

AN INTEGRATIVE FRAMEWORK FOR THE TEACHING OF INFORMATION MANAGEMENT IN A BUSINESS CONTEXT

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ABSTRACT

As professional, academic and accrediting bodies have periodically reviewed the need for and content of foundational college curricula in information management, a broad-based consensus has emerged as to what is to be covered in the standard management information systems (MIS) course. Within U.S. business schools today, there is little debate over the need for MIS courses and the topics addressed therein. On the other hand, those who teach information management continue to face challenges in connecting their sometimes highly-technical subject matter to the rest of the business school curriculum and more importantly in winning over their students to the fact that MIS plays a central role in the successful operations and competitive standing of all organizations. This lack of connection manifests itself very clearly in the serious drop witnessed over recent years in business school student interest in MIS as a major area of study and as a post-graduation career option.

The purpose of this article is to present a framework for thinking about and teaching MIS that in the view of the authors better integrates the learnings of a MIS offering with the rest of the business school curriculum. The framework includes business needs, information requirements, and information systems elements. The objectives of this framework are three fold:

- 1. to more accurately relate the processes and technologies of information management to the operational, managerial, and strategic needs of the enterprise.*
- 2. to provide the student with a lens through which to better appreciate the connections between the effective deployment and use of MIS and the realization of the organization's goals and objectives.*
- 3. to better enable the team of instructors who typically teach these courses within a business school program to provide a uniform and substantive MIS learning experience for their students while at the same time allowing individual instructors flexibility in their coverage of course materials.*

To these ends, the authors provide a historical context for the creation of their integrative learning and teaching model, an explication of the model itself, and then several illustrations of the application of this model in the teaching of representative business cases. We also outline course, student, and instructor-related benefits of employing the framework.

INTRODUCTION

The accrediting body for U.S. business schools (the Association to Advance Collegiate Schools of Business - AACSB) has mandated that all

undergraduate business programs must offer at least a single introductory course in information management (Stephens and O'Hara, 2001; Foltz, O'Hara, and Wise 2004; Gorgone, et al., 2006). Given the critical role that information

management plays in organizations of all sizes and descriptions, there is little debate on this point. Over the years, various professional and academic bodies have studied and offered recommendations as to what such a course should include (Ives, et al., 2002; Cater-Steel, et al., 2004; Beachboard and Parker, 2005; Andriole, 2006; Gorgone, et al., 2006; Wang, 2007, Kesner 2008). More recently studies of employer and post-graduate student assessments of these curricular designs have emphasized the need for a greater focus on the development of student data analysis, project management, and interpersonal skills but have not otherwise seriously challenged these course content models (Romm and Pliskin, 2000; Sirias, 2002; McGann and Cahill, 2005; Johnson, Bartholomew, and Miller, 2006; and Wang and Wang 2011). Similarly, even a summary review of MIS textbook offerings will confirm that the authors of these volumes pursue a fairly consistent scope of coverage, supplementing traditional textbook materials with videos, interactive case studies, and automated learning exercises (Kroenke, 2010; Laudon and Laudon, 2010; O'Brien and Marakas, 2010; Rainer and Cegielski, 2012).

These textbooks are not without their critics (Changchit, Cutshall and Gonsalves, 2006; Chen, 2006; Mallach, 2006; Harper, Lamb and Buffington, 2008), but overall they represent a clear consensus as to what a standard business school MIS course ought to include. Although the high level topic challenges to information management course relevance, content, and design are largely behind us, MIS educators still face any number of formidable barriers in the delivery of their subject matter to students.

