

THE IMPORTANCE OF INFORMATION GOODS ABSTRACTION LEVELS FOR INFORMATION COMMERCE PROCESS MODELS¹

Fons Wijnhoven

University of Twente, P.O. Box 217, 7500 AE Enschede, Netherlands

a.b.j.m.wijnhoven@sms.utwente.nl

ABSTRACT

A process model, in the context of e-commerce, is an organized set of activities for the creation, (re-)production, trade and delivery of goods. Electronic commerce studies have created important process models for the trade of physical goods via Internet. These models are not easily suitable for the trade of information goods. Lowly codified information goods are hard to represent unambiguously among trading partners, their property rights are hard to secure, and the determination of volume and price is difficult. Highly codified information goods are easier traded by markets but have varying levels of abstraction that have specific requirements for their process models. This article defines process model requirements for more codified information goods. These requirements have substantial consequences for the realization of information goods business models.

Keywords: Information goods, Information economics, Information services, Process models

The Nature of Information Goods

In markets, the goods traded must be comparable to a commodity. This implies that the goods must be highly codified and non-asset specific, and thus should have potential value for many buyers. The transactions are governed through classical contract law: sharp in by clear agreement; sharp out by clear performance- in which the identity of the parties is irrelevant (Williamson, 1991: 271). Information goods though often are less codified and thus require intense communications to be understood. This explains for instance much of the turnover of the consultancy and teaching market as addition to the market for management books. Additionally, many information goods are asset specific, implying that these goods are of use for only a limited group. For instance an overview report of currently available production capacity of a firm may not be understandable or of any value for other people than the firm's production planners and some clients. High exchange and product uncertainties require elastic contracting mechanisms. If the contracting parties maintain autonomy but are bilaterally dependent to a nontrivial degree, the contracts will not be complete, and "(1) contemplate unanticipated disturbance for which adaptation is needed, (2) provide a tolerance zone within which misalignment will be absorbed, (3) require information disclosure and substantiation if adaptation is proposed, and (4) provide for arbitration in the event voluntary agreement fails" (Williamson, 1991: 272). This is what Williamson calls hybrid transaction governance, and some other authors call clans (cf. Ciborra, 1987) or networks (cf. Liebeskind et al, 1996). It mostly does not make sense to supply high asset specific information goods by hybrids, because (1) the firm owning it may want to apply strict ownership conditions on it when it is an important competitive asset, or (2) members in the hybrid will not be interested or they are unable to understand it. Hierarchies aim at control over the ownership and provide a context to make sense out of the information. A strong point of hybrids is that they enable informal content transfers, thus they enlarge the access to information also outside of the organizational boundaries and hybrids are also supportive to interfirm knowledge creation and the management of tacit (low codified) knowledge (Liebeskind et al, 1996).

From the perspective of information goods buying, it may be difficult to value an information good, also because suppliers may be interested to conceal large portions of the good in the pre-transaction stage. The economic literature has introduced three concepts to analyze this problem (Nelson, 1970): search characteristics, experience characteristics, and credence characteristics.

¹ The author wants to acknowledge Jeroen Kraaijenbrink, Eveline van Stijn, anonymous reviewers, and the editors for their contributions to this paper.

- Search characteristics give a potential buyer information about the good to enable its valuation before consuming the good. In the context of information goods this may be for instance the occasion when you select a book on basis of its title and list of contents.
- Experience characteristics enable a buyer to temporarily or partially consume the good so that the buyer can value the good. This is typically the case with physical goods, like test-drives while buying a car. In selling information goods, experience characteristics are problematic, because when once experienced a buyer does not need to buy the good anymore. For instance once having experienced a specific course, one does probably not need to take the course again. A seller of an information good may handle experience characteristics in three ways (1) giving away the good for free to generate synergistic effects (e.g. academics may give away their articles to increase their reputation which may help them to gain funds in the future), (2) the seller shuts-off the buyer from further consumption by not selling an individual information good, but by selling access to a constantly changing resource of information goods (this is what happens for instance by a subscription to a stock exchange data service), and (3) distributing demos for free (a price below cost level) to develop a client's desire for the full good.
- Credence characteristics enable a buyer to rely on third-party judgments or a seller's credentials. This is an important characteristic in buying information goods that require high quality standards. For instance certain newspapers are often bought because of their reputation. Credentials are often built by experiences of buyers and influential others.

