

## Business process redesign for effective e-commerce processes in the service industry

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#### Business Process Redesign for effective e-commerce processes in the service industry

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#### Abstract

Many companies have found out the hard way that successful e-commerce requires more than a flashy web presence. Existing business processes must be seamlessly integrated with the new, electronic form of interaction with suppliers and customers. Despite this insight, little research has focused on the transformation of doing business to achieve the presumed benefits of e-commerce. This paper gives directions on how processes may be reengineered with this aim, particularly within the service industry. The presented views are based on existing research into Business Process Reengineering best practices. Careful consideration in this paper is given to the description of the conceptual background, which is used to classify existing research and to position the contribution of this paper. The guidelines which are discussed are illustrated by process models, represented by UML Activity diagrams.

Keywords: e-commerce, service industry, BPR, process models

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## 1 Introduction

There is a historic parallel for the current limited success of e-commerce. The first wide-scale introductions of IT in the business place focused on the improvement of isolated parts of business operations, for example the generation of invoices. Productivity increased locally, but generally the overall effect was small. Only during the 80s and 90s, companies started to see the benefits of considering entire business processes when implementing information systems, and as a result, huge gains were achieved.

Today, it seems, companies are at the start of this same loop again. The focus is on creating "brochure-ware pro forma, this-is-who-we-are Web sites" (Champy , 2002). Others report that 85% to 95% of corporate e-commerce web-sites are not even linked up with their back-office processes (Krzywonos , 2000). Once again, the view on the entire process is missing, which prevents the new technology to become truly effective.

This paper puts the emphasis on the process context of e-commerce. It addresses guidelines to redesign business processes when e-technology is introduced. The purpose of the redesign is to meet business partners' expectations raised by doing electronic business, in particular improving its performance. The specific business area under consideration is the service industry. This part of business is traditionally underexposed in literature (see e.g. Bharati and Tarasewich , 2002; Ngai and Wat , 2002), although we feel that it offers much more potential for e-commerce initiatives than the manufacturing environment. We will present some support for this opinion in this paper.

The structure of this paper is as follows. First, in Section 2, we take a step back to clarify the specific context of this paper: e-commerce, the service industry, BPR, and process modeling. Although this section is of some interest on its own, its basic purpose is to clearly position the contribution of this paper.

In Section 3, we present our analysis of what is essential to both doing e-commerce and delivering services in the service industry. This is based on an extensive literature study. The identified characteristics are then used to select precisely those BPR practices that make e-commerce transformations more effective. Already established best practices for BPR within the service industry are taken as starting point (Reijers , 2003).

Section 4 is the heart of this paper, which explains the effect of each of the selected practices in the context of e-commerce. UML Activity diagrams are used to visualize the used real-life examples. Finally, in Section 5 we present our conclusions and directions for further research.

## 2 Theoretical background

The basic notions of this paper are presented in this section. Each subsection ends with a positioning of the paper with respect to the treated subject.

#### 2.1 Defining e-business and e-commerce

The two concepts e-business and e-commerce are often mixed up. E-business can be understood as the ability of a firm to electronically connect, in multiple ways, many organizations, both internally and externally, for many different purposes (Fahey *et al.* 2001). This rather broad definition is further refined, see e.g. (Gloor, 2000), who distinguishes e-business from e-commerce. E-business covers the application of Internet technology (internet, intranet, extranet) in all aspects of the business world. This includes, apart from e-commerce processes, for example Internet and service providers, and providers of market places and reversed auctions. Additionally, Gloor defines the term e-commerce (EC) for the activities related to marketing, buying and selling of products and services on the Internet. Therefore, EC is considered to be a subset of e-business.

Another, frequently used definition of EC distinguishes four perspectives (Kalakota and Whinston, 1997):

- Communication perspective EC is the delivery of information, products/services or payments over telephone lines, computer networks or any other electronic means;
- Business process perspective EC is the application of technology towards the automation of business transactions and workflows;
- Service perspective EC is a tool that addresses the desire of firms, consumers and management to cut service costs while improving the quality of goods and increasing the speed of service delivery; and
- Online perspective EC provides the capacity to buy and sell products and information on the Internet as well as other online services.

Although in the literature the terms e-business and EC frequently get mixed up, we explicitly follow the restricted view on EC by Gloor and see all four perspectives from Kalakota and Whinston as valuable for our scope.

#### 2.2 E-commerce typologies

A literature review by Ngai and Wat (2002) distinguishes four broad classes of EC publications: (a) applications, (b) technology issues, (c) support and implementation, and (d) others. Ngai and Wat further subdivide the applications in several application areas. It is also possible to distinguish the types of processes within EC. We propose the following types of processes (see also Figure 1):



Figure 1: E-procurement versus e-sales

- o Requirement and ordering processes, generally referred to as 'e-procurement'
- o Inter-organizational processes
- Sales and delivery processes, generally referred to as 'e-sales'

E-procurement focuses on the internal processes of an organization when requiring goods or services via the Internet. This includes internal requests for ordering, authorization of requests, requests for quotations, final purchase orders, checking invoices and payments.

E-sales focuses on the internal processes of an organization when offering products via the Internet. This includes maintenance of catalogues, customer relationship management, sales support and (physical) delivery of the goods or services.

Inter-organizational processes mainly are a part of e-business, but also a part of EC. In relation to EC, inter-organizational processes focus on contracts, inter-organizational process modeling, and workflow support.

Another classification of EC known from literature is based on the type of agents involved (Cebra , 2002; Hall, 2000). At both the supply and demand side we distinguish business agents and consumers. The following types of EC exist:

- o Business-to-business (B2B)
- Business-to-consumer (B2C)
- Consumer-to-consumer (C2C)

Other important viewpoints are related to the type of product that is traded and the role that this product has in the organization (in case of B2B, procurement of primary versus secondary goods (Kraljic, 1983)). The type of product can be, for example, physical or non-physical. This viewpoint is further elaborated upon in the next subsection.

