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# MEETING THE NEED FOR
# FLEXIBILITY IN BUSINESS PROCESSES

# TIIVISTELMÄ

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Nykyaikaisessa liiketoimintaympäristössä organisaatioiden tulee olla joustavia. Joustavuuden tarve ilmenee monella tavalla – organisaatioiden tulee pystyä sopeuttamaan sekä toimintansa luonnetta että toimintatapojaan, sekä tilapäisesti että pysyvästi, sekä ennakoitavissa että ennakoimattomissa tilanteissa. Liiketoimintaprosessisuuntautuneisuus ja Business Process Management (BPM) ovat viime aikoina olleet merkittäviä paradigmoja organisaatioiden johtamisessa ja saaneet tunnustusta keinoina parantaa organisaatioiden suorituskykyä. On kuitenkin epäselvyyttä siitä, kuinka yhteensopivia perinteiset BPM-metodit ovat joustavuuden vaatimusten kanssa. Tällä eksploratiivisella kirjallisuuskatsauksella on kaksi tavoitetta. Ensimmäiseksi tutkimuksessa perehdytään liiketoimintaprosessien ja -ympäristöjen ominaispiirteiden moninaisuuteen erityisesti joustavuuden tarpeen näkökulmasta. Toiseksi perehdytään joustavuuden problematiikkaan johtamisen eri tasoilla (strategisella, rakenteellisella ja operatiivisella tasolla). Tutkimuksen johtopäätöksenä joustavuuden tarpeen todetaan olevan yksi tekijöistä erityyppisten liiketoimintaprosessien johtamisen lähestymistapoja valittaessa. Lisäksi tutkimus esittelee joitakin BPM-konsepteja, joiden avulla liiketoimintaprosessien joustavuutta johtamisen eri tasoilla on mahdollista tukea.

Asiasanat: liiketoimintaprosessi, liiketoimintaprosessisuuntautuneisuus, Business Process Management, joustavuus, mukautuvuus

# ABSTRACT

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In a modern business environment, organisations are facing the need to be flexible. The requirement for flexibility appears in many forms – organisations need to adapt both what they do and how they do it, both temporarily and permanently, in both foreseeable and unforeseeable circumstances. Business process orientation and business process management (BPM) have recently been some of the core paradigms within organisational management, and have gained recognition as ways of improving the organisational performance. However, it has been unclear how well the traditional BPM methods comply with the requirements of flexibility. This exploratory literature review has two goals. First, it investigates the diversity of business process and business environment characteristics, specifically in terms of the need for flexibility. Second, flexibility related issues relevant to the different levels of management (strategic, structural and operational level) are investigated. The study concludes that the need for flexibility has to be a factor in the selection of managerial approaches for the different types of business processes. Further, some of the BPM concepts available for facilitating process flexibility at different levels of management are introduced.

Keywords: business process, business process orientation, Business Process Management, flexibility, adaptivity, adaptability

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# 1 INTRODUCTION

Modern organisations, both in private and public sectors, are facing a highly competitive and a rapidly changing business environment. While the traditional strategies of competitive advantage, such as cost leadership, differentiation and focus (Porter, 1985) are still valid for today's organisations, the dynamic nature of the environment also raises completely new kinds of challenges for business management. Developing capabilities enabling the organisation to respond and adapt to the changing requirements as efficiently as possible can become almost as essential a factor in the organisation's success as optimization of performance or selection of market position. (Reeves & Deimler, 2011.)

The growing significance of knowledge is one of the factors shaping the post-industrial business environment. According to some studies, knowledge work has gained a substantial position among the workforce in western countries (e.g. Brinkley et al., 2009). The trend is also manifested by the growing market share of service industry and especially so-called knowledge-intensive services, often characterised by their intangible nature and the significance of knowledge as a value-creating asset (Miles, 2008). Some of the core characteristics of a knowledge-intensive environment is the low predictability and high situational adaptivity of work, driving the need to rethink the way knowledge work and knowledge workers should be managed (Davenport, 2005a).

Business process orientation, having roots in several disciplines of management, has emerged during the last couple of decades as one of the main paradigms in structuring and managing the operations of an organisation. Common to these disciplines is focusing on the organisation's value-adding business processes instead of organisational hierarchies. In a process-oriented organisation, all activities can be considered a part of some process and management focus is placed on these processes and end-to-end value chains instead of individual functional entities. (McComarck, 2001.) Business Process Management (BPM), on the other hand, can be described as an umbrella term for the practice of development, implementation, execution, control and continuous improvement of an organisation's business processes (e.g. Weske, 2010).

Several scholars have so far reported empirical evidence on the positive effects of business process orientation and the implementation of BPM on the overall performance of the organisation (e.g. McCormack, 2001; Bosilj-Vukšic et al., 2008; Kohlbacher, 2010; Kohlbacher & Reijers, 2013). However, although the significance of BPM seems indisputable, some studies (e.g. Davenport, 2010) have argued that traditional BPM approaches, often originating from industrial traditions, don't necessary provide adequate support for the requirements of adaptive processes typical to knowledge work. The challenge that management faces is that the organisations needs ways to deal with flexibility on several levels of management. Flexibility is needed in both *what* the organisation does and *how* it does it, organisations need to facilitate both temporary (adapting process instances to a situation at hand) and permanent (adapting process models to a changing environment) changes in their processes as well as respond to both foreseeable and unforeseeable circumstances.

The focus of this exploratory study is on understanding the diversity of business process characteristics in terms of the need for flexibility, independently of process types or industries, as well as exploring the current state of research in the area of facilitating the need for process flexibility on different levels of management: strategic, structural and operational levels. Another goal of the study is to contribute to a synthesis of flexibility related concepts proposed by the fields of business process, service and information technology research. The results of the study should provide theoretical insights and, consequently, practical implications on management of different types of processes in terms of flexibility and the ways an appropriate level of flexibility can be enabled in organisation's processes. Additionally, possibilities for further research are proposed.

The purpose of this section is to provide the study setting along with a motivation. The rest of the section is structured as follows:

- In 1.1, main concepts related to the study are introduced.
- In 1.2 and 1.3 respectively, the research problem and the research method are introduced.

## 1.1 Key concepts related to the study

This sub-section introduces some key concepts related to the area of study. Brief definitions are provided based on prior literature. Additionally, implications of each concept in terms of the study setting are justified.

### 1.1.1 Business process

There are several definitions for a *business process* available in the literature. Perhaps one of the most traditional ones is offered by Davenport (1993), who defines a business process as follows:

> "[A business process is] a structured, measured set of activities designed to produce a specific output for a particular customer or market. It implies a strong emphasis on how work is done within an organization --. A process is thus a specific ordering of work activities across time and space, with a beginning and an end, and clearly defined inputs and outputs: a structure for action."

Champy & Hammer (1993) define a business process in a more open-ended way, focusing not as much on the specific ordering of process activities, but specifically on the process' purpose of creating value for a customer, either internal or external one. Their more goal-oriented, "black box" definition can be seen as more suitable for processes with less structure and more inherent flexibility:

> "[A business process is] a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer."

Several classifications of business processes have been proposed based on their diverse nature, such as the traditional categorization of processes to core, support and management processes (Porter, 1985). Additional definitions have been later provided addressing some of the specific aspects of business processes, such as their organisational and technological context (e.g. Weske, 2010). Several industries have also created their own commercial, industry-specific process frameworks and classifications.

For the purposes of this study, the definitions by Davenport (1993) and Champy & Hammer (1993) will be applied, being generic enough to describe any goal-oriented activity within an organisation. Because we are interested in the characteristics of processes driving the need for flexibility rather than flexibility aspects in a specific field, the scope of investigation will not be initially limited to any specific type of process or industry.

### 1.1.2 Business process orientation

*Business process orientation* has emerged during the last couple of decades as one of the core paradigms in business management and a way of dealing with the requirements of a dynamic business environment. Above all, becoming a process-oriented organisation has been seen as a cultural shift towards a process and a customer centric way of thinking in contrast to the traditional organisation managed by functions and hierarchies. (McCormack, 2001.)

A process-oriented organisation has a process focus in every aspect of organisational management, such as the organisational structure and culture, performance measurement, people management, IT and supplier management. This requires establishing a process view as a basis for all management activities. (McCormack, 2001; van den Bergh et al., 2007.) One of the early and most generic definitions of business process orientation is provided by Johnson & McCormack (2001). They define business process orientation as:

> "-- the level at which an organization pays attention to its relevant (core) processes."

There has been extensive empirical work done on the effects of business process orientation on the performance of the organisation. The work of McCormack (2001) suggests that organisations with higher process orientation achieve better business performance. Some of the reported performance improvements include reduced process cycle time and costs, revenue costs as well as improved quality and customer experience (Kohlbacher, 2010). Similarly, the empirical evidence provided by Bosilj-Vukšic et al. (2008) as well as Kohlbacher & Reijers (2013) shows positive effects of business process orientation on both financial and non-financial measures.