Shapiro and Varian (1999) correctly state that information goods as experience "goods", thus goods with experience as a dominating characteristic, are nearly impossible to price. If a content producer wants to earn money, he should be able to differentiate the good. Following the lines mentioned above, differentiation can be realized by delivering high quality, raising the credence characteristics, or by reducing the costs of clients to find answers (thus raising the search characteristics). Despite potential high value of an information good, a content producer or retailer will not be able to earn any cent of he is unable to manage the property rights.

Following Furubotn & Pejovich (1974) three types of property rights exist (1) the right of use, (2) the right of changing forms and structure of the transferred good, and (3) the right to reap the profits of the good. Picot, Bortenlanger, & Rohrl (1997) add a fourth property right essential for markets (4) the right to sell the good. Because information exchanges implicate the transfer of information (and its property rights) from a supplier to a buyer, the exchange partners arrange some kind of payment. The actual price may result from the work of the invisible hand (the market), mutual understanding and networking (the handshaking in hybrids), and fiat in hierarchies. Because prices are hard to define in hybrids (Liebeskind et al, 1996), the payment for use mostly consists of invitations for collaboration on further development, and sharing profits when the information good can be sold or exploited. In the hierarchy, the most important ownership is the right to reap the profits exclusively.

Loebbecke (1994) believes that the following four dimensions are most relevant in classifying on-line delivered content, which covers most of what we defined as information goods before²:

1. Customization, which defines the transfer mode of the good and particularly the extent to which the good is or can be specified to the needs of a single client.
2. Timeliness, which defines the time slot in which the good has value. For instance stock exchange data are very time-dependent, whereas dictionaries may be relatively time-independent.
3. Intensity in use, which defines if a user may use the good once (for instance a movie) or several times (for instance a text book).
4. Externalities, which may be positive when the value of the good increases when more people use it, or negative when the value declines when more people have the good.

Though these dimensions are important from a trade perspective, they do not say anything about the content itself. Characteristics of the content, though, may have huge impact on the possibilities and limitations of customization, timeliness, use and externalities, and related process models. Because this article wants to make a contribution to the e-commerce literature from the statement that the object that is treated does make a

² Remark that the concept "information good" also includes content delivered off-line.

difference in e-commerce process models, we want to explore what it means when one wants to sell not physical goods, more specifically information goods, via e-commerce. This study is needed for two reasons:

1. Information goods are potentially a better subject for e-commerce than physical goods, because the trading and other processes of the e-commerce are more easily integrated than in the case of physical goods commerce (the last always needs an additional physical distribution as addition to the Internet activities).
2. The e-commerce literature has, despite several attempts, not been able to study the implications of intangible goods trade, as much of their processes models do not go into the differences of tangible and intangible goods.

Following Boisot (1998: 14) information (goods) may be classified along the dimensions of their level of codification and abstraction. Codification helps to give form to information, for instance by representing it in a language or mass-produced artifact. High codification implies that the representation is unambiguous for different receivers of the tokens. Abstraction refers to the level that content of the good (information and knowledge) can be applied more generally and is less restricted in scope.

Information goods are representations of events, objects, and ideas, which are codified such that they can be exchanged. Though the abstraction level may determine the level of control over processes (Bohn, 1994; Wijnhoven, 1999) and as such is basic for the application value of information goods, the codification level determines the efficiency of possible exchanges (Boisot, 1998). Low codification levels obstruct the market exchange opportunities of information goods, because it may be unclear for the buyer what actually will be sold. As such low codification goods are more effectively exchanged in networks, where credence determines much of the expected value, and higher risks of poor value deliveries are acceptable. High codification, in return, enables to tag a price to the commodity and also enables others to deliver comparable products that create market competition. Consequently, markets only enable the exchange of highly codified information goods, though if they are highly asset specific, they will have to be exchanged via hierarchies for the sake of maximum exploitation of the property rights. Low codified information goods require a conversion process to make them suitable for market exchanges, if they are not asset specific. Given the different levels of abstraction and codification, several information goods may be identified (see table 1).

Table 1: A classification and examples of information goods

Exchange governance	Market	Hybrid		Hierarchy	
Codification	High	Low	High	Low	High
Abstraction low	Data delivery services; News, journals; Infotainment	Qualitative observations & reports; Gossip	Data sets	Gossip; Business intelligence reports	Databases
Abstraction moderate	Magazines; Commercial software products	Research in progress results; Ideas & notions	Shared resources for academic group	Organizational routines & norms; Undocumented policies	Management reports; Documented business policies
Abstraction high	Professional services; Courseware; Scientific publishing; Patents; Insurances.	Theory ideas Paradigms	Scientific software; Models; Sponsored scientific books & CD-ROMs	Business & management consulting; Skills	Knowledge-based systems; ERP; Business models; R&D.

