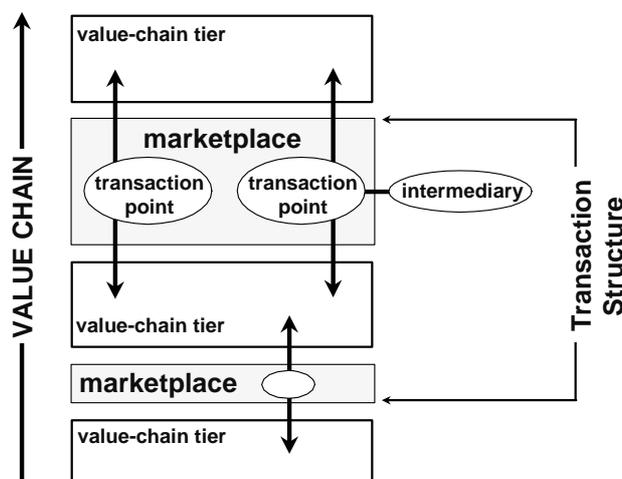


It is important to note that in different marketplaces, the same firm may have different relationships to other actors. Most firms act as both buyers and sellers - i.e. they procure and consume as well as produce. Thus, firms may be buyers in some marketplaces and sellers in others, and may display different characteristics depending on whether their presence in a specific marketplace is oriented to demand-side or supply-side criteria.

### 3. Applying the Transaction Structure Approach

In this section, an implementation framework is described to demonstrate how the transaction structure approach might be applied to case study research. The relationships and conceptual features described above are illustrated in Figure 5.

Figure 5: Conceptual features of the transaction structure approach



The *transaction structure* is comprised of various *transaction points* situated in various *marketplaces*. Some of the transaction points may involve *intermediaries* and others may not. As a whole, the transaction structure acts to facilitate the transfer of goods and services between different tiers in any given *value chain*. The *innovations* that occur with the implementation of electronic commerce will apply in the first instance to specific transaction points **but will often permeate significant parts of value chain**.

#### 3.1. Allowing for sector dynamics

Product/service characteristics influence buyer-seller relationships throughout the value chain and they can help to define the likely quality and extent of electronic commerce application in given sectors. Many different schemes can be devised, but for this project the most basic classification is as follows:

- *material* - products defined mainly by their physical attributes (e.g. vehicles and buildings), or services related mainly to the physical attributes of products (e.g. vehicle and building design or maintenance);
- *digital* - products and services that can be produced, stored and distributed in digital form.

Transaction characteristics relate to the complexity of commercial transactions. In this case, a basic distinction can be made according to the type of interaction that is required of buyers and sellers:

- *Routine* transactions involve the acquisition of a product or service under prescribed terms that essentially are the same for every participant in the marketplace. A simple example would be a retail sale at an advertised price.
- *Negotiated* transactions involve buyers and sellers in establishing at least some of the terms of the transaction each time the product or service changes hands. A simple example would be commercial insurance services, where policies typically would be negotiated differently with virtually every customer, or auctions where prices are fluid and are fixed individually for each sale.

Figure 6  
Comparing sector dynamics in electronic commerce

		PRODUCT	
		DIGITAL	MATERIAL
TRANSACTION CHARACTERISTIC	ROUTINE	<b>1</b> e.g. Publishing / music	<b>2</b> e.g. Clothing / food (retail)
	NEGOTIATED	<b>3</b> e.g. Insurance / recruitment	<b>4</b> e.g. agricultural commodities

For sectors with product/service characteristics that fall into quadrant '1' (e.g. books, music, newspapers etc.) much of the obvious potential for process efficiency gains, cost savings and the development of new business models is linked to the possibility that goods and services could be transmitted directly in digital form to large numbers of customers on standardised terms. Sectors in quadrant '2' would require retention of physical supply and distribution channels but could achieve benefits from electronic commerce through improved logistics for standard products, or by developing new business models for managing routine transactions with greater numbers of customers. Sectors in quadrant '3' operate in a predominantly digital product/service environment, but must engage in continuous negotiations with suppliers and customers. For them electronic commerce may offer benefits in the form of minimising or eliminating the need for co-location of agents and customers as terms and prices are negotiated. Sectors in quadrant '4' stand to gain from electronic commerce in the form of improvements in resources and logistics management, bidding and settlement procedures, and so forth.