Based on the evidence provided above, business process orientation has the potential to help management achieve better results by shifting the focus to the organisation's value-adding processes. Having reached a significant position as a managerial paradigm, business process orientation is considered one of the key concepts in the scope of this study. An interesting question is, however, whether business process oriented approaches are suitable as-is within environments with a high inherent degree of flexibility compared to the traditional industrial settings in which business process orientation first originated.

### 1.1.3 Business Process Management

In the previous sub-section, the concepts of business process and business process orientation as a management paradigm were discussed. *Business Process Management* (*BPM*) can be considered an umbrella term for holistic practices and tools related to the management and improvement of the organisation's business processes. BPM has emerged mainly in late 1990s, having roots in several managerial trends such as Total Quality Management, Workflow Management and Business Process Re-engineering (Harmon, 2015). A compact and comprehensive definition for Business Process Management is attempted by Weske (2010):

> "Business process management includes concepts, methods, and techniques to support the design, administration, configuration, enactment, and analysis of business processes."

A distinctive element of BPM is the business process lifecycle model encompassing some of the typical activities within the BPM discipline. According to the literature review performed by Dallavalle de Pádua et al. (2014), most of the definitions provided for the BPM lifecycle process include the following elements:

- *Strategy and planning* includes aligning the BPM actions with the overall strategy of the organisation and defining the necessary BPM activities. Often closely related to *governance*, which includes the management the overall BPM lifecycle process.
- *Analysis* includes the investigation of the current state processes and the improvement possibilities within them.

- *Design* includes designing the improved or new target business process specifications based on goals of the process and the expertise available, producing an implementable process model.
- *Implementation* includes the practical implementation of the designed process model, for example in terms organisational and IT support.
- *Enactment* includes the instance level execution of the implemented process models in practice, for example by employees or automation.
- *Monitoring and evaluation* includes continuous data collection in process execution for process control and further improvement analysis.

In their extensive collection of state of the art articles on BPM, vom Brocke & Rosemann (2015) attempt to provide a view of BPM as a *"comprehensive consolidation of disciplines sharing the belief that a process-centered approach leads to substantial improvements in both performance and compliance of a system"*. Further, the authors propose the core elements of BPM: *strategic alignment*, *governance*, *methods*, *information technology*, *people* and *culture*. Compared to the business process oriented paradigm itself, BPM takes a more practical approach providing a framework for process-oriented management.

BPM can potentially provide an organisation with tools for more effective management of its business processes, which makes it interesting in the scope of this study. However, in recent literature, observations are being made that the modern knowledge-intensive work environment might set new kinds of requirements for BPM. Traditional engineering-based approaches such as workflow management are especially considered incompatible with the dynamic nature of knowledge work and the inherent requirement for flexibility. New approaches are needed to better support these requirements. (Davenport, 2010.)

### 1.1.4 Organisational flexibility

Flexibility is suggested to be a strategic option taken by an organisation in order to handle environmental changes (Volberda, 1997). On a general level, *organisational flexibility* can be defined as the "capability to adapt" (Golden & Powell, 2000). The term "flexibility" itself is widely seen used in different business contexts and is considered to be an important or even an essential capability of a modern organisation. However, research also admits the multi-dimensional, ambiguous nature of the term. (Golden & Powell, 2000.) When discussing flexibility in more detail, it's important to distinguish between the different aspects of flexibility in order to avoid ambiguity. Some of the studies on the typology of organisational flexibility include:

- Volberda (1997) suggests that there are three types of organisational flexibility: *operational* (related to the organisation's routines), *structural* (related to the organisation's structures) and *strategical* (related to the goals of the

organisation). Additionally, each type of flexibility can be considered *internal* (responsive to an environmental change) or *external* (influencing an environmental change).

- Golden & Powell (2000) suggest that there are four dimensions of flexibility: *temporal* (whether the timeframe of the change is short-term, mid-term or long-term), *range* (whether the change is foreseeable or unforeseeable), *intention* (whether the change is offensive or defensive) and *focus* (whether the change is internal to the organisation or targets external stakeholders).

According to Volberda (1997), the organisations face two basic challenges: the challenge of designing an organisation to support flexibility and the creation of an appropriate "flexibility mix" for each specific organisational setting. Additionally, there are four forms identified in terms of the ways of handling environmental turbulence using organisational flexibility: *the rigid* (low flexibility, low controllability), *the planned* (low flexibility, higher controllability), *the flexible* (high flexibility, high controllability) and *the chaotic* (high flexibility, but no controllability) organisation types.

In this study, we are particularly interested in flexibility from the business process point of view, namely the ways in which organisational flexibility can be better achieved on various levels of management by taking advantage of a process-oriented approach and BPM principles. Based on the typology provided by Volberda (1997), it can be argued that there are process related issues that need to be considered on multiple levels of management, namely strategic, structural and operational levels. Based on Golden & Powell (2000), we can argue that process flexibility needs to facilitate organisational flexibility both short-term and long-term, both in foreseeable and unforeseeable situations, both proactively and reactively and with both internal and external organisational focus.

Although often associated to the field of software development in particular, *agility* is another flexibility-related term used in the literature. For example, Gunasekaran (1999) defines agile in the context of manufacturing as "the capability of surviving and prospering in a competitive environment of continuous and unpredictable change by reacting quickly and effectively to changing markets, driven by customer-designed products and services". On the other hand, Conboy & Fitzgerald (2004) propose flexibility as only a subset of agility. For the purpose of this study, we won't differentiate between the two terms.

### 1.1.5 Other related concepts

The previous sub-sections introduced some of the key concepts and the underlying theories behind the study. Additionally, the following sub-sections briefly introduce some of the additional concepts related to the area of study. Defining these concepts is needed in order to avoid ambiguity.

**Service and service orientation**

Although the significance of services in the modern society is indisputable, the use of the term "service" in the academic literature is heterogeneous and often vague due to the several different viewpoints available to service research. After studying the ways the term is portrayed in the literature, Edvardsson et al. (2005) identify several common characteristics for services, such as *intangibility*, *heterogeneity*, *perishability* and *inseparability of production*. In their attempt for a generic way of portraying a service, the authors focus on a service as a means of value creation from the viewpoint of its customer. Some particular views on service research include, additionally:

- *Service industry*, providing *services* to external customers (as opposed to the manufacturing industry providing physical products), has grown to become the dominant sector in the economies of the developed world and increasingly so also in the developing economies. Services have since been the target of research in multiple different disciplines of academic business research. (Maglio & Spohrer, 2008.)
- *Service orientation* as an architectural paradigm has emerged originating in the field of IT system architecture (*service-oriented architecture*), but expanding to include the business architecture as well (*service-oriented enterprise*). The idea behind service orientation is typically to achieve better flexibility through the componentization of business capabilities as autonomous *service components* that can be provided as services to external or internal customers. (Cherbakov et al., 2005.)

What makes services interesting from the point of view of this study is the process-like nature of services, as noted by Edvardsson et al. (2006). The definitions of a service and a business process indeed contain many similarities, such as the goal of providing added value to their customers through a series of activities. Especially in the context of service oriented enterprise architectures, the notion of a service component and an internal business process seem to be strongly interrelated, if not equated (Cherbakov et al., 2005). However, service flexibility has been studied separately from process flexibility. For this reason, we consider it useful to expand the investigation of flexibility to the context of service research, keeping in mind the various meanings of the term "service".

**Knowledge work (or knowledge-intensive work)**

The growth of the knowledge industry seems to be a major trend in the modern economy, along with the growth of the service business compared to manufacturing. According to a study done in UK, about 30 percent of the workforce represented so-called core knowledge workers, 30 percent faced knowledge-intensive tasks on a regular basis, while 40 percent performed mainly non-knowledge-related structured work. The changing nature of work has generated a research

interest for so-called *knowledge work*, *knowledge-intensive work* or *knowledge-intensive services*. (Miles, 2008; Brinkley et al, 2009.)

Brinkley et al. (2009) attempt to provide a definition for knowledge work, identifying the main characteristics being the cognitive complexity of tasks and the significance of the tasks including the use of tacit knowledge as opposed to more structured tasks that require mainly codified knowledge. Similarly Davenport (2005a) attributes knowledge work primarily to the process of creation, repackaging, distribution and application of knowledge, typically happening in an unstructured and unpredicted manner. In both cases, knowledge work highlights the role of the worker's expertise within the process.

The rise of knowledge-intensive work and knowledge-intensive services requires attention in terms of managing the underlying processes and forces managers to rethink the ways in which these types of processes can be supported by BPM tools and practices. Business processes dependent on knowledge, so-called *knowledge-intensive processes*, seem to require different BPM approaches by nature compared to traditional processes, as discussed for example by Davenport (2010) and Kemsley (2011). These types of processes and process environments seem to play a major role driving the need for process flexibility. A lot of the research available on process flexibility has been done specifically from the perspective of knowledge-intensive processes.