This article focuses on the information markets and the related information goods. To be able to define the process models, we have to define the concept of process models for information goods trade at a high-level of analysis. By using the related generic concepts we are able to define the different process models needed for the

different kind of information goods to be traded. We have stated that information goods on information markets differ with respect to their abstraction level. The consequences of this statement for information goods trade model requirements will be clarified through examples. Finally, we analyze and discuss the differences and generics of these models, and formulate challenges for research and practice.

A High-level Information Goods Trade Process Model

Electronic commerce is: "...the seamless application of information and communication technology from its point of origin to its endpoint along the entire value chain of business processes conducted electronically and designed to enable the accomplishment of a business goal" (Wigand, 1997: 5). Some research in electronic commerce focuses on the transaction system (e.g. Kambill and Van Heck, 1998). In the context of information goods trade, the virtual nature of its good and production processes enables high levels of integration along the complete value chain, from initial good creator to actual consumer and back. This has been recognized before by the EU's view on electronic publishing (European Commission, 1996) and Clemons and Lang (2000) on information products. This means that information goods creation processes should be explicitly included in the information goods process models. The information goods creation management process helps to make the good to a commodity that can be easily sold to generate the highest revenues. Some of the most important subprocesses of this activity are to help clients find the product (search), to realize the authenticity of the product (e.g. by copyrights), and to make attractive product representations that help clients to make buying decisions. Also after-sales services may be developed to increase the client's expected future product value. The actual production of the information good is an important part of the business model, because it will enable more or less mass-customization. As stated before, information goods may theoretically have nearly unlimited opportunities of mass-customization, and the production facility is thus an important part of the model, which requires specific communication and computing facilities, influence structures and processes. Finally, information goods require a retail and distribution facility, which is able to value the product, deliver, settle payments, legitimize the transactions, and efficiently treat disputes. This results in the classification of activities and processes for information goods trade as listed below (Clemons et al, 2000).

1. Information goods creation process, by e.g. artist, writer, reporter, researcher, photographer. Publishers and other goods managers may facilitate the creators by delivering software, groupware environments, and access to resources that may be used as base materials.
2. Information goods management includes the selection of content, promotion, contract writing, editing, generating sponsorship, certifying correctness, accuracy control, timeliness and suitability management, and managing the intellectual property rights. Many information goods creators want to save costs by avoiding using a specialist publisher, though promotion, contract management, creating production platforms etc. are specialist expertises that are needed for high quality professional product management.
3. Information goods production includes bundling data to packs, combining it for cross-selling (e.g. advertisements), printing, distributing to subscribers and retailers. Because the basic good has already been created in the initial stage of the value chain, and may already be in a state of access to consumers, in the information goods industry, information goods producers are basically *reproducers*.
4. Information goods retail and distribution includes the realization of subscription services, news agencies, newsstands, convenience stores and other outlets. Transaction-focused approaches of e-commerce have been developed to support these processes. Kambil & Van Heck (1998) distinguish several trade processes. All these trade processes have opportunities and specific problems when they want to trade information goods. These are listed below.
 - Search. Search engines, portals, and electronic agents reduce the search costs for information goods. The number of potential offers may be overabundant, requiring evaluation by credence and search information.
 - Valuation. A variety of electronic price discovery means (e.g. electronic auctions, bidding processes and negotiation via electronic agents) exist that differentially attribute costs to information goods buyers, sellers and intermediaries.
 - Logistics. Information goods offer excellent opportunities for transaction costs reductions via Internet delivery. The high levels of divisibility of most information goods enable customization.

- Payment & settlements. Third parties may provide the infrastructures to reduce for exchange risks, consisting of banking and legal services. The divisibility of information goods enables to stop delivery when payment is not done.
- Authentication. The authenticity of the trading parties in electronic commerce is required. Third parties may monitor conformance to the contract or agreement among parties, so that dispute resolution can be based on agreed data.
- Communications & computing. Improved processing, storage, input-output, and software technologies, transform the co-ordination capabilities of stakeholders in each process (European Commission, 1996).
- Product representation. Product representation determines how the product attributes are specified to the buyer or third parties. Too much representation, though, removes the trade value of information goods.
- Legitimization of transaction. Trade and exchange agreements can be validated on-line, by connections with credit card firms (which guarantee payment), checking the authority for transactions by PIN codes and membership numbers.
- Influence structures & processes. Explicit mentioning of the terms and conditions of the trade may reduce dispute problems.
- Dispute resolution. Probably legal institutes must be adjusted to settle legal problems in information goods commerce. Information goods property rights are hard to describe and secure. The time-taking legal processes around Napster and Chinese CD copiers have shown that this is far from easy.