Taking these classifications and perspectives into account, this paper is particularly focused on the optimization of e-sales processes, either B2B or B2C.

#### 2.3 Defining the service industry

Literature that explicitly defines the application area of EC often distinguishes between *tangibles* and *intangibles*. The trade of tangibles is often seen as the core of manufacturing, where intangibles form their counterpart in the context of services. Levitt (1981) even suggested to replace the terms 'goods' and 'services' by 'tangibles' and 'intangibles'.

Other authors, e.g. Loebbecke (1999), have a narrower interpretation of an intangible, seeing it as an immaterial good expressible in bits and bytes. Intangible products within this view are considered as *information products*, which include products based on data, information, and knowledge. A typical further subset of information products is so-called 'on-line delivered content' (ODC). It includes on-line newspapers, magazines, music, education, searchable databases, consulting and possibly expertise ideas. Although many products have intangible components nowadays, ODC explicitly has no tangible components at all (Loebbecke, 1999).

The 'manufacturing process' of information products characteristically resembles a refining process, composed of five information-processing stages: acquisition, refinement, storage/retrieval, distribution, and presentation or use (Meyer and Zack, 1996; Wijnhoven, 2002). Trading intangible products demands new business models and processes (Loebbecke, 1999). Intangible goods are not limited by physical constraints and hardly fit into traditional economic categories: They can simultaneously be 'durable and ephemeral, lumpy and infinitely divisible, unique and ubiquitous, scarce and abundant' (Goldfinger, 1998). This explains why their trade should be well-suited for EC, as we claimed in the introduction of this paper.

To a large extent, *services* can be seen as covering the delivery of intangibles and information products. By service, we will understand the trade of any class of immaterial products – intangibles or information products – with a semantically well-defined functionality, whose provision involves the execution of a set of human and/or computational activities within an organization, or across several organizations (Dumas *et al.*, 2001). Examples of electronic services include e-finance (banking, insurance, stock exchange, etc.), e-health care, e-government and electronic travel services (booking a flight, renting a car, booking accommodation, etc.).

Because services may make use of physical actions or items, Dumas *et al.* (2001) provide the helpful concept of *integrated services* or *composite services*. Take, for example, a travel package that includes the booking of a hotel, the provision of the physical hotel vouchers, and a rented car at the location of the hotel. This package includes both tangible and intangible elements and is therefore a composite service.

Our focus in this paper is the provision of services, where we do not exclude composite services. Within the electronic context, an e-service is then a service that is accessible through electronic means (e.g., a web interface).

#### 2.4 Some background on BPR

Hammer (1990) and Davenport and Short (1990) were the first to report on more or less systematic approaches to generate radical performance improvement of *entire* business processes. Their major vehicles were the application of information technology on the one hand and the restructuring of the business process in question on the other. This approach was coined with the terms "Business Process Reengineering" by Hammer (1990) and "Business Process Redesign" by Davenport and Short (1990), to both of which we will refer to as 'BPR'.

BPR was embraced by industry in the early nineties. Despite great successes and failures, high acclaim and sharp criticism, "process-thinking" and BPR by now have become main-stream thinking in industry (Sharp and McDermott, 2001) and have permanently influenced management and computer sciences (Heusinkveld and Benders, 2001).

The BPR guru's of the first hour propagated the "clean sheet" approach, i.e. a process should be designed from scratch without considering the existing process in too much detail. However, most BPR projects take the existing business process as starting point (Reijers, 2003): Within the setting of a workshop management consultants, business professionals, and managers try to think of favorable alternatives to the business process as a whole or parts of it. The resulting process design is then used by IT-specialists, change management experts, and other specialists to implement the new lay-out of the process within the organization.

The technical heart of BPR is the sensible application of a number of recurring redesign practices. Hammer and Champy (1993) present several examples, such as "Small tasks in a business process should be combined into larger tasks". An extensive literature survey in this field, extended with actual BPR experiences, has rendered 30 practices that are often applied in the redesign of a business process (Reijers , 2003). This survey will be taken as the basis for exploring the possibilities to integrate BPR within the transformation of a process into the delivery of e-services.

#### 2.5 The use of process models

For both the redesign and implementation phases within a BPR project, a *process model* is an indispensable device. During redesign, a process model can be used as a frame of reference to trigger alternatives and as a mental vehicle to test them. For the implementation, the process model is the specification that drives all further efforts. Different versions of the implementation model can be used to record new insights and to reflect updates to the initial design.

In this paper we will use process models to illustrate the various redesign practices within the context of EC. There is an abundance of modeling techniques, which all have their own specific advantages and drawbacks (for an overview, see e.g. Kettinger *et al.* 1997). The formalism that we adopt in this paper are the Activity Diagrams of the Unified Modeling Language (UML) (see e.g. Fowler and Scot, 2000). A strong argument for their use is that this modeling technique is part of the de facto standard in the modeling arena. However, in contrast with the frequently applied Use Cases and Class Diagrams being part of the UML, Activity Diagrams are not that popular. We see this paper as an opportunity to demonstrate their ease of use and clarifying power.

Note that Activity Diagrams are closely related to the Petri net as it is used in workflow modeling (see e.g. Aalst and Hee, 2002). In comparison, Petri nets may have a better defined semantics and many possibilities to verify behavioral properties (Chaudron *et al.* 2003), but are less well-suited for communication with laymen. Overall, it seems wise to restrict oneself to the modeling of the subclass of Activity Diagrams which can be mapped onto Petri nets. This, however, is not an issue we will elaborate on.

We will use the notations as given in Table 1, in conformance to the notation of Activity Diagrams (see e.g. Fowler and Scot, 2000).

