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Business rules management in healthcare: A lifecycle approach

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ABSTRACT

This paper proposes a framework to apply business rules management (BRM) to healthcare service delivery. Implementation of recently government-mandated quality standards for healthcare provider requires them to modify or change their business processes, practices, and approach to healthcare delivery. An automated business rules management will provide significant benefits to these providers. The benefits include greater control, improved flexibility, and the ability to rapidly deploy business rules across processes, information systems and channels (web, legacy, wireless and otherwise). These benefits, in addition to trends in service orientated architectures, web semantics, and business process management, have spawned an emerging business rules engine (BRE) market. Despite these developments, little has been published in MIS journals that examine the management of business rules management systems (BRMS) development and deployments in general, and in healthcare service sector in particular. Making use of structuration research methods, we collect data from leading developers, end-users, researchers and thought leaders from the industry. Data collection results revealed a business rules management lifecycle inclusive of these steps: align, capture, organize, author, distribute, test, apply, and maintain. The contextual influences, actors, inputs, outputs and artifacts are identified in each step. Academic and managerial contributions, as well as recommendations for future research are provided.

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1. Introduction

The healthcare industry faces unprecedented changes and reform. Recently introduced government legislation encompassing quality standards for healthcare service providers are forcing providers to re-evaluate and analyze their existing business processes and practices. These standards require the healthcare service to provide appropriate and relevant care, avoid patient complications, and collect information on illness/diseases, their treatment, and the results of the treatment providers. In addition, to ensure information quality, this information must also be collected and validated by the hospitals as the patient is treated, not after the fact. If healthcare providers fail to meet these standards, this may result in reduced reimbursements from government-funded healthcare programs. Healthcare service providers will also need to adapt to best treatment practices and other benchmarks that emerge from the mining of nationwide data that is being collected as part of the mandated standards [17,25,57]. Add to this list a litany of industry norms, state and local legislation and existing federal laws such as the Health Insurance Portability and Accountability (HIPPA) Act of 1996, the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 and a growing list of qualifying exceptions (and challenges) to the Health Care Affordability Act of 2009. In short, healthcare service providers need to reassess their business rules on a regular basis to ensure that they comply with the mandated standards and laws of today and best practices of tomorrow. This leads to important questions such as, "*What are business rules*?" and "*How to best manage them*?"

Whether we realize it or not, we're confronted with business rules (BR) numerous times on a daily basis. Take for example, a simple trip to the pharmacy. From a *competitive perspective*, business rules are structured around which drugs are offered at a sales discount, the duration of the discount, and conditions of the discount. From a *regulatory perspective*, business rules require restricted consumer access to certain drugs, prescribe which drugs can (and cannot) be shelved with other goods and define the allowable shelf duration of pharmaceutical products. From an *industry norms perspective*, business rules are used to designate certain types of check-out lanes, identify which drugs are placed near exits/entrances, and to establish return policies. From a *legislative perspective*, business rules dictate the sales tax rate on categories of drugs, require proof of age prior to the purchase of other drugs, and require a prescription from a licensed medical doctor prior to the purchase of still other drugs.

It is not difficult to imagine that a single item, such as a prescription strength liquid cough syrup may be affected by all of the above rules. There are more than 55,000 community pharmacies across the United States, dispensing (and managing) more than 3.6 billion annual prescriptions, at a retail cost exceeding $250 billion [13]. Pharmacies store and stock thousands of items with high turnover rates, impacted by hundreds of different business rules from a variety of

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sources. These rules are embedded throughout the store's point-of-sale systems, inventory systems, promotion systems, accounts payable, product placement systems and their associated business processes. This was a trip just through a pharmacy store. When one considers the volatility to which business rules are added or changed in the healthcare industry which transcend time-zones, seasons, information systems, statutory boundaries and channels (web, legacy, wireless or otherwise), the complexity of BR management can grow on an exponential basis.

1.1. Business rules management benefits

Fortunately, there has been some research and development to assist organizations with many of the technical challenges associated with business rules. In industry, for example, vendors such as ILOG SA, Blaze Advisor™ and Pega Systems, Inc. have been developing business rule engines (BRE) since the late 1980s and are now leaders in an emerging BRE segment [7,27]. In academia, the computer sciences and engineering outlets have been active in BR research, with extensive studies in rule programming, meta-modeling, rule mining, rules engines, business user interfaces and their role in services orientated architectures (SOA). Furthermore, joint academic and industry developed Object Management Group's (OMG) Semantics of Business Vocabulary and Business Rules (SBVR) standards (released in September 2006), which are intended to provide standards surrounding BR structure, terminology, classifications and meaning in BR authoring and repositories [51].