The first and perhaps the most formidable of these is that - despite the technological savvy of current students - student appreciation of the information management resources and tools at their disposal is rather limited. They are engaged but not enlightened users of MIS. For many of these students, the subject of MIS signifies a technical field that does not connect with many of their other business school classes and even less with their personal interests and career plans. Indeed the precipitous decline of U.S. university students majoring in information management-related fields has caused concern among professional associations and employers alike (Abraham, et al., 2006; Chrysler and Van Auken, 2006; Smith, Salaway, and Caruso, 2009). How

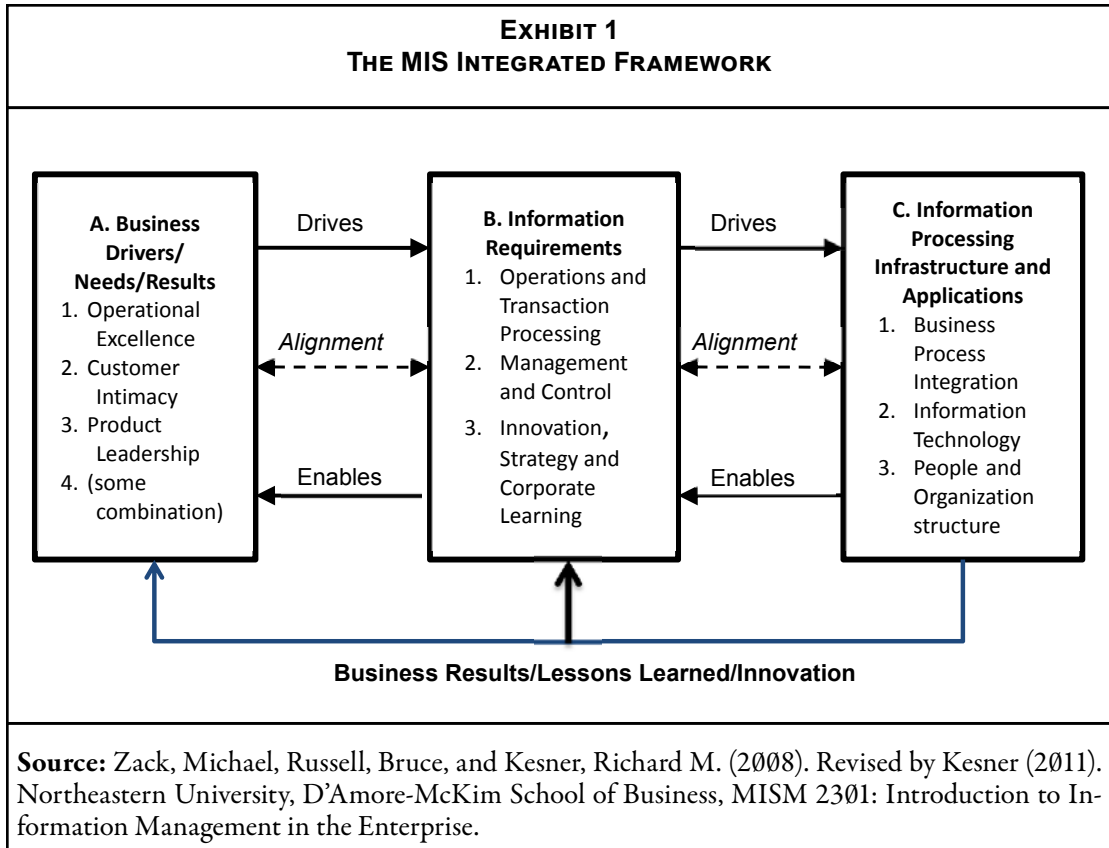
might educators more effectively associate the meaning, role, and importance of information management with the rest of the business school curriculum, and as a desired outcome draw more students into information management-related careers?

In contemplating these issues, Professors Mike Zack, Bruce Russell and Richard Kesner, a faculty team at Northeastern University's (NEU) D'Amore-McKim School of Business (DMSB), concluded that what was needed in MIS teaching was a learning framework that better connected information management thinking with the greater business goals and objectives of the enterprise. Such a framework would draw heavily on the substantial work of others, and in particular that of Michael Porter, Michael Treacy, and Fred Wiersema (Porter, 1985; Treacy and Wiersema, 1997), while providing a lens through which to better understand the complex relationships among a business' goals, its information needs, and its choices among an array of MIS solutions. This lens would then serve as the integrative element for viewing and filtering knowledge about organizations and their MIS practices. Furthermore, given the practical needs of Northeastern and other university programs to offer multiple iterations of the standard MIS course, some of which are necessarily taught by adjunct instructors, this integrative framework could also serve as a unifying element in the delivery of a common learning experience across the multiple sections of a MIS course offering.