Symbol	Meaning
•	Initial state of the process.
Filt order	An <i>activity state</i> or simply <i>activity</i> . An activity is a state of doing something, in this case on the left: filling an order.
[rush order] [else]	A <i>branch</i> has a single incoming arrow and several guarded outgoing arrows. Only one of the outgoing routes can be taken, so the guards are mutually exclusive. Using [else] as a guard indicates that this route must be taken if all the other guards on the branch are false.
	A <i>merge</i> has multiple input arrows and a single output. A merge marks the end of conditional behavior started by a branch. Either one of the branches is fulfilled.
	A <i>fork</i> has one ingoing arrow and several outgoing ones. When the incoming fork is triggered, all of the outgoing routes are taken in parallel.
	A <i>join</i> has multiple input arrows and a single output. With a join, the outgoing route is only taken when all the states on the incoming arrows have completed their activities.
	End state of the process

Table 1: Symbols in an activity diagram

In addition to these symbols, we use so-called 'swim-lanes' to partition the activities. In this way, it can be indicated what type of resource is responsible for the activities within the same lane. The actual diagrams will accompany the examples of Section 4.

# 3 Characteristics of processes for e-commerce and service industries

In this section, three possible scenarios for BPR in EC projects are elaborated. We show how BPR practices are valuable in each of these scenarios. Subsequently, we provide an overview from literature of the peculiarities of EC processes compared to conventional processes. Also, we compare service delivering processes with processes for tangibles and intangibles. The purpose of this overview is to make a valid selection of BPR practices that will be most helpful to make an EC initiative successful. The criteria that are used for this selection are given at the end of this section and will be applied in section 4.

#### 3.1 The use of BPR for e-services

It seems indisputable that the constraints on an e-business process are different from those on a conventional process. For example, consider the 24-hours/7-days-availability that is almost a standard requirement for an EC process. Our claim is that many known BPR practices to improve a process may be used to make an EC process *better aligned* to such new constraints. Consciously using the best practices of BPR could make the difference between a process that allows EC and a process that *excels* in supporting EC. There is an analogy in software design: Although a functionally correct program is good, a correct program with a good performance is crucial.

When a conventional process is already being transformed into an EC process, then clearly there is a momentum of change. This is an extra argument to consider BPR to be included: (i) no additional work is required to understand the process and (ii) changes from both the EC and BPR perspectives could be combined. Truly integrating the efforts to enable a process to support EC and reengineering is, however, just one of the possible scenarios that can be found in practice. We distinguish three scenarios:

- 1. A business process is first enabled for EC, subsequently used for some time, and finally reengineered;
- 2. A business process is first reengineered (with respect to future EC), subsequently used for some time, and finally enabled for EC;
- 3. Reengineering and EC enabling are integrated in one effort.

When BPR is carried out in the context of EC, the first scenario is probably the one that is most frequently encountered in practice. After an e-enabled process has been used for some time, one may find that it is not effective enough and improvements are made in response. Although this is not ideal, we obviously prefer this scenario over situations where the EC processes remain ineffective.

The second scenario differs from the first in the sense that improvements to an existing process are already made in preparation for its e-enabling. One may expect that this will be of benefit to the success of the EC process once it becomes effective. Probably, the improved performance of a reengineered process will not hamper its conventional execution in the mean time. Nonetheless, if the time between reengineering and EC enabling is long, this is certainly a costly alternative: The real benefits of the reengineering only will be experienced in time. It is also questionable whether it is possible to overlook all required performance changes before EC

enabling comes into question. In other words, some additional fine-tuning may be necessary during or after the e-enabling.

The most preferable scenario, from a conceptual viewpoint, is the last one. In changing the process for its EC enabling, changes to the process structure and support are interwoven, i.e. each process change from a BPR perspective is aligned with the desired functionality from the EC perspective and vice versa. Clearly, the resulting process will incorporate all desired functionality and provide the performance in answer to new business constraints. A possible drawback is that such a change is more complex and involves more risk than making two subsequent shifts. The purpose of this paper is to reduce this kind of complexity by structurally presenting the possibilities in reengineering such a process.

Note that we did not incorporate in the mentioned scenarios whether the original, conventional process will still remain effective after the EC initiative. Although this issue raises many interesting questions (e.g. is it better to integrate the conventional process with the EC process or to have them separate), we will not deal with it at this place. We merely focus on the new process, which is being subjected to EC enabling and BPR.

Although the focus of BPR might change a little depending on the chosen scenario, the redesign is based on characteristics either in EC processes or in the service industry. The remainder of this section provides an overview from literature of these peculiarities. The purpose of this overview is to make a valid selection of BPR practices that will be most helpful to make an EC initiative successful. The criteria that are used for this selection are given at the end of this section and applied in section 4.

#### 3.2 Essentials of processes for e-commerce

This subsection highlights the characteristics of EC processes. Although conventional processes in specific cases may reveal comparable characteristics, they are more dominant in EC. On the other hand, some of these characteristics can even be considered as distinctive enablers for EC.

The characteristics are described for all applicable life-cycle phases: product research, design and development, marketing, sales, production, distribution, order fulfillment and after-sales service. The characteristics are inter-related, but for the sake of clarity discussed separately.

#### 3.2.1 Business structures

Due to decreasing transaction costs between and within enterprises, conventional business structures are under pressure. This results in a renewed focus on core activities, alliances with business partners and competitors, and even in entire networked organizations. This trend can be observed in many organizations, but especially applies to EC (Oosterhaven, 2000). Also, Gunasekaran *et al.* 2003 acknowledge the importance of outsourcing in this context and observed that outsourcing of service functions is becoming popular.

We also observed that EC is changing manufacturing systems from mass production to demand-driven, possibly customized, just-in-time manufacturing systems (Gunasekaran *et al.* 2003). Hall (2000) refers to this phenomenon, namely that customers increasingly expect personalized service.

#### 3.2.2 Transparency

For EC, the back-office of an enterprise should become much more transparent for the customer, particularly with respect to the status of orders and tracking & tracing (Lummus and Vokurka, 2002). This may be based on ERP systems in case of physical goods or on Workflow Management Systems in case of services and administrative processes (Oosterhaven, 2000).

Supply and demand markets also become increasingly transparent, while the power of customers is expanded. This may result in co-production of parts of the process and asks for tailor-made services. For B2C, it enables the customer to develop market power, for example by initiatives like LetsBuyIt.com (Oosterhaven, 2000).