We describe some of the market trade and goods examples of table 1 following the generic processes identified above.

Process Models for Low Abstract Information Goods

Table 1 mentioned the following low abstraction information goods: data delivery services, news services, and infotainment (popular music and books). Because news service is a specific example of data delivery services, only the data delivery services and the infotainment examples will be discussed in this section.

Data delivery service

The information supplier delivers elementary data to the acquisition activity of the service, and helps to fill the structure and content of the product platform. Next these data may be analyzed, integrated, synthesized, added and standardized, and consequently stored and made easily available to clients to facilitate customized client needs. These acquisition, refinement, and storage and retrieval facilitations are the information goods creation process. The distribution process is similar to the retail process and thus also includes the contracting and product presentation. The buyer receives information packages, and submits information needs specifications to the access tools and information product family resource. These data delivery services thus deliver customized information packs and access to large data resources. These services are also called information refineries (Meyer & Zack, 1996). See figure 1 for a model of the data delivery service.

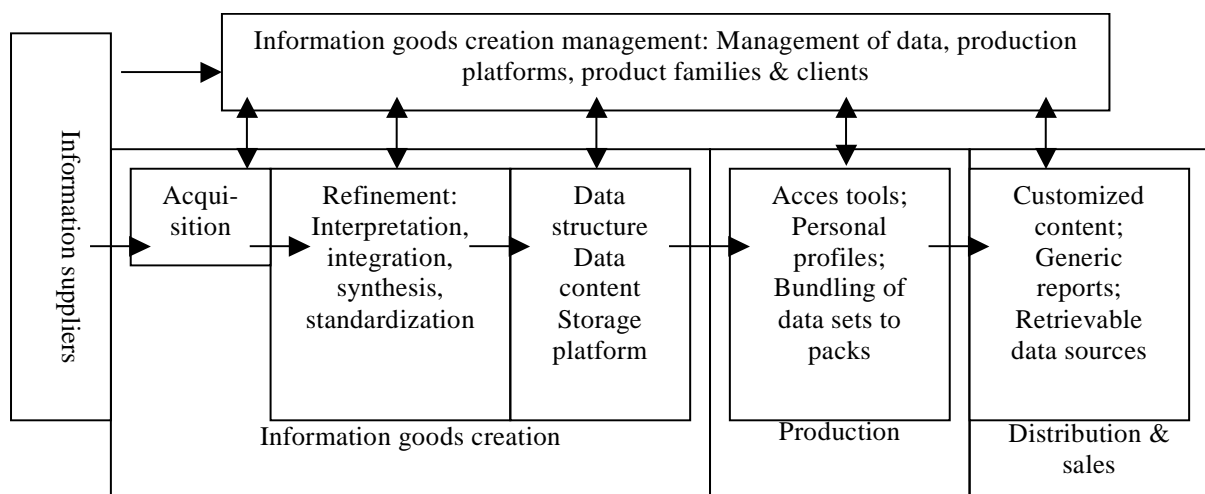


Figure 1: Data delivery services trade model

Modern news services can be organized as data delivery services, while improving the customization and topicality (real time news), and reducing the production and delivery costs. As addition though, they need a certification process to manage the quality if the supplied data and maintain the reputation of the service.

Infotainment service

Infotainment is a broad term for software for fun. Basically an artist or group of artists produce a piece of art, like a movie, a piece of music, or a game. The artist(s) first create a composition, arrangement, script or initial game design and tries to convince a recording company to arrange the facilities to produce the idea, and sell and distribute it. There is a tendency for music groups and game developers to create the products on their own, which means that the artist (group) and the product creation management firm are the same people, but often the investments and the commercial expertises needed are insufficient for this unity (cf. Clemons & Lang, 2000). The information goods creation manager also facilitates the bundling of pieces of the art product to optimally suit specific market groups and so to make the product more attractive. Information goods of this kind can be delivered in hardcopy and digital form. The digital form, though more sensitive for violations of copyrights, enables more flexibility in the delivery and customization of the good. Also the distribution and production cost are less. See figure 2 for a model of the Infotainment trade.