## 1.2   Research problem

After having defined some of the key concepts relevant to the study, we can conclude that flexibility, or the capability to adapt, is one of the requirements an organisation faces in the current dynamic environment. This is further highlighted by the growing share of knowledge work typically characterised by its unpredictable and unstructured nature. Adapting the typologies of Volberda (1997) and Golden & Powell (2000), organisations need ways to deal with flexibility issues on several levels of management: strategic, structural and operational levels. In other words, organisations need to be flexible in both *what* they do and *how* they do it, flexible enough to facilitate both temporary (adapting process instances to a situation at hand) and permanent (adapting process models to a changing environment) changes in their processes and be able to respond in both foreseeable and unforeseeable circumstances.

Although business process orientation and BPM have proven to be successful approaches in improving the organisational performance, it can be argued that the nature of the business environment and business processes may be a factor in the selection of appropriate BPM tools and approaches for each organisational setting. Understanding the heterogeneous nature of business processes and business environments in terms of the need of flexibility involved can be the key to the selection of appropriate managerial approaches. Additionally, organisations need to be aware of the BPM concepts available in order to facilitate flexibility on different levels of management.

Therefore, the research questions for this study are:

- How do business processes differ by nature in terms of the need for flexibility and what generic processes flexibility types can be identified?
- What are some of the managerial issues related to flexibility on different levels of management and what are some of the BPM concepts available in facilitation of flexibility on each level?

## 1.3   Research method

The study was performed using an exploratory literature review in order to investigate the current state of research relevant to the research question and attempt to form a synthesis as a basis for further research. The following describes the review process used (adapted from Kumar, 2011).

### 1.3.1 Search

The literature was initially searched for using the Google Scholar database. The search terms used contained the combinations of the notion of a "process" or a "service" following by a notion related to "typology" and "flexibiliy" (table 1) in singular and plural forms. First, literature related to process typologies was investigated on a general level to acquire an understanding about process diversity. Next, literature related specifically to the flexibility aspect in processes was investigated. Finally, based on the insight extracted from these searches, some of the key concepts related to facilitating flexibility in the context of processes or services were further investigated.

TABLE 1 Search terms

| Point of view | Search terms |
|---|---|
| Process typology | - ("process" OR "service") AND ("typology" OR "type" or "taxonomy" OR "classification" OR "categorization" OR "categorisation") |
| Process flexibility | - ("process" OR "service") AND ("flexibility" OR "adaptivity" OR "adaptability" OR "agility")<br>- ("flexible" OR "adaptive" OR "agile" OR "unstructured" OR "ad-hoc" OR "knowledge-intensive") AND ("process" OR "service") |

## 1.3.2 Review

The search results were initially filtered based on a quick analysis of the title, the abstract and the keyword information. Further, the relevance of the literature in terms of the focus of the study was evaluated based on the defined criteria (table 2). The selected articles were further investigated in full and additional literature was extracted from references. The process was repeated until the sample was considered subjectively saturated.

TABLE 2 Inclusion and exclusion criteria

| Criteria | Principles |
|---|---|
| Inclusion criteria | • Literature relevant to business or service process research from managerial, commercial or information system perspective<br>• Literature relevant particularly to the flexibility aspect of business or service processes<br>• Literature after the year 2000 prioritised<br>• Literature with the most references prioritised |
| Exclusion criteria | • Literature focusing on other than process related flexibility, such as product or manufacturing flexibility<br>• Literature focusing exclusively on technical aspects, such as the design of process support systems<br>• Literature with no electronic version available |

## 1.3.3 Theoretical framework

A comprehensive overview of business process literature by Isik & Sidorova (2010) demonstrates the variety of traditions and elements of research in the area of business processes. The authors identify four elements of core business process research: *business process design*, *organisational implementation*, *IT* and *on-going management and control*. Further, several areas of associated research are identified in addition to the core research areas. The main interest within this study falls within the area of core business process research, in particular.

Several distinctive categories of literature were additionally identified based on the research field and tradition of publications. An assumption was made that there are, however, significant similarities in the flexibility related concepts studied within different disciplines. The following categories of literature were identified:

- Literature in the field of *business process research*. The background of these articles is typically in the field of Business Process Management (or one of its ancestor fields), Operations Management or similar practices, focusing on the management of business processes. When dealing with flexibility according to the typology by Volberda (1997), the focus of this research often seems to be on operational or structural, internal flexibility.

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- Literature in the field of *service research*. These articles typically have a commercial viewpoint, focusing on issues such as service strategy, service proposition and customer interfaces. When dealing with flexibility according to the typology by Volberda (1997), the focus seems to be on strategical, external flexibility, however some of the research focuses specifically on the operational process aspect of services.
- Literature in the field of *information technology research*. The focus of these articles is typically on the technology, system or tool support for business or service process management and enactment. In terms of flexibility according to the typology by Volberda (1997), the focus is mainly on structural, internal flexibility.

### 1.3.4 Conceptual framework

The study builds on the idea that we need to understand the nature of different types of processes and services in order to be able to select an appropriate approaches of facilitating flexibility in organisation's business processes. The study combines research from several fields of study in order to answer the research questions (figure 1). The remaining of the paper is structured as follows:

- Section 2 answers the research question 1. Based on the literature, it attempts to provide a synthesis of a business process typology based on the flexibility aspect.
- Section 3 answers the research question 2. Based on the literature, it attempts to provide a review of managerial issues and concepts available in facilitating business process flexibility on different levels of management.
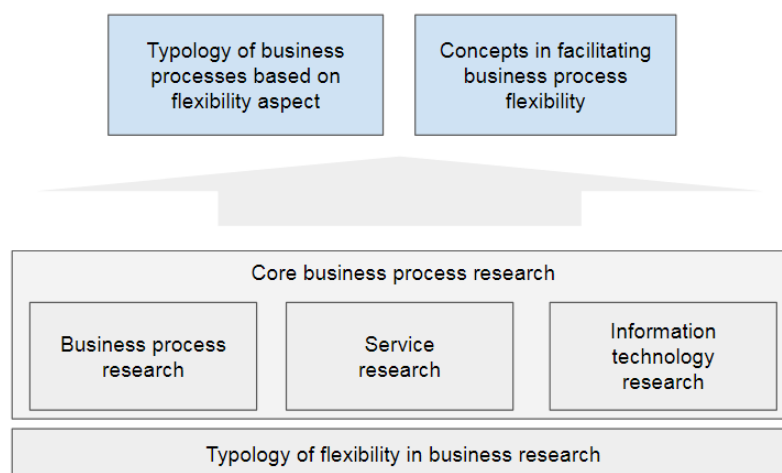- Section 4 discusses the findings and concludes the study.

FIGURE 1 Conceptual framework

# 2    TYPOLOGY OF BUSINESS PROCESS FLEXIBILITY

Business processes cannot be considered a homogenous group when it comes to their characteristics. This is natural considering that almost any activity done within an organisation can be regarded a business process. Some of the aspects affecting the nature of business processes include, but are not limited to the industry context, the types of the process inputs and outputs, the typical process volume levels, the level of customer interaction involved, the level of automation versus manual tasks, the complexity of tasks and many others. Similarly, service taxonomies have been proposed based on aspects such as the level of customer contact and involvement, capital intensity and tangibility of the service, among others. (Chung et al., 1999.)

In this study, the main focus will be placed on investigating the flexibility aspect of business processes specifically. We are especially interested in finding out the characteristics of business environments and processes in which flexibility, or the capability to adapt to environmental changes, plays an important part, independent of the traditional process classifications or the industry-specific contexts of business processes. By introducing a typology of process flexibility, the ground is laid for the latter part of the study, focusing on the concepts available in the facilitation of process flexibility.

The rest of the section is structured as follows:

- In 2.1, literature from different fields of research is introduced, dealing with process typology and classification based on the flexibility aspect.
- In 2.2, a synthesis of the process typology and process characteristics based on the flexibility aspect is attempted.

## 2.1  Process flexibility in literature

The table in appendix 1 introduces some of the relevant literature available on process typology in terms of the need for flexibility involved in various types of

business processes and the characteristics of different process flexibility types. The reviewed literature was selected based on the criteria mentioned in sub-section 1.3. Judged by the places of publication, the reviewed studies had roots mostly in the fields of business process research (9 articles), service research (8 articles) and information technology research (1 article). The domain contexts of the reviewed studies were diverse as well, most of the studies being non-industry-specific (7), while some targeted at some specific fields such as knowledge work (5), various services (4), manufacturing (1) and e-commerce (1). The literature included both theoretical and empirical work.

## 2.2   Synthesis and conclusions

Sub-section 2.1 provided a selection of literature dealing with process typology in terms of the need of flexibility involved as well as the characteristics of different process flexibility types. Based on the list of articles alone, it's safe to say that the typology of process flexibility can be considered a relevant issue in process-related academic literature. First of all, it's important to both researchers and practitioners to understand that processes are not homogenous in terms of the need for flexibility, hence need different management approaches. Secondly, it's important to understand the characteristics of different types of processes in order to be able to identify them. This sub-section will first discuss the characteristics of processes requiring flexibility, and then proceed to synthesise a typology of process flexibility suggested by different authors.