### 3.2. Research in the value chain: what kind of firms to study?

It is potentially likely that electronic commerce implementations by highly proactive firms who have become very significant actors in given value chains will influence the evolution of buyer-seller relationships within these chains. The conceptual framework developed in Section 2 implies strongly that evolution in the business models of these successful firms is likely to provoke a 'learning' response from other firms engaged in the same value chains. By examining changes in the relationship of proactive implementers at key transaction points in key marketplaces, powerful insights can be gained of changes that are likely to occur in the transaction structures of sector value chains.

### 3.3. Analytical Framework

The ultimate objective is to show structural change in the relationships between buyers and sellers in the marketplace. Research findings can be assessed and organised using criteria embodied in a simple grid. The grid builds upon the basic mapping concept as shown above in Figure 2. Essentially, the grid relates evidence concerning innovation in the three transaction zones to corresponding product, process, and relational innovations. In order to complete the grid, three complementary sets of data must be assembled:

- **Data Set 1** consists of general and historical information about sector dynamics, the characteristics of products and services, market structure, technological profiles and investment patterns etc. From this information, the basic value chain can be constructed in terms of production tiers, interactions between

firms in different tiers, and the characteristics of the relevant marketplaces and intermediaries. This data set can be compiled through both desk-based and survey research.

- **Data Set 2** identifies the innovations that have been made in the various transactions. This data set can be compiled through interview-based research.
- **Data Set 3** charts product, process and relational innovations relevant as relevant to various participants in given value chains. This data set can be compiled through interview-based research, supplemented where possible by quantitative indicators of specific effects at selected transaction points (e.g. transaction volumes, values etc.).

The grid displays the connections that have been established through research between innovations through electronic commerce (Data Set 2, classified and arrayed on the horizontal axis) and product, process and relational innovations (Data Set 3, classified and arrayed on the vertical axis). This creates a stylised pattern (or ‘footprint’) of where electronic commerce is having observable effects in a given value chain, as viewed from the perspective of participants in that chain, along with an indication of the nature of these effects.

Applied on a cross-sectional basis, the grid approach acts mainly to organise and demonstrate findings. Applied over time, sequences of footprints could be generated that could illustrate the evolution of transaction structures. In more comparative contexts - e.g. cross-sector or cross-border - a higher level of presentation may be preferable. In this case, pre-defined, general categories of more aggregate innovation in the transactions could be complemented by similarly aggregated categories of product, process and relational innovation. This is illustrated in Figure 7 (note that the categories on the vertical axis are not exhaustive).

Figure 7: The analytical grid

		Electronic Commerce Innovations											
		Transaction Preparation				Transaction Completion				Production Support			
		advertising	catalogues	info services	negotiation	orders	billing & payment	finance	delivery	transaction info capture	information management	market analysis	market development
Product innovations	diversification												
	differentiation												
	customisation												
	bundling												
Process innovations	design												
	logistics												
	production lines												
	co-ordination and integration												
Relational innovations	geographical expansion												
	market segmentation												
	trust												
	loyalty												

**4. Conclusion**

By coupling the grid demonstration to the value chain analysis, significant trends can be detected that can be used to construct exploratory scenarios for the likely evolution of value chains. These exploratory scenarios will show how the configurations of specific value chains as described by Set 1 findings are likely to be restructured as a result of the actions of firms who are proactive in implementing electronic commerce, and the reactive and/or complementary actions of other firms.

The objective will be to show the extent to which firm-specific effects from innovation have resulted in competitive advantages for some firms, and how generic effects have permeated the value chain as a whole. In so doing, the information contained in the 'footprints' can be used to project future value chains.