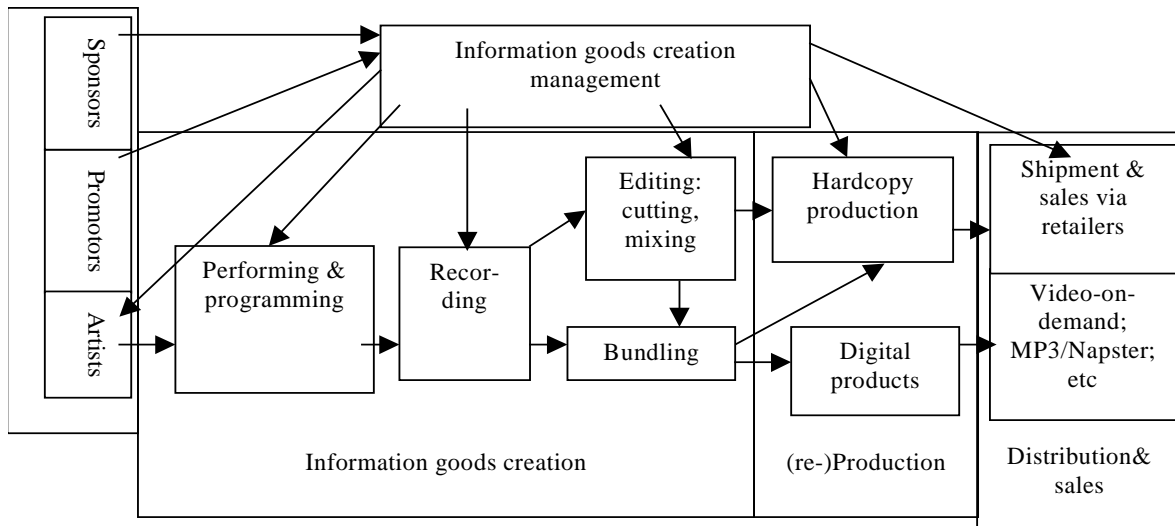


Figure 2: Model of infotainment

Many infotainment services require a continuous development, while users/players and designers discover new opportunities or generate new ideas related to the basic product. After some time the many new ideas may be combined to a new release, which may be supplied via shops as CD-ROMs or via the Internet-based product supply site. Consequently, the management of the exchanges of users and designers is a most important part of product management, and the information goods creation management.

Process Models for Moderate Abstract Information Goods: Magazines

Magazines publish articles with a higher level of abstraction than news services. This implies that more content expertise has to be added. Consequently, the information goods creation process is more intense and takes more time. Additionally, magazines have to hire external expertise to check the quality of the product or to add to it when the editors have insufficient depth of knowledge. Some information goods buyers may be expected to be more knowledgeable and can add sometimes by delivering their comments. The readers may want more resources and may be interested to reuse articles, though they do not know which and when. The most important additions to the news services thus are (1) the research process, (2) acquiring external expertise for additions and review, and (3) resources for readers. See figure 3 for a model of a magazine.