#### 3.2.3 Customer loyalty

Especially in B2C environments, customer loyalty is an important EC success factor. After all, at each specific point in time, the customer may have access to competitors relatively easily. Process characteristics such as quality, speed, privacy and safety are important. Quality can be found in the product, but also in the distribution or aftersales service. Dissatisfied customers will soon take their business elsewhere; the competition is only a mouse-click away (Hall, 2000).

Customer loyalty may be influenced in a negative way, due to technical issues. Gunasekaran *et al.* (2003) mention that users that already have the intention to buy may still abort transactions due to frustration over the sales and communication process as implemented.

#### 3.2.4 Time independence

Whereas a conventional store generally has limited opening hours, an e-store should be opened 24 hours a day and 7 days a week, 365 days a year (Hall, 2000; Lummus and Vokurka, 2002). Although a typical customer may choose particular periods of time, the store itself has to be prepared for customers all around the clock. This effect is further strengthened by the fact that EC is much more location-independent than conventional business, which reduces the purchasing pattern of a 'typical customer'. This typical customer no longer exists, which to a high degree influences the way orders are fulfilled.

Time independence obviously influences marketing and sales processes, but indirectly also all other processes of the life-cycle. Due to expectations on speed – which may be implicit - requirements are posed on production and distribution. Hall (2000) additionally stresses a frequently neglected phase, which requires around-the-clock attendance: helpdesk and after-sales service.

## 3.2.5 Quality of the fulfillment cycle

Quality and speed of the entire fulfillment cycle should be in line with the suggestion made by electronic transactions (Oosterhaven , 2000). Quality and speed in EC are closely related, in fact speed is an important aspect of product quality. To retain, grow and benefit from today's fast changing environments, enterprises should be innovative, *highly* efficient and provide high quality with respect to time-to-market, products, processes and service (Hall , 2000).

Electronic transactions ask for a reduction in development cycles and acceleration of time-to-market through collaborative engineering, product, and process design,

regardless of the location of participants. Additionally procurement cycles should be shortened through the use of on-line catalogues, ordering, and payment; drastically reduce purchasing and production cycles (Gunasekaran *et al.* 2003).

An important aspect of quality is to ensure that the product, marketing information, and prices are always up to date (Gunasekaran *et al.* 2003). Due to aspects such as time and location independence, a bad performance on quality has a negative impact on customer loyalty.

#### 3.2.6 Privacy and safety issues

Turban *et al.* (2000) mention security and safety issues, especially in a B2C environment, which may result in a lot of resistance. Gunasekaran *et al.* (2003) mention security fear (integrity, authentication, authorization and non-repudiation). Belanger *et al.* (2002) refer to the outcome of several studies that suggests that a large number of individuals using the Internet have serious privacy concerns.

Belanger *et al.* (2002) researched four common trust indices: (1) third party privacy seals, (2) privacy statements, (3) third party security seals, and (4) security features. The results indicate consumers valued security features significantly more than the three other trust indices. They also conclude that consumers' ratings of trustworthiness of Web merchants did not parallel experts' evaluation of sites' use of the trust indices. This study also examined the extent to which consumers are willing to provide private information to electronic and land merchants. The results revealed that when making the decision to provide private information, consumers rely on their perceptions of trustworthiness irrespective of whether the merchant is electronic only or land and electronic. Finally, they investigated the relative importance of three types of Web attributes: security, privacy and pleasure features (convenience, ease of use, cosmetics). Privacy and security features were of lesser importance than pleasure features when considering consumers' intention to purchase.

#### 3.2.7 Impact of technology

Processes also involve people and culture – they can make them, shape them or break them (Hall, 2000). Whereas privacy and safety issues can be determined to a large extent objectively, the human aspects we refer to in this subsection are more subjective and personal. We distinguish two viewpoints: the supply view and the demand view.

As seen from the supply view, technology is an enabler for the process. It affects the processes that are carried out and the employees who are involved in these processes. The introduction of EC implies that at least some process steps are supported by technology due to the web-based interfaces. However, due to aspects such as time and location independence, it is likely that additional process steps are supported by automated systems, or that human activities are even replaced by automated systems (Gunasekaran *et al.* 2003). From a process point of view, this may influence the quality of the process due to technical limitations of an automated system compared to humans (Turban *et al.* 2000). A well-known example is the application of artificial intelligence (AI). From literature on AI, the discussion on the effect on the quality of decisions that are made in the process is well documented. From a process *redesign* point of view this may introduce a great possibility for flexibility. On the other hand, Oosterhaven (2000) postulates that both for physical goods and for services, major adjustments in business management are required: many (partial) human links

compensated the imperfection of systems, now to be replaced by seamless connections.

The main issue at the demand side involves the way the customer may experience the use of technology. The customer benefits from the characteristics mentioned in the previous subsections, such as time and location independent shopping, and other positive aspects, such as increased possibilities for product and price comparison or additional services at home. However, many customers are uncomfortable with technology. This feeling may be based on objective grounds such as privacy or safety (see e.g., Belanger *et al.*, 2002), but also on the unfamiliarity with technology in general, the use of computers and internet, the lack of standards between systems, rapidly changing systems, a lack of support services, etc. (Turban *et al.* 2000). Hall (2000) mentions that it is vital that interfaces that are used by a variety of customer-access devices are attractive and easy to use.

Additionally, Gunasekaran *et al.* (2003) acknowledge the important role of human contact. Customers generally do not trust an unknown faceless seller, paperless transactions and electronic money. Another typical example can be found in e-retailing of groceries. The lack of touch and feel of the customer, not knowing whether a particular purchase of lettuce or chicken is fresh, causes customer resistance.