### 2.2.1 Characteristics of processes requiring flexibility

Based on the literature, there are lot of specific characteristics that can suggest a certain process or a process environment is a potential candidate for a higher need for flexibility. This sub-section briefly introduces and discusses the meaning of each of the characteristics. The terminology used by the different authors is diverse, so the generic headings are suggested by this paper for similar types of characteristics. There are also some clear interrelations that can be seen between the groups of characteristics and the characteristics themselves.

**Role of the customer**

The role of the customer within the process, often referenced also as *customer involvement*, is mentioned by several authors as a factor driving the need for process flexibility. Depending on the nature of the process, the role of the customer can range from completely passive to highly active. In the most passive form, the customer only provides an order and expects the output from the process as specified (e.g. retail sales). In the more active forms, customer can be a part of creating the order specification (e.g. contract manufacturing) or even

actively participate in the specification and fulfillment process (e.g. consulting services). The more active the role of the customer, the more flexibility is generally required. This is intuitive considering that customer involvement creates an additional factor of variability within the process. The company can control its own environment, but has less ways of influencing the customer processes. Due to this, processes having higher customer involvement require the organisation to have a better customer process understanding and sufficient flexibility within its own processes to handle the variability. (Lovelock & Maister, 1982; Schmenner, 1986; Fitzgerald et al., 1992; Tinnilä & Vepsäläinen, 1995; Boyer & Verma, 2000; Lee & Park, 2009; Grgecic et al., 2010; Kemsley, 2011; Glückler & Hammer, 2011; Carlborg & Kindström, 2014; Gemmel et al., 2015.)

**Role of the employee**

The role of the employee, sometimes referenced more narrowly as *labor intensity*, is also mentioned by several authors. Depending on the nature of the process, the significance of the role of the employee can range from low to high. Typically, in technology based processes (e.g. mass manufacturing) the role of the employee is rather small and is related to the control or support of an automated process. On the other hand, there are processes (e.g. arts, any personalized services) in which the employee is responsible for the most part of the process, perhaps supported by technology. This characteristic also describes whether the employee is passive (e.g. following instructions by the book) or an active decision maker (e.g. allowed to make independent decisions about their tasks) within the process. The third aspect is the level of collaboration needed within the process. The more significant role of the employee and employee collaboration, the more flexibility is generally needed. This is due to the fact that in order to automate work, tasks need to be linear and pre-defined. Human decision making and collaboration are still needed especially in tasks that are hard to automate or especially require creativity, one of the main assets of a human employee. (Schmenner, 1986; Fitzgerald et al., 1992; Boyer & Verma, 2000; Lee & Park, 2009; Grgecic et al., 2010; Glückler & Hammer, 2011; Kemsley, 2011; Leopold, Mendling & Unger, 2015.)

**Role of knowledge**

The role of knowledge within the process is discussed by many of the authors, especially in the research of so-called *knowledge-intensive business processes*. There are many ways to approach the role of knowledge. We can discuss, whether knowledge used within the process is simple, mechanical and mainly explicit (e.g. step-by-step instructions for completing a task can be provided), or whether the knowledge is complex or even tacit in some parts (e.g. the process involves human knowledge based decision making that is currently too complex be documented comprehensively). Another way of looking at knowledge is through the knowledge management process and whether the process at hand involves

mainly the use and application of existing knowledge (e.g. production processes) or creation of new knowledge (e.g. research and development processes). A third way of looking at the role of knowledge is whether the process inputs, tasks and outputs are tangible (e.g. physical products) or intangible (e.g. knowledge-based service). The greater knowledge-intensity the process has, generally the more flexibility is needed, since more knowledge typically also means harder to prescribe and automate. A distinctive example within this category are processes that have a creative nature and no pre-defined outcomes to begin with. Typically, the role of knowledge is also highly correlated to the role of the employee. (Fitzgerald et al., 1992; Davenport, Järvenpää & Beers, 1996; Lee & Park, 2009; Grgecic et al., 2010; Glückler & Hammer, 2011; Di Ciccio, Marrella & Russo, 2015; Leopold, Mendling & Unger, 2015.)

**Role of variability**

The role of variability is discussed by several authors, a related concept being the *level of customization*. When discussing variability, Hall & Johnson (2009) provide a usable separation between the *level of natural variability* within the process and the *value of variability* in terms of the process. The level of natural variability refers to the inherent level of variability (i.e. uncertainty) within the process environment, such as the industry and the type of the process in question. Factors causing variability within the process have been discussed earlier in this sub-section. On the other hand, we need to look at the actual value that variability has in different settings, and whether the value is positive or negative. A typical approach (e.g. in mass manufacturing settings) views variability as a negative phenomenon, a common source of quality and cost efficiency problems. However, variability can also have a positive value, enabling the customization of products and services to better meet the customer's diverse needs and expectations. In any case (be variability a chosen strategy or a cause of the process environment characteristics), the higher the level of variability, generally the higher need for the processes to be flexible enough to accommodate it. Processes with lower level of variability tend to have greater volumes and repeatability compared to highly variable processes that are rarely repeated exactly the same way several times. (Lovelock & Maister, 1982; Schmenner, 1986; Fitzgerald et al., 1992; Boyer & Verma, 2000; Lillrank, 2003; Hall & Johnson, 2009; Lee & Park, 2009; Grgecic et al., 2010; Leopold, Mendling & Unger, 2015.)

**Nature of inputs, tasks and outputs**

Several authors discuss the characteristics of *process inputs and outputs* of different process types as a factor of process flexibility. Similarly, the nature of tasks within the process has characteristics such as *task complexity*, *task structuredness*, *task interdependence* and *task execution logics*. These characteristics are interrelated to each other, as well as to the most of the other headings of this sub-section. It can be even argued that in a way, the nature of process inputs, tasks and outputs is

the natural outcome of other process characteristics mentioned earlier. In simple processes, the input and output sets and their acceptance criteria are typically controlled. Hence, the process can be designed to follow a pre-defined algorithm and binary logics, expecting specific outputs for specific inputs. As the significance of customer, employee, knowledge and the level of controlled or uncontrolled variability within the processes grows higher, the processes tend to become more complex, unstructured and interdependent with other processes. For such processes, it's not possible to pre-define comprehensive input and output sets or criteria, since there are multiple sources of variance involved. The execution logics of these types of processes are not linear, but can be based on situational interpretation or heuristics, focusing on the goal that needs to be achieved rather than the structure of the process. These types of processes demonstrate complexity by nature (i.e. it's hard to impossible to predict and document all the possible process variants comprehensively), the process tasks are typically hard to structure (i.e. the process workflow cannot be described explicitly) and the process instances tend to have interfaces or dependencies to other process instances (i.e. collaboration or the execution of other, internal or external processes is required for process execution). All of these characteristics drive the need for higher process flexibility and the ability to adapt to each specific situation rather than depend on prescribed workflows. (Georgakopoulos et al., 1995; Tinnilä & Vepsäläinen, 1995; Lillrank, 2003; Davenport, 2005a; Grgecic et al., 2010; Kemsley, 2011.; Dijkman et al., 2015; Leopold, Mendling & Unger, 2015.)

### 2.2.2 Typology of process flexibility

The previous sub-section discussed some of the characteristics that seem to suggest if a specific process has a higher need for flexibility. For presentation purposes, the paper grouped the interrelated characteristics under the categories of "*role of customer*", "*role of employee*", "*role of knowledge*", "*role of variability*" and finally the "*nature of inputs, tasks and outputs*", which was argued being in many ways influenced by the characteristics mentioned under the previous four headings. This sub-section finally discusses some of the typologies or process archetypes proposed by the literature that can be used for process classification based on the flexibility criteria.

Most authors provide two to four categories of process flexibility types. For the purpose of this paper, they are presented grouped into three basic categories (the "*low flexibility*", "*some flexibility*" and "*high flexibility*" types). While the assumption is made that process categories having a higher level of flexibility should have more of the flexibility characteristics mentioned in the previous sub-section, it's important to note that the borders between the archetypes are not clear and individual processes can have characteristics of several flexibility categories. The division between low flexibility and high flexibility processes is more of a spectrum than a polarisation (figure 2), so a three-level categorisation was considered sufficient in terms of this study.

| Low flexibility | Some flexibility | High flexibility |
|---|---|---|
| Passive customer | | Active customer |
| Low labor intensity | | High labor intensity |
| Employees act by the book | | Employees' role as decision makers |
| Low need for collaboration | | High need for collaboration |
| Simple, mainly explicit knowledge | | Complex, partly tacit knowledge |
| Using or applying knowledge | | Applying or creating knowledge |
| Mainly tangible inputs and outputs | Some characteristics of both archetypes | Mainly intangible inputs and outputs |
| High volume and repeatability | | Low volume and repeatability |
| Low level of natural variability | | High level of natural variability |
| Low value of variability | | High value of variability |
| Pre-defined input and output sets | | No pre-defined input and output sets |
| Highly structured, simple tasks | | Poorly structured, complex tasks |
| Algorithms and binary logics usable | | Non-linear judgement-based decision making, heuristics |
| Low interdependency with other processes | | High interdependency with other processes |

FIGURE 2 Spectrum of process flexibility

**Low flexibility**

Processes with a low level of flexibility are typically referenced in the literature using words such as *rigid* (Carlborg & Kindström, 2014), *mass* (Maister, 1982; Schmenner, 1986; Fitzgerald et al., 1992; Hall & Johnson, 2009; Lee & Park, 2009), *standard* (Lillrank, 2003; Grgecic et al., 2010), *routine* (Lillrank, 2003; Grgecic et al., 2010; Tinnilä & Vepsäläinen, 1995) and *structured* (Kemsley, 2011). Judging by the category names alone, these types of processes can be seen as common or high volume, highly repeatable, highly structured and highly standardised. A typical setting for these types of processes is *administrative* and *operational* work (Davenport, Järvenpää & Beers, 1996), in other words *administrative* or *production* processes (Georgakopoulos et al., 1995). Having obvious roots in the industrial setting, these types of processes can however also be found in mass service production.