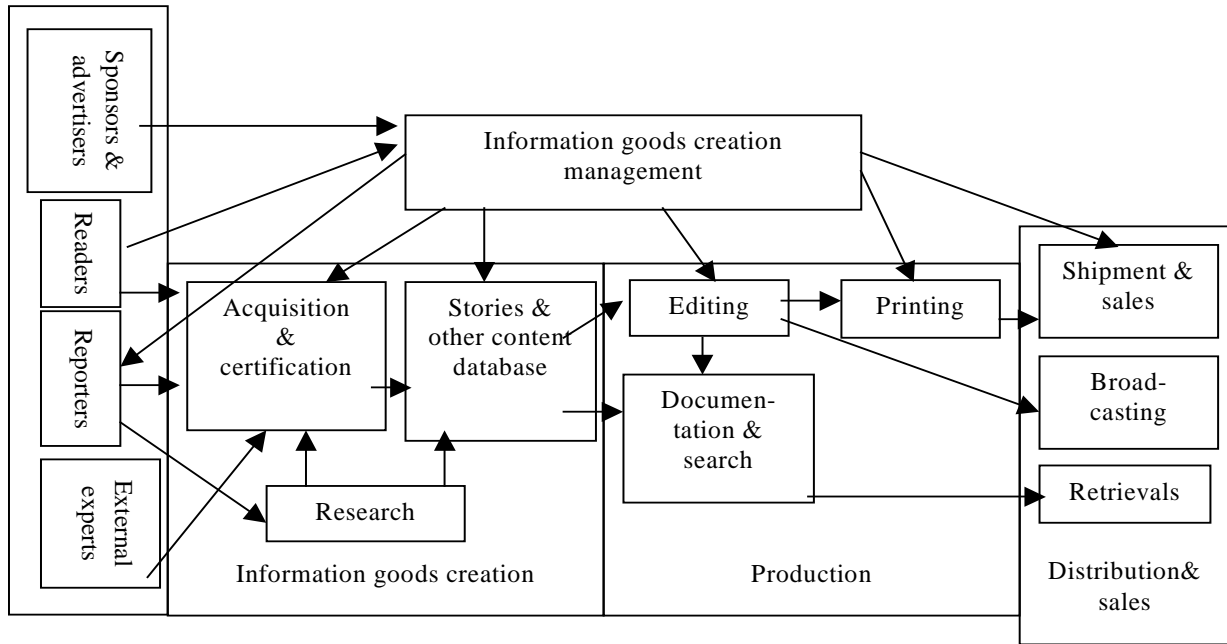


Figure 3: A model of a magazine-like information trade

Process Models for Highly Abstract Information Goods

Table 1 mentioned five examples of high abstract information goods: professional services, courseware, scientific publications, patents, and insurances. Only the examples of professional services and patent trade are described here.

Professional services marketing

Professional services have a high level of abstraction and consequently it may be difficult to codify them fully. As far as they are not fully codifiable, other trade mechanisms than markets are more useful (Liebeskind et al, 1996; Williamson, 1991). Most hospitals, organization consultants and educational institutes have web sites, which help clients to make an initial diagnosis, an initial analysis, or give information concerning research results and courses. Many of these sites are free of charge, because they help to develop a need among prospects for more profitable services, which are difficult to codify. To understand the typicalities of such professional services marketing, let's analyze the case of Cap-Gemini-Ernst &Young's Dutch operational benchmark service. CGEY clients can fill in a form consisting of benchmark items. The data submitted are compared to data from other firms, and some diagnosis and advice is given. Via the system, clients receive a well-grounded advice, combining theoretic insights, expertise and data. They pay a small fee for the service. Sometimes they will be able to solve the detected problems themselves, but they may also hire the professionals from CGEY or another organization consultancy firms. At least two different types of products may be delivered: (1) the electronic advice via the website, and (2) professional skills. The information goods production thus has two production lanes, and these lanes build on data, expertise (case experiences), and theoretical insights, that are modified to the consultancy systems and the consultancy method. See figure 4 for a model of professional service trade.

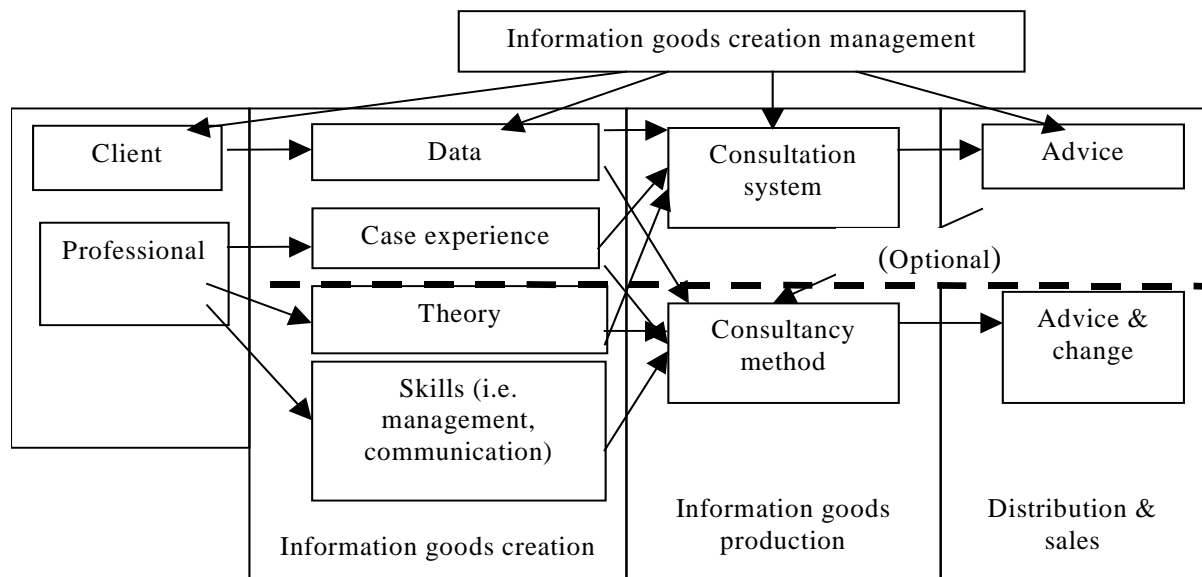


Figure 4: Professional service marketing-like information goods trade

Typical for this information trade process is that some of the information goods are hard to codify, and thus are difficult to trade via markets (this is represented as everything below the dashed line in the figure 4), and are certainly not to be traded by electronic commerce. These low codification goods though are important complements to the codified goods.