This research and development is beginning to pay-off. The BRE market has grown to a half billion U.S. dollars in annual product sales alone with more than 50 vendors worldwide [54]. The Business Process Management (BPM) market, that BRE products are traditionally closely aligned, has an estimated market size of $1.9 billion in annual sales and annual growth rate of 15% [55]. The drivers underlying this growth are the benefits enabled to organizations with effective BREs including improved interoperability [12], greater flexibility and control over deploying BRs across channels and systems, enhanced quality of BR updates, reduced cost and greater speed of implementing rule updates. Furthermore, the SBVR release provides a foundation for extending these benefits beyond the enterprise level and into supply-chains and industrial groups.

1.2. Research questions

Despite this substantial progress in business rules research, there has been little published in MIS academic outlets relating to the business rules topic and more specifically to managing BR developments and deployments. The research and development presented thus far is traditionally at a micro-level, pertaining to technical considerations such as rule engines, rule mining, rule authoring and interfaces. BR automation, however, is a quintessential example of the integration of business process, information technology and human interaction. Organizations need an understanding of the entire BR perspective and context from development through implementation. For example, the IRS recently spent a considerable amount of money and time in formal solicitation and evaluating bids from BRE vendors, only to realize during an audit of the bidding process by an inspector general that a BRE was not actually required for their business rules project and should have only been considered under certain conditions [36].

In another widely publicized BR project failure, the Government of Canada's CAN$300 million initial business rules project failure was due (in part) to front loading the project with a plethora of related (but out of scope) initiatives such as legacy systems modernization efforts [9]. Finally, Australia's Department of Family and Community Services found that 34 versions of a BR vendor's contract existed and had been changed 129 times. The estimated cost of project failure is AU$64 million [41].

As the business drivers for automating BRs in organizations continue to grow and the benefits of BR automation continue to be realized the need for viewing BR management at a higher contextual level and with a broader lifecycle perspective are mounting. Indeed, BR project management and implementation failures (such as those described above) are growing more commonplace in the absence of such studies. We seek to raise the level of discussion by considering the entire business rules management lifecycle with greater breadth, than depth and examining the larger context to which BR management fits in an organization. The underlying research questions include-

- *Does a general process or lifecycle exist that organizations follow when automating and managing business rules*?
- *What steps are involved and what effective practices can be solicited from these organizations to prevent project derailment*?

By utilizing a structuration lens, we explore these questions through a literature search, structured interviews and data collection from leading BR end-users, developers, and thought leaders. The study was conducted during two time periods (set 12 months apart) and the results synthesized, using techniques in structuration MIS literature to develop a business rules management lifecycle (BRMLC). The academic contributions include identification of initial BR research streams, highlighting distinctions between knowledge management versus business rules management lifecycles, extending structuration techniques into the BR area and describing the BR fit into the larger service science, management and engineering (SSME) research context with similar initiatives such as SOA, process management, workflows, web semantics and the management of BRMS. Managerial contributions include an understanding of how healthcare organizations can manage their BR automation implementations, a broader perspective of the full BRMLC from initiation through maintenance and how BR management fits into the larger enterprise-wide context.

2. A literature review of business rules management systems (BRMS)

A literature search was conducted to better understand the extent, type, and streams of BR related research. The formal search focused in MIS academic journals, with less structured searches in computer science and engineering related journals and the business press.

2.1. Literature review methodology

The primarily literature review encompassed academic MIS journals covering time periods from the late 1980's through 2008. This time period was selected to coincide with origins and developments of modern-day BRMS in academia and industry. The journals were selected based on their ranking and propensity to published articles relating to decision management and rules-based technologies. The manuscripts were coded and highlights of the literature review results are provided below.

2.2. Distinguishing BRMS

Modern-day BRMS has its roots in early artificial intelligence (AI), expert systems and more recently in knowledge management systems. Arguably, the mid to late 1980s is when the modern-day BRs segment began to distinguish itself from the AI and expert systems arenas. Researchers and developers began to realize the practical real-world applications of the initial artificial intelligence systems. Sheil comments in her 1987 article about the practical shortcomings

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