**Some flexibility**

Processes with a medium level of flexibility fall naturally in between of processes with a low level of flexibility and processes with a high level of flexibility. These process types have some characteristics of both groups, typically having a smaller volume, being less repeatable and more customized than low flexibility processes, but having significantly more structure than high flexibility processes.

Some characterisations of this type of processes include *non-routine* (Lillrank, 2003; Grgecic et al., 2010), *flexible* (Tinnilä & Vepsäläinen, 1995), *mass customization* (Hall & Johnson, 2009), *service shop* (Maister, 1982; Schmenner, 1986; Fitzgerald et al., 1992), *structured processes with ad-hoc exceptions* and *unstructured processes with pre-defined fragments* (Kemsley, 2011) referring to the way of achieving the flexibility. For reasons mentioned before, enabling some flexibility in a process while maintaining efficiency and quality is a relevant issue in both traditional and service industries, which especially creates a need for a process type able to incorporate both rigid and flexible characteristics.

**High flexibility**

Processes with the highest level of flexibility are typically referenced in the literature using words such as *fluid* (Carlborg & Kindström, 2014), *ad-hoc* (Georgakopoulos et al., 1995; Lillrank, 2003; Grgecic et al., 2010), *unstructured* (Kemsley, 2011) and *adaptive* (Tinnilä & Vepsäläinen, 1995). These types of processes are generally less common, have lower volumes and lower repeatability and little to no structure. Especially associated with knowledge work (Davenport, Järvenpää & Beers, 1996) and artisctic processes (Hall & Johnson, 2009), this types of processes are especially common in the field of so-called professional services (Maister, 1982; Schmenner, 1986; Fitzgerald et al., 1992; Lee & Park, 2009). In the most extreme case, the process can be even completely non-existent or broken (Hall & Johnson, 2009).

# 3 FACILITATING FLEXIBILITY IN BUSINESS PROCESSES

The previous section concluded that business processes are not a homogenous entity and that different types of business environments and business processes vary in terms of the inherent need for flexibility involved. Some of the process characteristics driving the need for higher flexibility include, but are not limited to the significance of knowledge within the process, the higher level of customer involvement, the complexity and unstructuredness of tasks, the role of human decision making and collaboration involved and the low predictability of process inputs and outputs. These process characteristics seem to be particularly common in knowledge-intensive environments and service industries.

The purpose of this section is to further discuss the implications of the flexibility requirement on the ways business processes are designed and managed. As discussed earlier, flexibility can be considered from multiple perspectives. Organisations need the capability to adapt to the requirements of a changing business environment (Reeves & Deimler, 2011). At the same time, they need ways to support the day-to-day operations of their increasingly knowledge-intensive, unstructured processes (Davenport, 2010; Kemsley, 2011). While these questions can be considered two separate managerial issues, facilitating flexibility in business processes can potentially provide answers to both.

The rest of the section is structured as follows:

- In 3.1, a potential framework for discussing organisational flexibility on different levels of management is introduced.
- In 3.2, some of the concepts useful in facilitating process flexibility on different levels of management are further discussed.

## 3.1  A framework of organisational flexibility

As discussed earlier, *flexibility* is suggested to be a strategic option taken by an organisation in order to be able to adapt to environmental changes (Volberda, 1997). This definition is generic enough to be used when examining both adapting the organisation's processes to global changes occurring in the macro environment, as well as changes that need to be done during the execution of day-to-day operations of the organisation's processes in order to meet the specific requirements of each particular process instance.

The above can be reflected to Volberda's (1997) typology of flexibility, according to which organisations need ways to deal with flexibility on several levels of management: strategic, structural and operational levels:

- *Strategic flexibility* refers to capabilities related to the goals of the organisation or the environment. In a dynamic environment, strategic flexibility enables the organisation to adapt the fundamental nature of its activities according to the situation at hand, either by changing its internal strategies or externally trying to influence the environment. Such changes are often highly unstructured, non-routine and require creativity as past experiences may not provide any advantages.
- *Structural flexibility* refers to the capability of adapting the organisation's internal or external structures, such as processes, organisational structures and responsibilities, information systems or partner relationships, to a changing business environment. Such changes typically need to be made in order to facilitate the execution of the organisation's strategy in the most effective way, e.g. in terms of cost and quality.
- *Operational flexibility* refers to the capability of adapting the execution of individual processes and process instances to the situation at hand, however without changing the existing structures and goals of the organisation. Operational flexibility enables the organisation to respond to changes that are reasonably predictable and for which, even certain routines can be developed in order to reduce the uncertainty.

According to Volberda (1997), the managerial challenge that organisations face is the selection of an appropriate "flexibility mix" for each organisational setting. This encompasses the creation of a repertoire of capabilities to support flexibility on strategic, structural and operational levels, as well as the capability to activate these measures in a rapid manner in order to respond to the changing situations. However, this requires that organisational conditions support flexibility in terms of structure, technology and culture.

## 3.2   Facilitating flexibility in business processes

The table in appendix 2 introduces some literature dealing with flexibility concerns as well as concepts in facilitating flexibility on different levels of management. Taking Volberda's (1997) framework as a starting point, literature is categorized based on whether the main focus of a specific study is on the strategic (4 articles), structural (12 articles) or operational (5 articles) aspect of flexibility. An unambiguous distinction between the different types of flexibility is hard to make, however, because of the obvious interrelations between the levels. It can also be argued that the levels serve as enablers to one another – the strategic intent is fulfilled by the structural and operational choices, while the structural choices in turn act as enablers for both strategic and operational flexibility. Similarly, while strategic and structural flexibility are mostly fulfilled during the *design and implementation* phases, operational flexibility is realised mostly during the *execution* phase of the BPM lifecycle.

### 3.2.1 Strategic flexibility

*Strategic flexibility* refers to capabilities related to the goals of the organization or the environment (Volberda, 1997). Managerial issues related to strategic level flexibility are not typically restricted to Business Process Management alone, but are more global and mainly concern the positioning of the organisation within the market and fulfilment of the overall organisational goals. Several authors (Lillrank, 2003; Hall & Johnson, 2009; Lee & Park, 2009; Bask et al., 2010) discuss the linkage between business strategies and operational processes.

Bask et al. (2010) study the relationship between service strategies, business models and operational business process models. They conclude that there needs to be a match between these three components of business, each of which responding to similar problems on different levels of management. The main purpose of service strategies is to define the positioning of organisation's services in the marketplace in terms of, for example, service offering characteristics and delivery methods. Business models are then used to formulate the value proposition of service offerings in more detail in terms of the business logics behind them, in other words the mechanisms of service fulfilment and monetization. Finally, business processes provide the operational means of service delivery. In terms of strategic flexibility, the interdependence of each three components means that changes on strategic level, such as service positioning, can cause the need to change the other components as well, requiring flexibility on all individual levels in order to facilitate the change. This creates a link between strategic flexibility and especially structural process flexibility.

Because of the fact that strategic choices typically affect the organisation's process portfolio in some way, managers also need to be aware of the types of processes required in order to fulfil the chosen strategies. Lillrank (2003) and Lee & Park (2009) both discuss some of the differences in the selection of managerial

strategies between different types of processes, especially those with a low level and those with higher levels of flexibility. The less flexibility required by the process, the more managerial strategies tend to shift towards cost efficiency and elimination of variation. The more flexible the processes are, the more values such as variety, customization and customer centricity emerge in terms of their management. Hall & Johnson (2009) provide an extreme example of such case by discussing the concept of artistic processes somewhat incompatible with the traditional principles of scientific management.

Based on the above, we can argue that strategic choices and strategic flexibility cannot be completely separated from other levels of flexibility because of the interdependence with the underlying processes needed to accomplish the chosen strategy. While strategic organisational flexibility certainly has several additional non-process-related, such as cultural aspects not covered by this paper, it certainly has implications to both design and management of underlying processes and needs to be viewed holistically.