Patent trade

Though patents are representations of highly abstract knowledge, they are suitable for codification. This means that they are described such that other people can use them in a profitable way when they pay for its use. This makes patents as information goods, particularly suitable for market trade.

Because using a patent is only possible through coming to an agreement with a patent owner, the actual production requires the publication of the patent, a valuation of the patent and the negotiation and contracting. These production processes are combined within the Yet2.com site. Yet2.com wants to be a global patent marketplace, by giving clients (searchers and potential buyers of patent licenses) access to owners of advanced technologies. Several leading technological firms are sponsors of Yet2.com, and they share their patents via Yet2.com with the market. The Yet2.com site gives information for valuation and pricing of patents, via its "done deals database", assists in structuring a deal by providing past deals as a frame of reference, and helps to learn about royalty rates in similar transactions. Yet2.com also gives assistance in legal services like patent prosecution, trainee programs, and setting up legal protection. The site gives multiple references to other firms that can help by providing their professional services, and as such is a professional services marketing site as well. The information good is created via the review of a patent submitted for publication and the actual delivery of it as an information good via publication (hardcopy or on-line). This review (the job of patent and trademark offices and authorities) focuses on removing ambiguity in the patent description, and checking the novelty of the invention. The results of these reviews are processed by specialized publishers like Derwent via hardcopy prints and on-line databases. See figure 5 for a model of patent trade.

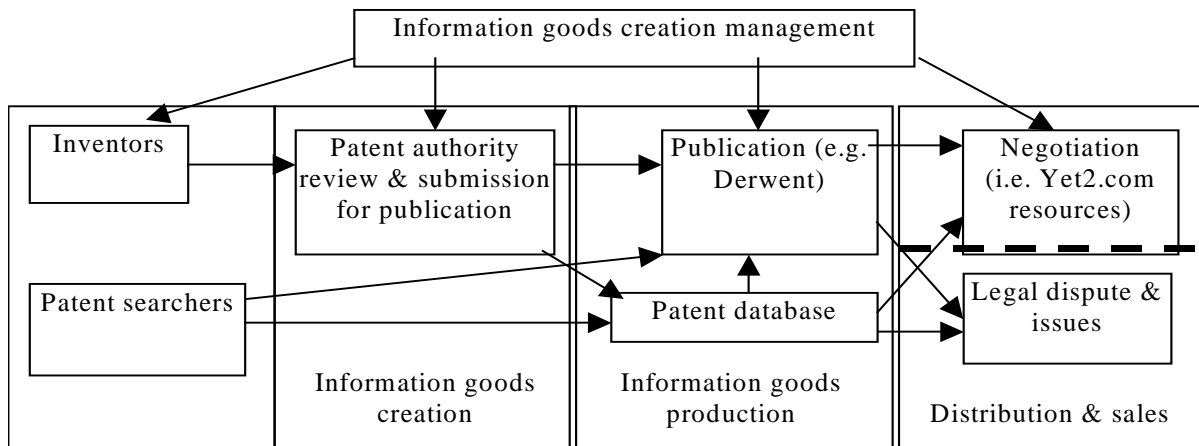


Figure 5: A model of patent trade

The elements below the dashed line have low levels of codification and are hard to trade via electronic commerce systems.

Conclusions and Discussion

Although this study does not pretend to be complete on all possible information good trade models -the cases have been selected as examples within a framework- several conclusions for theory and practice can be drawn. These conclusions result from a comparison of the models among different information goods abstraction levels, and within similar abstraction levels.

Trade models for moderate abstract goods require the addition of more expertise than for the low abstract good trade process. This expertise often has to be insourced, and requires review and commenting activities of (external) experts. High abstract goods can hardly be traded completely by electronic means, and requires supplementary human commercial interactions to deliver the information goods completely. Electronic commerce systems for high abstract goods thus need a human expertise supplement in its production and delivery processes for clients who want more.

Within the low abstract information goods group, the models differ on:

- The level of human interaction needed. With some goods an execution-driven process may satisfy, whereas with other goods clients need access tools to create their own end product.
- The level of bundling and customization of the information good. For instance books are completely bundled information goods, whereas data delivery services may supply unbundled data.
- The virtual or physical nature of the supplied good. Most low abstraction information goods models enable virtual as well as physical deliveries.

Within the moderately abstract group the most important difference may be the level of user/reader/consumer interaction in the information goods creation process. Electronic reader platforms may facilitate discussions and facilitate further critical explorations by the reader. This may be extended to reader involvement in magazine production activities.