#### 3.2.8 From EC characteristics to EC performance aspects

In this paper, our main focus concerns the *performance aspects* of EC, as this can be influenced by applying BPR. The seven characteristics we discussed in relation to EC don't equally contribute to the performance of business processes. The issues related to the impact of technology, for example, are *enablers* for process change, while other issues refer to the current flux that EC finds itself in (Business structures) or to difficulties that are encountered with EC provision (Privacy and safety issues). The success of a particular e-service is determined by aspects such as customer loyalty and quality of the fulfillment cycle. These contribute to an adequate and timely delivery of e-services. Therefore, speed is an important performance criterion for EC-processes. Other process performance aspects related to the quality of the fulfillment cycle are the time-to-market and the cost and quality of the business process. A process performance criterion related to customer loyalty is transparency of the business process. The last performance criterion that we would like to mention here is the availability aspect, caused by the time-independent nature of EC processes. Although this might not be a limitative listing, we feel that the mentioned aspects are especially important to make e-services effective and successful.

#### 3.3 Essentials of processes in service industries

Service processes are different from other types of processes, such as (discrete) manufacturing processes. In this section we explore these differences to find out how process redesign may affect EC in this area.

#### 3.3.1 Physical constraints are less relevant

Gunasekaran *et al.* (2003) noticed that the life-cycle of information products differs from the life cycle of physical products and is less hampered by physical limitations (production, distribution). Levitt (1981) already observed that such intangible products are highly people-intensive.

(Turban *et al.* 2000) classify EC based on 3 dimensions: whether the product, agent and process are digital or not. They conclude that when the service industry is concerned, pure EC can be used in most cases, resulting in savings that are much larger than for most physical products. Meyer and Zack (1996) also state that intangible products have characteristics suitable for EC: not limited by physical constraints and indefinitely divisible. This corresponds to the conclusions from Wijnhoven (2002) and Loebbecke (1999).

#### 3.3.2 Difficult to value the process output (i.e. service)

From the perspective of buying, it may be difficult to value information goods, also because suppliers may be interested to conceal large portions of the good in the pretransaction stage. Wijnhoven (2002) researched this topic and proposes three alternatives: (1) search characteristics give a potential buyer some information; (2) experience characteristics give a temporary user extra information; and (3) credence characteristics enable a buyer to rely on third party judgments. This equally holds true for the (generally significant) information part of a service. Choi *et al.* (1997) and Loebbecke (1999) mention several characteristics that influence the value:

- 1. customization, which defines the transfer mode of the goods 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 goods have value;
- 3. intensity in use, which defines if a user may use the goods once or several times;
- 4. externalities, which may be positive when the value of goods increases when more people use it.

#### 3.3.3 Level of customization

Wijnhoven (2002) observed that physical goods are highly codified and usually nonasset specific to add value to customers. Information goods however, are generally less codified and require intense communication to be understood. Many information goods are asset specific, implying that these goods are of use for only a limited group. Loebbecke (1999) refers to this phenomenon as customization, Boisot (1998) and Wijnhoven (2002) as abstraction.

#### 3.3.4 Time aspects

Loebbecke (1999) mentions timeliness, which defines the time slot in which the goods have value. This especially applies to some information products, such as newspapers (yesterday's newspaper is worthless), but may also be applicable for services. For example, a mortgage offering is worthless after a competitor's offer has been accepted.

#### 3.3.5 From service characteristics to EC performance aspects

The absence, or limited impact of physical constraints in the service industry can be classified as a major enabler for BPR in the service industry. Another important characteristic of the service industry is the fact that the process output is difficult to value. Transparency of the business process is a performance aspect originating from this. Other performance criteria are the quality (Level of customization) and speed (Time aspects) of the business process. Similar to the performance aspects related to

EC-processes, this might not be a limitative listing, but these are especially important to make e-services effective and successful.

#### 3.4 Summary

Our main concern in this paper is towards the performance aspects that are identified in discussing the various characteristics, as this can be influenced by applying BPR. To a large extent, these aspects determine the success of any particular e-service. As the BPR best practices we will discuss in section 4 can be expected to improve upon one or more of these aspects, they are relevant to distinguish explicitly at this place. Summarizing from the sections 3.2 and 3.3, these are the following:

- 1. speed;
- 2. time-to-market;
- 3. availability;
- 4. cost;
- 5. transparency; and
- 6. quality.

Although this is not intended as a limitative listing, we feel that the mentioned aspects are especially important to make e-services effective and successful.

## **4 BPR best practices for e-commerce**

The BPR best practices, often also referred to as BPR heuristics, principles or rules (e.g. Klein , 1995) , that we first mentioned in the introduction of this paper will be discussed in detail in this section. Also, their applicability to EC will be demonstrated. The various practices are often derived from experience gained within large companies or by consultancy firms with repetitive application of these practices in BPR engagements. For example, the rules as proposed by Peppard and Rowland (1995) are derived from the experiences of the Toyota Company. Generally, many BPR best practices lack an adequate (quantitative) support, as noted by e.g. Aalst (2000). As a result, their application to EC cases in this section are qualitative and explorative.

#### 4.1 Selection of relevant BPR best practices

The 30 best practices as gathered and identified by Reijers (2003) can be classified using the following categories:

- task rules, which focus on optimizing single tasks within a business process;
- *routing rules*, which try to improve upon the routing structure of the business process;
- allocation rules, which involve a particular allocation of resources to activities;
- resource rules, which focus on the types and availability of resources;
- *rules for external parties*, which try to improve upon the collaboration and communication with the client and third parties; and
- *integral process rules*, that apply to the business process as a whole.

Note that this distinction is not mutually exclusive. In other words, it is to some degree arbitrary to which category a best practice is assigned.

We have selected from the 30 best practices 13 rules that are specifically promising in the context of EC. For this selection, we used the performance criteria as summarized in section 3.4. A best practice was selected as soon as one or more of these criteria is positively and significantly affected by its application. The selection process is summarized in

Table 2.

In the next subsections, we will discuss each of the 13 rules and illustrate most of them with a UML Activity Diagram.

#### 4.2 Task rules

From the four task rules collected from literature, we selected two of them: task elimination and task automation.