### 3.2.2 Structural flexibility

*Structural flexibility* refers to the capability of adapting the organisation's internal or external structures to a changing situation (Volberda, 1997). Managerial issues related to structural level flexibility typically involve aspects such as design and implementation of process models and IT systems in such way that they support flexibility. In order to fulfil the changing organisational strategies, the organisational structures need to be flexible enough as well. In a way, structural flexibility can be seen as an architectural enabler for strategic and operational level flexibility. Several authors (Durisin & Todorova, 2002; van der Aalst et al., 2008; Mendling et al., 2009; Bask et al., 2010; Bush & Lin, 2010; Grgecic et al., 2010; Bask et al., 2011; Bask et al., 2012; Holten et al., 2012; Carlborg & Kindström, 2014; Döhring et al., 2014; Di Ciccio, Marrella & Russo, 2015; Dijkman et al., 2015; Hauder et al., 2015) discuss structural issues in  some way.

**Process architecture choices to enable flexibility**

The question of flexibility versus standardisation (Mendling et al., 2009; Bask et al., 2010; Grgecic et al., 2010; Holten et al., 2012; Dijkman et al., 2015) and modularity as an architectural paradigm (Durisin & Todorova, 2002; Bask et al., 2010; Bush & Lin, 2010; Bask et al., 2011; Bask et al., 2012; Carlborg & Kindström, 2014) seem to dominate the literature when discussing ways to facilitate flexibility in process models using architectural choices and process design. These concepts are briefly introduced below.

*Standardisation* in the context of business processes is defined by Davenport (2005b) as "the unification of business processes and the underlying actions within a company --", an effort typically targeted at reducing any unnecessary variability and improving operational efficiency and quality of organisation's

business processes. While standardisation can be intuitively considered contradictory to flexibility, several authors agree that the type of the process is a factor in determining the appropriate extent of standardisation efforts. Mendling et al. (2009) stress the importance of understanding, which processes or which parts of the processes are amendable to standardisation in the first place and which aspects of them should be standardised. Different standardisation strategies are needed in different scenarios. The authors also identify the need for so-called "pockets of creativity" and "pockets of variability" in order to incorporate the possibility for flexibility in standardised business processes. Similar results are given by Grgecic et al. (2010) in their study on process standardisation success factors, Holten et al. (2012) in their study on process complexity effects on standardisation efforts and Dijkman et al. (2015) in their study on contextual factors of process standardisation. All studies seem to agree that process with a higher inherent degree of flexibility are harder to standardise. However, especially together with modularity, standardisation can also be seen as one of the enablers for flexibility (Bask et al., 2010).

*Modularity* is defined by Schilling (2000) in the general modular systems theory as the "degree to which a system's components can be separated and recombined". Modularity in the business management context has been studied from several different perspectives, including internal and external product modularity, organizational structure and process modularity, knowledge modularity (Durisin & Todorova, 2002), as well as the more recently emerging service modularity (Bask et al., 2012). The authors agree that the purpose of modularity as an architectural choice is generally the management of complexity involved in a system, enabling decoupling the individual system components to manageable standardised entities, while enabling the mix-and-matching of components in order to easily combine them to create new systems. This overall increases the flexibility of a system and has implications on both operational (e.g. service customization) and strategic (e.g. adapting to a market situation) flexibility of the organisation. Other advantages related to modularity include the use of service-oriented architectures (Cherbakov et al., 2005). Thanks to standardised module interfaces, the modules can be reused or the implementation of a module's internal mechanisms can be changed without affecting the overall system, enabling cost optimization techniques such as process outsourcing (Bask et al., 2012). While there is evidence that modular process designs indeed seem to contribute to flexibility and operational performance (Bush & Lin, 2010), the research also suggests that there needs to be a match between different perspectives of modularity in order for it to contribute to the overall flexibility (Durisin & Todorova, 2002). The selection of modular strategies for different types of service processes is discussed in depth by Bask et al. (2011) and Carlborg & Kindström (2014).

**IT support for process flexibility**

Realisation of process flexibility strategies often requires support in terms of supporting IT systems during the different phases of the process lifecycle (van der

Aalst et al., 2008). Döhring et al. (2014) additionally discuss some of the features required in the implementation of a process variant management system, including *process variant construction* (by either *configuration* or *adaptation*), *modularization support*, *runtime variant construction*, as well as *data-flow and resource variability*. Especially in an IT enabled environment where most of the work is supported by information systems, IT support can act as the most noticeable prerequisite for operational process flexibility.

A taxonomy suggested by van der Aalst et al. (2008) in the context of process-aware information systems seems usable when discussing the different approaches available to support process flexibility at the structural level in terms of IT. The authors recognize the need for different types of flexibility in different phases of the Business Process Management lifecycle. Their typology categorizes the approaches to four distinctive flexibility types. They can be characterised by whether the flexibility is enabled in the design or the execution phase of the process model lifecycle. The four flexibility types are:

- *Flexibility by design* means that the various execution options of a process are predicted and incorporated in process design. During process execution, the most appropriate execution path for each process instance can be selected. Realisation options for such process designs include structures such as decisions, parallelism and iteration. Although an obvious way to support process flexibility, this approach leans strongly on pre-defined process flows and therefore has its restrictions. The more flexibility the process requires, the more complex the process model becomes and the harder it is to predict all the execution paths.

- *Flexibility by deviation* means that individual process instances can deviate from the prescribed process model at runtime. This enables the adaptation of each instance to the situation at hand during process execution, however without affecting or changing the original process model. Realisation options for such scenario include enabling the alteration of the process task sequence at runtime for example by skipping, redoing, undoing, creating and invoking new tasks. While providing a great amount of flexibility, constraints and conditions related to task sequencing and process outcomes need to be taken in consideration.

- *Flexibility by underspecification* means that uncertainty related to a process flow is predicted and incorporated in the process design, leaving the final detail level process specification to be done for each process instance at runtime. This can be realised by only defining a high-level process structure with so-called placeholders that can be completed at runtime with either pre-defined process fragments (i.e. late binding) or process sequences constructed from scratch (i.e. late modeling). Compared to the other methods, this provides a compromise between structure and flexibility, enabling both the autonomy of executing individual process tasks, while complying with the overall process model.

- *Flexibility by change* means that, much like in case of deviation, a process needs to be changed at runtime. However, in this case, the change may be needed not only temporarily in the scope of an individual process instance, but the process model used for any new process instances needs to be permanently changed, as well as any possible running process instances based on that specific model. Changing the process model at runtime involves several considerations, such as whether the change is momentary or permanent, whether a change affects the running or only new process instances and how the running instances should be migrated to the changed process model.

Based on the above, we can argue that flexibility can be supported at the structural level by certain architectural choices, such as process standardisation and modularity, as well as process-aware IT systems enabling the required alterations in process models during either process design or execution. It can be further argued that structural level issues play a role as an enabler in achieving organizational flexibility on strategic and operational levels.

### 3.2.3 Operational flexibility

*Operational flexibility* refers to the capability of adapting the execution of individual process instances to a situation at hand (Volberda, 1997). Managerial issues related to operational level flexibility are typically tied more strongly to operational management, i.e. the handling of everyday work and individual process cases. Since many of the hard limits of operational flexibility, such as the process structure, the business rules associated with process decisions and the IT system support enabling process flexibility are typically decided at the structural level, making a distinction between these levels can be somewhat vague. Several authors (van der Aalst et al., 2003; van der Aalst et al., 2005; Motahari-Nezhad & Swenson, 2013; Di Ciccio, Marrella & Russo, 2015; Hauder et al., 2015) discuss some of the concepts related to flexibility at the operational level in particular.

Workflow Management (WfM) is one of the root traditions of Business Process Management especially concerned with instance-level operational process management. Originating from a manufacturing setting, Workflow Management Systems (WfMS) have been widely used to support the specification, enactment and control of business processes in order to improve efficiency, quality and co-ordination of work (van der Aalst et al., 2003). During the last couple of decades, however, the pitfalls of traditional WfM concepts and systems have been discussed by several authors and especially their suitability to support non-structured, knowledge-intensive work with higher need for contextual awareness and flexibility has been questioned (van der Aalst et al., 2003; van der Aalst et al., 2005). The shortcomings of traditional WfM have recently caused an emergence or new paradigms such as Case Handling (van der Aalst et al., 2003; van der Aalst et al., 2005) or Case Management (Motahari-Nezhad & Swenson, 2013; Hauder et al., 2015). The authors suggest that these paradigms differ from the traditional

WfM mainly in some of the following characteristics in order to better serve the needs of flexible and knowledge-intensive environments:

- Context tunneling is avoided by focusing on the case instead of individual process activities, providing all information available for the process actors who have more control over the process execution.
- The process is driven by data instead of a specified control flow. Activities are enabled and the available options to proceed are defined based on the information available rather than the executed activity flow.
- Work distribution is separated from authorization, allowing for additional types of process roles in addition to the execution role.
- Viewing, addition or modification of data is made possible before or after the corresponding activities have been executed. This makes information entry possible as soon as it becomes available.

Di Ciccio, Marrella & Russo (2015) additionally study the characteristics, requirements and approaches to process management systems in the context of knowledge-intensive business processes. Based on the characteristics inherent to such processes, the authors derive a set of requirements that can be set for a process management system in order to support the so-called KIBPs. Several state-of-the-art technological process modelling standards are finally compared in terms of these requirements.