Within high abstract information goods the major differences are:

- The completeness of the product codification. High abstract information goods mostly have a codifiable and complementing noncodifiable part. The noncodifiable part also requires a consultant-driven trade process (Picot, et al, 1997).
- The leading actor in the market. In some cases the product creator owns the trade system (i.e. insurance firms), whereas in other cases the product creator and buyer community may own the trade system (e.g. some scientific communities).
- The inter-organizational nature of the trade system. Some information goods require the collaboration of several specialized information good creators (i.e. the patent trade market of Yet2.com).

We mentioned that information goods trade has specific complications because of its goods representation, property rights, and pricing problems. But at the same time, information goods can profit more from electronic

media for reducing transaction costs, and improving producer-buyer interactions. Electronic media also enable more integration in the value chain and opportunities of exploiting this. All the information goods trade models have high opportunities of customization and intense user/client involvement in product creation and production. The access tools, though important for customization, make information good trade systems very sensitive for property rights violations.

Information goods process models at a high-level share actor roles, information goods creation activities, information goods production activities, distribution and sales activities, and the co-coordinating tasks of information goods management. Further analysis and design of the models architectures require considering several organizational and information technological decisions. Though some significant insights are accomplished on concepts and models of information goods trade, this article is just a start to further systematic exploration of information goods electronic commerce. Much more practice has to be documented and analyzed, resulting in the development of management instruments. Many e-commerce process and architecture modeling tempts to neglect aspects of the content or substance that is actually traded. We have argued here that being clear about the content (in terms of codification and abstraction) does make a big difference for the commerce process model requirements.

REFERENCES

- Bohn, R.E., "Measuring and Managing Technological Knowledge," *Sloan Management Review*, Vol. 36, no. 1: 61-73, Fall, 1994.
- Boisot, M. H., *Knowledge Assets: Securing Competitive Advantage in the Information Economy*. Oxford [etc.]: Oxford University Press, 1998.
- Ciborra, C. U., "Research Agenda for a Transaction Costs Approach to Information Systems," *Critical Issues in Information Systems Research*, R.J. Boland, R.A. Hirschheim (eds.), Wiley, Chichester (UK), pp. 253-274, 1987.
- Clemons, E.K and K.R. Lang, *Newly Vulnerable Markets in an Age of Pure Information Products: An Analysis of Online Music and Online News*. Working paper, University of Science & Technology, Hong Kong, 2000.
- European Commission DG XII/E (ed.), *Strategic Developments for the European Publishing Industry towards the Year 2000, Europe's Multimedia Challenge*. European Commission, Brussels/Luxembourg, 1996.
- Furubotn, E. and S. Pejovich, *The Economics of Property Rights*. Ballinger, Cambridge (MA), 1974.
- Kambil, A. and E. Van Heck, "Reengineering the Dutch Flower Auctions: A Framework for Analyzing Exchange Organizations," *Information Systems Research*, Vol. 9, no. 1: 1-19, 1998.
- Liebeskind, J.L., A.L. Oliver, L. Zucker, and M. Brewer, "Social Networks, Learning, and Flexibility: Sourcing Scientific Knowledge in New Biotechnology Firms," *Organization Science*, Vol. 7, no. 4: 428-443, 1996.
- Loebbecke, C, "Electronic Trading in On-line Delivered Content," *Proceedings of the 32nd Hawaii International Conference on Systems Sciences*, <http://computer.org/proceedings/hicss/0001/00015/00015009.PDF>, 1999
- Meyer, M. H., and M.H. Zack, "The Design and Development of Information Products," *Sloan Management Review*, Vol. 37, no. 3: 43-59, 1996.
- Nelson, P., "Information and Consumer Behavior," *Journal of Political Economy*, Vol. 78, no. 2: 311-329, 1970.
- Picot, A, C. Bortenlanger, H. Rohrl, "Organization of Electronic Markets: Contributions from the New Institutional Economics," *The Information Society*, Vol. 13, no. 1: 107-123, 1997.
- Shapiro, C. and H.R. Varian, *Information Rules: A Strategic Guide to the Network Economy*, Harvard Business School Press, Boston (MA), 1999.
- Wigand, R.T., "Electronic Commerce: Definition, Theory, and Context," *The Information Society*, Vol. 13, no. 1: 1-16, 1997.
- Wijnhoven, F., "Development Scenarios for Organizational Memory Information Systems," *Journal of MIS*, Vol. 16, no. 1: 121-146, 1999.
- Williamson, O. E., "Comparative Economic Organization: The Analysis of Discrete Structural Alternatives.," *Administrative Science Quarterly*, Vol. 36, no. 2: 269-196, 1991.