# Chapter 1
# Challenges and Solutions for Complex Business Process Management

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## ABSTRACT

*A business process displays complexity as a result of multiple interactions of its internal components and interaction between the process and its environment. To manage complexity and foster flexibility of business process management (BPM), we present the DCAR architecture for developing complex BPM systems, which includes decomposition of complex processes (D); coordination of interactive activities (C); awareness of dynamic environments (A); and resource selection and coordination (R). On the other hand, computing technologies, such as object-oriented programming, component-based development, agent-oriented computing, and service-oriented architecture have been applied in modeling and developing complex systems. However, there is considerable ambiguity involved in differentiating between these overlapping technologies and their use in developing BPM systems. No explicit linkage has been established between the requirement of complex BPM and the supporting technologies. In this study, we use the DCAR architecture as the foundation to identify the BPM requirements for employing technologies in developing BPM systems. Based on an examination of the both sides (BPM requirements and supporting technologies), we present a clear picture of business process complexity with a systemic approach for developing complex BPM systems by using appropriate computing technologies.*

## INTRODUCTION

Businesses around the world are paying more attention to process management and process automation to improve organizational efficiency and effectiveness. It is increasingly common to describe organizations as sets of business processes that can be improved by business process management (BPM). Most

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approaches to BPM have used information technologies to support or automate business processes, in whole or in part, by providing computer-based systems support. These technology-based systems help coordinate and streamline business transactions, reduce operational costs, and promote real-time visibility in business performance.

Traditional approaches to building and implementing BPM systems use workflow technologies to design and control the business process. Workflow-based systems follow highly structured and predefined workflow models, and are well suited to applications with stable inputs, processes, and outputs. Contemporary business processes are becoming increasingly complex and dynamic as they seek to cope with a wide range of internal and external interactions and changes. To provide sufficient flexibility and adaptability in BPM, a number of researchers have been investigating the approaches and techniques for developing BPM systems for an increasingly turbulent environment (Casati et al., 1999; Chiu et al., 1999; Weske, 2001; Wang et al., 2002, 2005a; K. Kumar et al., 2006). Most studies have focused on present process structures and provide rapid response to changes that lead to temporary and short term fluctuations in the organization's activities.

In this study, we view business process as a complex system that adapts to continuously changing and unpredictable environments in order to survive. A business process displays complexity because of multiple interactions of its internal components and interaction between the process and its environment. To manage complexity and foster flexibility of complex systems, modularity is the key to the solution (Baldwin et al., 1997; Simon, 1981). Modularity in BPM requires decomposing a complex BPM system into a number of interacting components that perform the processes. Based on the investigation of business process complexity and modularity theory, we present the DCAR architecture for developing complex BPM systems, which include decomposition of complex processes (D); coordination of interactive activities (C); awareness of dynamic environments (A); and resource selection and coordination (R).

On the other hand, various modular computing technologies, such as Object-Oriented Programming (OOP); Component-Based Development (CBD); Agent-Oriented Computing (AOC); and Service-Oriented Architecture (SOA); have emerged to model and develop complex systems. There has been a proliferation of studies about the application of these modular technologies in developing BPM systems (Weske, 1998; Kammer et al., 2000; Jennings et al., 2002; Wang et al., 2005b; Leymann et al., 2002). As the modular computing paradigms and technologies become popular, researchers often attempt to employ and integrate them in creating business process management solutions. However, there is considerable ambiguity involved in differentiating between these overlapping terminologies and consequently their use for BPM systems development. The fundamental questions about the use of these technologies, i.e., why we need to use them for solutions of BPM, how we apply them, and how we integrate them with other solutions, remain unexamined. Most research on technology support for BPM is experience-driven, ad-hoc, and often lacks a systematic analysis of the rationale for the technology support (Wang et al., 2008a). Little work has examined the root of complexity of business processes, the need for effective approaches to BPM, and how this need affects the technology solutions for process management (K. Kumar et al., 2006). In this study, we analyze the differences and relationships between these overlapping terminologies and techniques, and match them to BPM requirements. The DCAR architecture we proposed for complex BPM is used as the foundation to identify the BPM requirements for employing these modular computing technologies in developing BPM systems. Based on an examination of both sides (BPM requirements and supporting technologies), we present a clear picture of business process complexity with a systemic approach on how these technologies can be applied and integrated in developing systems for complex process management.