#### 4.2.1 Task elimination

Reducing unnecessary tasks or activities from a business process is a widely know BPR best practice (e.g. Peppard and Rowland, 1995). A common way of regarding a task as unnecessary is when it adds no value from the client's point of view. Typically,

Task rules						
	Speed	Time-to- market	Availability	Cost	Transparency	Quality
task elimination	+					
task automation			+			
Routing rules	5					
_	Speed	Time-to- market	Availability	Cost	Transparency	Quality
knock-out	+					
control relocation	+				+	+
parallelism	+					
Allocation ru	les		· · · · · · · · · · · · · · · · · · ·			
	Speed	market	Availability	Cost	Transparency	Quality
case manager					+	+
Resource rul	es					
	Speed	Time-to- market	Availability	Cost	Transparency	Quality
empower	+			·		
Rules for exte	ernal parties		<u> </u>		- <b>- -</b>	
,	Speed	Time-to- market	Availability	Cost	Transparency	Quality
outsourcing		+		+		
contact reduction	+					+
buffering	+					
trusted party				+		
case types		+				
case-based work	+					

#### Table 2: Selection of BPR best practices on the basis of e-services criteria

control tasks in a process do not do this; they are there to fix problems created or not elevated in earlier steps. Control tasks can often be found back as iterations and reconciliation tasks and are often performed by middle-management.

In an EC context, the advantage of omitting a task that requires a scarcely available resource is huge. It can make the process execution faster and delivery dates more reliable. Omitting a task may more easily outweigh the potential loss of quality than in conventional processes. This especially holds in a B2C context where clients generally are less loyal and more impulsive to look for alternatives (Srinivasan *et al.* 2002). Achieving market dominance and economies of scale may then be key elements in the business process, although this will occasionally lead to less-than optimal results.

An example task elimination from a process that brings out mortgage offers is shown in Figure 2.



Figure 2: Task elimination

In this specific example, the commercial check on prepared mortgage offerings is eliminated from the original process. When we consider that it is a common banking management practice to collect a large number of mortgages first before checking and signing them all, we may expect a considerable reduction of lead time by this measure. Note that the obvious drawback of this effect is a drop in commercial quality of the offerings. A commercial training of the clerk or occasional spot-checks may reduce this risk.

#### 4.2.2 Task automation

In many BPR projects, automating tasks is pursued to the effect that tasks can be executed faster, with less cost, and with a higher quality. In the context of EC, a paramount advantage of an automated part of a process is that it is available to be executed 24 hours a day & 7 days a week against relatively low cost.

Consider the example in Figure 3, where the original situation shows the part of the process that is executed once a client requests a life insurance. As a standard

procedure, a medical exam of the applicant must take place. The date for this exam is chosen, which is dominantly determined by the available capacity of the regional hospital that is involved. In the current process, the insurance officer makes an inquiry into the available data and selects one to schedule.



Figure 3: Task automation

Now suppose that the hospital gives the insurance company limited access to its own planning system. An automatic query could then take place to find the first available date within this system, which could be subsequently booked.

Although the best practice is widely known (e.g. Peppard and Rowland , 1995), the possibilities of automating tasks against reasonable cost for actual processes are often underestimated. In a recent BPR project conducted for a social security office (Reijers , 2003), on average 75% of all operations performed by human operators could be automated. As a result, over 10% of all requests for unemployment claims required no human attention anymore. Only tasks that could not be explicitly defined and/or required an ethical judgment still required human involvement.

In the context of EC, an automatically produced *preliminary* task result that precedes a definitive outcome may also be of value. Customers, for instance, that request a personalized repair advice in an after-hours situation may be offered a standard list of solutions, accompanied with the promise of a specific answer at the start of the new business day.

#### 4.3 Routing rules

There are five routing rules, of which three seem to be of special interest in an EC context: the knock-out, control relocation, and parallelism.

#### 4.3.1 Knock-out

Many processes within the service industry involve various subsequent checks, socalled *knock-outs*. If a knock-out is not satisfied, this puts a stop to the entire processing of this case (Aalst , 2000). In an EC situation for services there are two scenarios that might trigger a reconsideration of the ordering of these knock-outs. In a highly competitive B2C environment, it may be wise to first perform the knock-outs that have the highest probability of stopping the process. In this way, clients are informed as soon as possible about the outcome of the process. In a high-volume B2B situation, cost-effectiveness may be of such importance that knock-outs are ordered in a decreasing order of effort *and* in an increasing order of termination probability. In other words, the knock-out that has the most favorable ratio of expected knock-out probability versus the expected effort to check the condition should be pursued. Doing this will on average lead to the least costly process execution and the shortest lead time of a sequential process (Aalst, 2000).

Consider the example in Figure 4 of a process that handles applications for loans. In the initial situation, three knock-outs can be distinguished: a check whether the applicant appears on a "black list", a check whether the applicant is creditworthy, and a check whether the goal of the loan is in accordance with the issuing bank's policy. On closer examination of the actual process execution, it may appear that the goal of the loan is usually the "show-stopper", while the occurrence of an applicant on a black list rarely occurs. Because both checks roughly take the same amount of time, it is more efficient to exchange these checks in the redesign to minimize average processing time.



Figure 4: Knock-outs

#### 4.3.2 Control relocation

In some cases, it is possible to relocate controls towards other parties. Klein (1995) gives the example of Pacific Bell that entirely moved its billing controls towards its clients. This eliminated the bulk of billing errors, which also improved client satisfaction. This specific example shows that the control relocation could take on the form of the outsourcing best practice, which will be discussed in Section 4.6.1.

Especially when doing EC, it is possible to incorporate all kinds of intelligent checks within the forms that are used in exchanging information between parties. This particular appearance of the best practice is closely related to the standardizing effects of EDI and XML in electronic communication. It is therefore closely related to the task automation best practice (see Section 4.2.2).

In Figure 5 the example is shown of a tax declaration process. In the initial situation, the tax official performs a cross check on the various figures to see if they match. If

not, a new form is sent back to the tax payer and the process restarts. In the redesign, tax payers are given a tool with which they can perform the cross check themselves.