Based on the above, we can argue that while the need for better operational support of processes with a higher level of flexibility has been identified by the academics as well as the BPM practitioners, the research in this area is still rather recent and most process-oriented information systems lack sufficient support for design and execution of these types of processes. As the share of unstructured, knowledge-intensive processes in the organisations' portfolios continues growing, as do demands for quality and performance, information systems used in process control and execution will require better support in order to efficiently manage these new types of processes.

# 4 CONCLUSION

The purpose of the study was to explore the diversity of business process characteristics in terms of the need for flexibility, as well as the current state of research in the area of facilitating process flexibility on different levels of management. Especially highlighted by some of the major trends faced by organisations today – a rapidly changing, highly competitive environment and the growing significance of service and knowledge-intensive industries – flexibility seems to be a current topic in the field of organisational management. Organisations need to be flexible in both what they do and how they do it, being able to facilitate both temporary and permanent changes in their business processes in both foreseeable and unforeseeable circumstances. A better understanding was needed about the state of the art in process flexibility related research.

Due to the somewhat unconsolidated nature of business process research, the study was performed as an exploratory literature review in order to acquire a better overall view of the research area. While the study focus was on so-called core business process research as proposed by Isik & Sidorova (2010), three major research traditions could be identified within the reviewed literature: business process research, service research and information technology research. While there are considerable similarities in process flexibility related issues being investigated by each of these areas, there has been little dialogue between the research traditions, each of them viewing flexibility from its own viewpoint. One of the outcomes of this study is contributing to a more holistic view of process flexibility taking into account both commercial, operations and technological viewpoints of management and process flexibility issues on strategic, structural and operational levels. To the knowledge of the author, a holistic approach like this has not been used in prior literature.

Section 1 of the paper introduced some of the key concepts within the scope of the study and described the research questions and the research method. Section 2 attempted to answer the research question "*How do business processes differ by nature in terms of the need for flexibility and what generic processes flexibility types can be identified?*" and section 3 the research question "*What are some of the managerial issues related to flexibility on different levels of management and what are some of*

*the BPM concepts available in facilitation of flexibility on each level?"*. Finally, this section concludes the study, discussing implications, limitations and possibilities for further research.

The rest of the section is structured as follows:

- In 4.1, the implications of the study to theoretical research and managerial practice are discussed.
- In 4.2, the limitations of the study are discussed.
- In 4.3, possibilities for further research are suggested.

## 4.1 Study implications

The study can be argued to have implications on both theoretical research and managerial practice in the field of business processes. First, light is shed on the heterogeneous nature of business processes in terms of their inherent need for flexibility. Second, concepts that can be considered usable in facilitating flexibility on different levels of management are introduced.

The first research question provides insight into the environmental characteristics that seem to drive the need for flexibility in business processes. While business process orientation has been emerging as one of the important paradigms of business management, the research in the field of managing business processes only recently has started to take into consideration the fact that processes of different types require different kinds of approaches and support in terms of Business Process Management. The differences can be seen in both the selection of managerial strategies for such processes as well as the support for flexibility needed at the operational level. By being able to better identify the characteristics of business environments and business processes that seem to increase the need for process flexibility, managers can be more aware of the nature of their business processes when selecting managerial approaches, designing individual business processes and the overall process architecture, implementing IT support systems for business processes or managing the execution of different types of processes. For example, it should be obvious that the approaches to managing an industrial mass-manufacturing processes differ fundamentally from the approaches needed to manage a knowledge-intensive service process. On the other hand, research and development processes of two separate industries can have a lot of common in terms of the need for flexibility.

The second research question provides insight into flexibility related issues on different levels of management as well as some of the tools available to managers in order to facilitate flexibility on each level. The results attempt to provide a holistic view on the different kinds of flexibility, also highlighting the interrelations between flexibility concerns on different levels of management and the significance of structural flexibility as an enabler for both strategic and operational flexibility. In other words, it seems that in order to be flexible both strate-

gically and operationally, the organisation needs certain structural flexibility capabilities that enable a sufficient level of adaptation in both short-term and long-term scenarios, either temporarily or permanently.

*Strategic flexibility* is primarily related to the goals of the organisation. In a modern-day business environment, being able to efficiently adapt to a changing environmental situation can be seen as one of the important competitive advantages of an organisation and therefore becomes a relevant issue for managers. Adapting at the strategic level can mean, for example, a change in the market position, production strategies, value proposition, products or services or even the industry. In other words, a strategically flexible organisation is able to use its agility in order to outperform its competitors by efficiently shifting its goals towards more potential markets. However, in order to achieve this, the underlying organisational structures, such as the business processes, need to support flexibility as well. It can be argued that strategic flexibility can be viewed as a strategic intent that needs to be supported by other levels of management.

*Structural flexibility* is primarily related to organisational structures. In order to enable flexibility on both strategic and operational levels, organisational structures such as the underlying business processes and IT systems supporting them need to provide an appropriate level of adaptivity. Strategic flexibility is supported by the ability of an organisation to efficiently introduce changes in its process models, for example by creating new processes, changing or combining existing processes or altering the ways processes are implemented. Operational flexibility is, on the other hand, supported by the ability to change the running process instances according to specific needs of each case. It can be argued that choices made at the structural level act as enablers for both strategic and operational flexibility, making it possible to alter both process models and process instances with a relatively small effort. These choices include process architecture principles such as modularity and standardisation, as well as appropriate IT support for process design, execution and control.

*Operational flexibility* is primarily related to the execution of individual process instances. Processes characterised by an inherently high level of flexibility are becoming more common due to the rise of the service industry and especially the growing share of knowledge work. Because these types of processes are hard or impossible to prescribe comprehensively before execution, they often need to be adapted in one way or another during runtime, making it also harder to support these types of processes using traditional Workflow Management Systems. For example, an individual medical care process can rarely be specified before the medical expert has assessed the situation and defined the appropriate activities for each specific case, which can be done by composing the process by combining a set of standardized examination and treatment activities. A modern Case Management System can additionally support process execution by providing the expert with all the data and standard procedures available in the case context. Much like strategic flexibility, it can be argued that operational flexibility needs to be supported by structural choices.

## 4.2 Study limitations

The study has several obvious limitations that need to be considered before any generalisations can be made based on the results. Due to the research method being a literature review, the results are based on a limited set of literature available at the moment, including some theoretical work and some empiric research done in various industries and organisational settings. The synthesis and the conclusions presented can be considered theoretical and require empirical validation in terms of applicability to any specific real-life environment. Some of the limitations are further addressed in the following sub-section by suggesting possibilities for further research in the area.

Due to the exploratory nature of the study, the definition that was used for a business process was purposefully broad and did not limit the scope to any specific type of business processes. The selection criteria of the literature review allowed for literature dealing with process flexibility independently of any existing process categorisations or specific industries. While the choice was justified by focusing on the flexibility aspect independently of the process context, the broad focus can make the application of results more difficult. The study does not provide insight into the role played by flexibility in specific process types, such as core, support and management processes or processes within a specific industry, but takes a more general approach.

Finally, another limitation is caused by the variety of research traditions behind the reviewed literature and the possibility of terminological ambiguity because of that. The literature allowed by the selection criteria included research in the fields of business processes, services and information technology. While the interdisciplinary approach was considered appropriate for an exploratory study and the research traditions do have a lot of concepts in common, there is a possibility that some of the terminology is used in different meanings in different research traditions. At the very least, the viewpoint to the same concepts differs depending on the field of research. While service research typically has a commercial viewpoint, business process research is typically more closely associated with operations and IT research with technological issues. More attention is needed in order to align these different points of view.

## 4.3 Possibilities for further research

The study also brings up several possibilities for further research. The theoretical work presented requires empiric validation in terms of its applicability to real-life organisational scenarios. Additionally, some of the concepts introduced in this paper need more research attention in addition to what was allowed by the scope of the exploratory study. The following research topics are further suggested in order to deepen the understanding of the area.

The application of the process classification introduced in section 2 to a real-life environment brings up several follow-up questions. In addition to the empiric validation of the process characteristics driving the need for process flexibility, we can ask whether processes positioned in a certain way on the flexibility spectrum tend to have other aspects in common. Studying the relationship between flexibility and other process classifications would provide additional insight into, for example, whether certain flexibility characteristics are typical to certain process types, such as core, support or management processes or processes related to a certain industry, product or service type. This would improve the applicability of results in practice.

The results presented in section 3 need empiric validation as well. An interesting question would be, whether the potential ways of facilitating process flexibility on different levels of management are actually used by real-life organisations, which of the concepts are being used, to what extent and whether the process' positioning on the flexibility spectrum has a concrete effect on the ways the processes are being managed. Another question is whether there actually is a positive correlation between the use of flexibility concepts and the assumed realisation of positive effects of flexibility, such as process performance enhancement or reduction of efforts needed to adapt processes. Finally, more attention is needed on the relationships between flexibility issues on strategic, structural and operational levels and especially the hypothesis that structural flexibility could have a positive effect on both strategic and operational flexibility.

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# APPENDIX 1
# LITERATURE - TYPOLOGY OF PROCESS FLEXIBILITY

TABLE Literature – typology of process flexibility

| Source | Relevant contribution | Context |
|---|---|---|
| Carlborg & Kindström, 2014 | Proposes classification of service processes to two main types: *rigid service processes* and *fluid service processes*. Identifies some typical characteristics for both types of service processes. Discusses the role of the customer involvement in the service process, additionally categorising services based on whether the customer has an *active* or a *passive* role in service fulfilment. | Service research |
| Davenport, 2005a | Discusses the characteristics of knowledge work. Proposes classification of knowledge processes based on two aspects: *level of interdependence* and *complexity of work*. Identifies four types of knowledge-intensive processes: the *collaboration model*, the *expert model*, the *integration model* and the *transaction model*. | Business process research |
| Davenport, Järvenpää & Beers, 1996 | Differentiates between *administrative*, *operational* and *knowledge work* processes. Discusses the various approaches to improving knowledge work processes. Identifies additional factors affecting the segmentation of work processes, such as whether they focus mainy on *discovery*, *creation*, *distribution* or *application* of knowledge. | Business process research |
| Di Ciccio, Marrella & Russo, 2015 | Discusses the concept of knowledge-intensive business processes and attempts to provide a definition for the concept. Building on Kemsley's classification, discusses the ways to support processes of different levels of structuredness. | Business process research |
| Dijkman et al., 2015 | Discusses the influence of process characteristics in the context of process standardization. Identifies the structuredness of a process as one of the factors affecting its suitability for standardization. | Business process research |
| Fitzgerald et al., 1992 | Proposes classification of service processes based on six dimensions: *equipment vs. people focus*, *customer contact time*, *degree of customization*, *degree of discretion*, *value added front vs. back office* and *product vs. process focus*. Identifies three basic service process archetypes: *mass services*, *service shops* and *professional services*. | Service research |

| | | |
|---|---|---|
| Gemmel et al., 2015 | Discusses the importance of customer process understanding in service processes. Identifies characteristics of processes having a high level of *customer interaction* (so-called *on-stage processes*) and lower level of customer (so-called *backstage processes*). | Service research |
| Georgakopoulos et al., 1995 | Proposes process classification based on two aspects: *task complexity* (the complexity involved in task coordination rules or constraints) and *task structure* (the extent to which the organisation of process tasks can be structured). Identifies three basic types of process: *administrative processes*, *production processes* and *ad-hoc processes*. | Information technology research |
| Glückler & Hammer, 2011 | Proposes service categorization based on three distinctive aspects: demand orientation, knowledge intensity and technology intensity. Identify differences between *operational*, *knowledge-intensive* and *technological knowledge-intensive* services. | Service research |
| Grgecic et al., 2010 | Building on Lillrank's classification, proposes additional characteristics for processes that represent the *standard*, *routine*, *non-routine* and *chaotic process types*. | Business process research |
| Hall & Johnson, 2009 | Discusses specifically processes that are artistic by nature. Proposes process classification based on two aspects: the inherent *variability of the process environment* and the *value of variability* (whether process variability in each setting would produce positive or negative customer value). Identifies four basic types of processes: *mass processes*, *mass customization processes*, *nascent or broken processes* and *artistic processes*. | Business process research |
| Kemsley, 2011; also referred by Di Ciccio et al., 2015 | Discusses the different natures of routine and knowledge work and the management of such processes. Proposes process characterization based on three dimensions: the structured vs. unstructured, controlled vs. collaborative and internal vs. external participation. Additionally, proposes process classification based on their structuredness, identifying a variety of process types: *structured processes*, *structured processes with ad-hoc exceptions*, *unstructured processes with pre-defined fragments* and *unstructured processes*. | Business process research |
| Lee & Park, 2009 | Discusses categories of e-commerce services and their characteristics. Identify three distinctive groups of services: *mass services*, *intellectual services* and *professional services*. | Service research |

| Leopold, Mendling & Unger, 2015 | Discusses the concept of knowledge-intensive business processes and attempts to provide a set of characteristics typically associated with such processes. | Business process research |
|---|---|---|
| Lillrank, 2003; also referred by Mendling et al., 2009 and Grgecic et al., 2010 | Proposes process classification to four types: *standard processes*, *routine processes*, *non-routine processes* and *chaotic processes*. Discusses the characteristics of process types. | Business process research |
| Lovelock & Maister, 1982 (according to Fitzgerald et al., 1992) | Proposes classification of service processes based on two dimensions: *extent of customization* and *extent of customer contact*. Identifies four basic service process types: *factory*, *mass services*, *job shop* and *professional services*. | Service research |
| Schmenner, 1986 (according to Boyer & Verma, 2000) | Proposes service categorization based on two aspects: the *level of customer contact and customization* and the *level of labor intensity*. Identifies four types or services: *service factory*, *mass service*, *service shop* and *professional service*. Provides typical characteristics of each service type. | Service research |
| Tinnilä & Vepsäläinen, 1995; also referred by Bask et al., 2010 | Proposes classification of service processes to four types based on the *complexity* and *contingency* involved. Identifies four service types: *mass transactions*, *standard contracts*, *customized delivery* and *contingent relationships*. Additionally, identifies four generic service process types: *fast routine processes*, *flexible integrated processes*, *focused processes* and *adaptive processes*. | Service research |

**APPENDIX 2**
**LITERATURE – FACILITATING FLEXIBILITY IN BUSINESS PROCESSES**

TABLE Literature – facilitating flexibility in business processes

| Source | Relevant contribution | Flexibility aspect | Context |
|--------|----------------------|--------------------|---------|
| Bask et al., 2010 | Discusses the relationship between service strategies, business models and process architectures. Discusses *process standardisation* and *process modularity* as a means of managing service flexibility. | Strategic Structural | Service research |
| Bask et al., 2011 | Discusses the positive effect of modularity on service flexibility. Identifies several aspects of service modularity and the relationship between service and process modularity. | Structural | Service research |
| Bask et al., 2012 | Discusses *modular service design* as an architectural paradigm used in managing complexity, improving efficiency and dealing with uncertainty. Based on literature, provides definitions for concepts related to service modularity. | Structural | Service research |
| Bush & Lin, 2010 | Discusses the positive effect of *process modularity* on manufacturing agility, mediated by information system flexibility. Provides definitions for manufacturing agility. | Structural | Information system research |
| Carlborg & Kindström, 2014 | Discusses service modularisation and modular strategies as a way of managing the efficiency of services while meeting the diverse customer needs. Suggests the need for different service design strategies for different levels of service flexibility. | Structural | Service research |
| Dijkman et al., 2015 | Discusses the contextual factors affecting the success of *process standardisation*. Identifyes process types applicable to standardisation efforts. | Structural | Business process research |
| Döhring et al., 2014 | Discusses system design approaches in order to support the flexibility of process execution. Identifies several principles supporting flexibility in process runtime. | Structural | Information system research |
| Durisin & Todorova, 2002 | Discusses *architectural modularity*, as a way of achieving strategic flexibility. Identifies several aspects of modularity and the need of coordination between them. | Structural | Business management research |
| Grgecic et al., 2010 | Discusses *process standardisation* as a means of gaining organisational performance improvements. Identifies the types of processes most suitable for standardisation. | Structural | Information system research |

| | | | |
|---|---|---|---|
| Hall & Johnson, 2009 | Discusses the differences in managerial strategies suitable for processes of different degree of flexibility. | Strategic | Business process research |
| Hauder et al., 2015 | Discusses *case management* as a paradigm to support the management of knowledge-intensive processes. | Operational | Business process research |
| Holten et al., 2012 | Discusses the relationship between process complexity, *process standardisation* efforts and the value achieved by standardisation efforts. | Structural | Business process research |
| Lee & Park, 2009 | Discusses the selection of managerial strategies for different types of services based on the process flexibility typology. | Strategic | Service research |
| Lillrank, 2003 | Discusses the differences in managerial strategies relevant for different types of processes based on the level of flexibility. | Strategic | Business process research |
| Mendling et al., 2009 | Discusses *process standardization*. Suggests that different process flexibility types require different types of approaches to standardisation efforts. | Structural | Business process research |
| Motahari-Nezhad & Swenson, 2013 | Discusses *case management* as a paradigm to support knowledge-intensive business processes. Discusses the trends of case management tool support. | Operational | Information system research |
| van der Aalst et al., 2003 | Discusses *case handling* as a paradigm designed to overcome the shortcomings and limitations of the traditional workflow management and workflow management systems. Explores the advantages and disadvantages of case handling systems. | Operational | Information system research |
| van der Aalst et al., 2005 | Discusses *case handling* as a paradigm supporting the requirements of process flexibility and knowledge-intensive work. | Operational | Information system research |
| van der Aalst et al., 2008 | Discusses the means to support *process flexibility* in process design and process support systems. Provides an extensive taxonomy of process flexibility, identifying four different approaches to achieve flexibility. Introduces the tool support currently available to facilitate flexibility. | Structural | Information system research |
| Di Ciccio, Marrella & Russo, 2015 | Discusses the characteristics of knowledge-intensive processes and requirements for process-aware information systems supporting such processes. | Operational | Information system research |