Figure 5: Control relocation

Another approach is to provide a client the equivalent of a check, which can be used to *estimate* the outcome of a real service request. For example, a financial provider may supply an application that clients can use to determine whether the intended mortgage amount is realistic given their financial situation.

The main advantage of the control relocation best practice is that the process is not disrupted by repetitive requests for correct information, which has a negative effect on lead times and costs. Also, parties may get some up-front insight into the outcome of the process, which is a transparency aspect. Finally, the outsourcing party will reduce operational cost.

#### 4.3.3 Parallelism

Any e-service process will almost inevitably involve considerable information processing. As technology to distribute and share information have become widely accepted (e.g. databases, groupware systems, e-mail), possibilities to introduce more concurrency within a business process increase. After all, information may be made available to different parties at the same time instead of having one party waiting for the other to complete his update on the single (paper) file. The most important effect of applying this best practice is that the lead time may be drastically reduced, a major benefit in the perspective of EC. Clearly, only tasks that do not depend on each other are candidates to be put in parallel.

In Figure 6, a part of the process is shown of handling damage claims by an insurance company. For each claim, a legal clerk has to establish whether the damage is covered by the policy and, if so, for what amount. Also, the financial administration has to check whether premiums have been paid and whether this was done on time. On the

basis of the information they provide, an acceptor makes the final decision on repaying the damage. In the redesign, the work of the legal and financial clerks are put in parallel. Both clerks are provided with a digital copy of the claim and a reference to the claimant.



Figure 6: Parallelism

Note that the availability of technology in itself is not sufficient for achieving the gains of parallelism. In a survey by Eindhoven University of Technology and Deloitte & Touche that is still underway, service processes of ten Dutch companies have been investigated, see for example (Degens , 2002) or (Veld , 2002). Although the companies were selected in the survey because of the adoption of a Document Management System, none of their processes were restructured such that some degree of parallelism was achieved. In other words, the new processes were just as sequential as the original ones. This once more emphasizes how process transformation is different from introducing new technology and requires special attention the delivery of e-services is pursued.

#### 4.4 Allocation rules

Out of six allocation rules found in literature, we discuss one in particular that is especially promising in relation to EC: the case manager.

#### 4.4.1 Case manager

Appointing a case manager within a process means that one person becomes responsible for the handling of a specific case. The case manager is responsible for the case, but he or she is not necessarily the (only) resource that will work on tasks for this case. The most important aim of this best practice is to improve upon the external quality of the process. The process will become more transparent from the viewpoint of a party that interacts with it, as the case manager provides a single point of contact. It may also have a positive effect on the internal quality of the process, as someone is accountable for correcting mistakes.

In Figure 7 we have represented a customer care process. However, in the initial situation both a clerk from the service department and a clerk from the customer care

department may interact with a client about the same complaint. After the application of the case manager best practice, all information for the client is communicated by the case manager. This is the case even when the clerk from the service department requires further information from the client.



Figure 7: Case manager

It is interesting to relate this best practice to a known characteristic of EC, and of the introduction of computers in general: A form of alienation will take place between the people representing the various parties (Sheridan *et al.* 1983). Several attempts are made to counter these effects, for example by automatic personalization of the interactions (Rowley and Slack , 2001). However, if the handling of a case really goes astray, then the best approach from a quality perspective is to devote human care to such a case in order not to aggravate the situation. Appointing a case manager may still be cost-effective if the ratio of care-taking cases remains low.

Note that a variation of this best practice is the appointment of an account manager, who is responsible for all cases that involve a specific *party*.

#### 4.5 Resource rules

Out of the four resource rules known from literature, we selected one that is of particular interest with respect to EC: the empower rule.

#### 4.5.1 Empower

In traditional service processes, substantial time may be spent on authorizing work that has been done by others. If workers or subcontractors are empowered to take decisions independently, this may result in smoother operations with shorter lead times. The reduction of middle management from the process also reduces the labor cost spent on the processing of cases. A drawback may be that the quality of the decisions is lower and that obvious errors are no longer found. Especially in EC situations that span an entire (complex) supply chain, autonomy of individual parties on shared issues could save much communication overhead. To show an example of the empower rule, we have re-used the initial situation of the mortgage process in illustrating the task-elimination best practice (see Section 0).



Figure 8: Empower

In contrast to the application of the task-elimination best practice, the commercial check on the mortgage offering is not skipped, but assigned to another clerk. This best practice is known as 'separation of duties' in the financial and administrative world. As it would be ineffective to have an offer checked by the same person, moving this task to a colleague instead of a manager will speed up the process – managers are scarce - and decrease cost – managers are expensive.

#### 4.6 Rules for external parties

This class of BPR best practices is compiled of six rules of which we have selected four: outsourcing, contact reduction, buffering, and trusted party.

#### 4.6.1 Outsourcing

In traditional BPR, it is already understood that other parties may be more efficient in performing the same work, and therefore they might as well perform it (Klein, 1995; Poyssick and Hannaford, 1996). The primary aim of outsourcing work is that it will generate less cost. In an EC situation, however, there may be an added bonus. It can be attractive to look for parties that already have electronic versions of some part of the business process up and running, as this may shorten one's own time-to-market of a new e-service. An example of a financial service provider is Experian, delivering on-line credit scores. As a result of this best practice, a re-evaluation of the partners that are already involved in delivering parts of the process could also take place. Perhaps there are alternatives that deliver services that better fit the profile of EC.

An example of this best practice is represented in Figure 9. As part of the services a private banker provides to major clients, he issues a yearly, arranged annuity in their name. As a final step in this process, he or she has to acquire the securities that fit the

investment strategy of their deposit. In the alternative scenario, this latter step is outsourced to a specialized company providing this kind of back-office work.



Figure 9: Outsourcing

#### 4.6.2 Contact reduction

Many traditional processes involve several contacts with customers, suppliers, and third parties. Such information exchanges are always time-consuming. Especially when information exchanges take place by regular mail, substantial wait times may be involved. Each contact also introduces the possibility of introducing an error. Hammer and Champy (1993) describe a case where the multitude of bills, invoices, and receipts creates a heavy reconciliation burden. Reducing the number of contacts may therefore decrease lead time and boost quality.

If it is not possible to skip certain information exchanges, it may be attractive in an EC situation to *combine* them with limited extra cost (in terms of additional effort compared to potential loss of information). So, for example, instead of contacting a client again after the first checks have proved to be adequate to understand the details of his request, this information should be gathered together at the start of the process execution. Obviously, a client may in such a situation provide too much information, but the process can proceed under all circumstances. In Figure 10, we have illustrated the contact-reduction best practice.

#### Jansen-Vullers



Figure 10: Contact reduction

In this example, repetitive communication between a general practitioner and an psychiatrist take place through an office clerk. Depending on the symptoms, the psychiatrist decides whether he or she requires the parts of the medical file from the general practitioner on the mental state of the patient. This information, however, could also be requested directly when the general practitioner is contacted first. Note that we abstract here from difficulties that may arise from privacy issues.

#### 4.6.3 Buffering

Instead of requesting full information of a particular case from an external source, it is also possible to buffer it by subscribing to updates. The social security agency we mentioned before in this section is subscribing to all contracts that regional employment agencies issue. In case of an unemployment benefits claim by a temp worker, a large part of the relevant information is already available. In the financial services there are companies continuously collecting information on financial behavior of consumers, which they can provide to any bank at request.

Clearly, a buffering solution may involve considerable cost and storage capacity, but this may be well worth the increased speed of delivering an e-service.

#### 4.6.4 Trusted party

Instead of determining information oneself, it is possible to use the results of a trusted party. Some decisions or assessments that are made within a process are not specific for the process they are part of. Other parties may have determined the same information in another context, which – if it were known – could replace the decision or assessment part of the process. An example is shown in Figure 11. If a student applies for a study grant at the Dutch Ministry of Education, a civil servant checks whether the student is enrolled in a registered study, whether the financial situation of the student requires a grant, and whether the academic qualifications of the student are sufficient. Then a decision is made. Now let us suppose that universities provide grant recommendations for students. These recommendations could be used by the Ministry of Education instead of the enrollment and qualifications check. Obviously, this requires an authenticity check on the recommendation.



Figure 11: Trusted party

Clearly, the trusted-party best practice reduces costs and may even cut back lead time. On the other hand, the quality of the process becomes dependent upon the quality of some other party's work. Some coordination effort with trusted parties is also likely to be required.

Note that this best practice differs from the outsourcing best practice. When outsourcing, a work item is executed at *run time* by another party. The trusted party best practice allows for the use of a result in the recent *past*. It is different from the buffering best practice, because the process owner is *not* the one obtaining the information.

#### 4.7 Integral process rules

From the last class of best practices we discuss the case types and case-based work.

#### 4.7.1 Case types

The *case types* best practice can be formulated as follows: determine whether tasks are related to the same type of case and, if necessary, distinguish separate processes and case types (Hammer and Champy , 1993; Rupp and Russell , 1994; Peppard and Rowland , 1995; Berg and Pottjewijd , 1997). A real-life problem in transforming a business process into delivering e-services is that many subtle differences exist between individual cases. As a result, various alternative routings through a process must be supported. Incorporating all these paths in one uniform e-process may be extremely hard, though desirable from a maintenance point of view.

As a rule of thumb it can be stated that 80% or more of all cases follow the same routing, while the remaining 20% is responsible for the many variations on this routing. In an attempt to shorten the time-to-market of a new e-service, it could be attractive to focus on this majority of similar cases first. Cases that do not fit within the standard process must – for the time being – follow the conventional (non-EC) route. This may result in more coordination problems between the e-process and the conventional process and less possibilities for rearranging the process as a whole.

This is a flexibility issue. (Note the similarity of focusing on the common case with the task automation best practice.)

#### 4.7.2 Case-based work

Many service processes are essentially case-based and make-to-order (Reijers , 2003), although the actual implementation of the process may possess several features that are on bad-terms with these concepts. The most notable examples are the piling up of work items in batches and periodic activities, depending on computer systems which are only available for processing at specific times. Getting rid of these constraints may significantly speed up the handling of cases. Especially, in EC the delays that are caused by these constraints may interfere with competitiveness and customer satisfaction. On the other hand, efficiencies of scale can be reached by batch processing. The cost of making information systems permanently available may be costly also.

An example of the application of this best practice is shown in Figure 12. It is the case of a general practitioner who remits a patient to the hospital for an operation. The condition '[weekly staff meeting]' indicates that operation assignments are made only once each week at the joint staff meeting. However, if we suppose that the head of staff has perfect information on the availability of all resources – e.g. by means of an information system – this person could assign new patients to an operation team and room as soon as they are registered. This is represented by the right part of the figure.



Figure 12: Case-based work

#### 5 Conclusion

We have argued that the success of EC within the service industry can be positively affected by the sensible application of BPR. On the basis of essential performance criteria for EC, which were identified in this paper, the most promising BPR best practices have been discussed and illustrated. The best practices themselves result from an earlier literature survey.

This paper contributes to a broader awareness of the business process that is the context of any EC effort. In the end, it is the performance of the entire process that will determine the effectivity and success of EC. The extra effort to reconsider the process that is the subject of EC is presumably well worth this effort. Especially in the setting of service delivery, there is often considerable freedom in rearranging the process structure because of the lack of physical constraints. Neglecting the BPR knowledge accumulated over the past decade is really a missed opportunity for electronic commerce, and especially for e-services.

A quantitative assessment of the impact of the various BPR best practices would be a valuable extension of the presented research. The first challenge would be to make the relevant performance criteria operational and to distinguish the relevant factors that determine them, after which proper models must be developed to predict and explain the impact. Formal models as developed by Aalst (2000) and Seidmann and Sundararajan (1997) could serve as an inspiration for this research direction. An alternative to these formal analytical models would be to investigate the application of simulation techniques instead of general models. A real EC test case would be needed to validate such an approach.

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