In the article that follows, the authors chronicle the evolution and current form of the Northeastern *MIS Integrative Learning Framework* as employed in the teaching of its business school's MIS courses. (See *Exhibit 1*). After documenting the framework itself, the authors apply the Framework in the teaching of four representative MIS case studies drawn from Northeastern's introductory course - MISM 2301. We conclude with an assessment of teaching outcomes in employing the Framework.

AN INTEGRATIVE LEARNING FRAMEWORK FOR INFORMATION MANAGEMENT

Turn to any established information management textbook and you will find any number of frameworks for the study of MIS content. The authors of this article take no exception to any



of these approaches other than to suggest that many of these frameworks tend to be more heavily weighted towards the consideration of information technology than they are towards business processes and the operational, managerial, and innovation needs of the enterprise (Kroenke, 2010; Laudon and Laudon, 2010; O'Brien and Marakas, 2010; Rainer and Cegielski, 2012). In the same vein, these published works are replete with case studies that attempt to connect real-world situations to textbook content. Many of these stories pertain to large, global enterprises and to their respective successes in the deployment of IT systems. Some of these cases are dated; others misrepresent what actually happened; and still others do not necessarily align with the particulars of the course content addressed in the textbook narrative but most of all they do not sufficiently bring the real world into the classroom (Cannon, et al., 2004; Mallach, 2006; Janicki, Fischetti and Burns, 2007; Abrahams, 2010; Ajendla 2011; Han and Rienzo, 2011; Hepner and Swanson, 2011).

After considering the costs and benefits of using some standard textbook for Northeastern's

introductory information management course, the MIS faculty have settled on the authoring and use of their own customized case studies – about twenty-five in all – that consider a diverse spectrum of enterprise types and business contexts. In so doing, we have joined other colleagues who bring their own real-world business experiences to bear in the teaching of MIS. (Fox, 2002; Green, 2002; David and Comeau, 2004; Kumar, 2006; Kesner and Russell, 2008; Lucas, et al., 2009) The NEU/DMSB library of home-grown case studies covers well known organizations (e.g., Progressive Insurance, Amazon.com, and Boeing). The case study library also includes lesser known not-for-profit organizations (e.g., Young Audiences, Inc., and Partners Health-Care), retailers and wholesalers (e.g., PepsiAmericas), and global engineering-oriented enterprises (e.g., Brose Automotive, and CDM/Smith, Inc).

Though each case study in question is tailored to align with the subject for that class session (e.g. computer software, decision support systems, information security, et al.), the revised course still lacked an integrating framework that brought all of the subject matter together. To address this

major shortcoming, a team of NEU/CBA faculty that included, Mike Zack, Bruce Russell, and Richard Kesner, came together to devise a heuristic tool that would close this gap. It was from this effort in 2007 that the current *MIS Integrative Learning Framework* was born.

The framework itself draws on several seminal works in the literature as well as the extensive professional experiences of its authors, all of whom worked in industry before joining the ranks of academe. First among our inspirations was provided by Michael Porter through his value chain model, (Porter, 1985) which speaks to the integrated nature of core business processes within the enterprise and therefore the inter-relatedness of the information used and generated by these processes. Porter also identifies information technology as one of the supporting structures of the modern organization and the pathway through which vital information passes from one core process to another. The Porter model has stood the test of time and remains an excellent lens through which to study the design and operation of complex enterprises.

If Porter's work speaks to the need to connect the functions and information of business operations to one another, Michael Treacy and Fred Wiersema's work on the discipline of market leaders serves as yet another key stimulant in the creation of our integrative model. (Treacy and Wiersema, 1997) In their book on market leadership, Treacy and Wiersema posit that successful enterprises focus on one of three core competencies: operational excellence, customer intimacy, or product leadership. An operationally excellent business is one that focuses on low-cost, error-free transaction process in the delivery of products and services to its customers. Wal-Mart, Amazon.com, Bank of America, and Progressive Insurance are examples of companies who thrive in this space.

By comparison, customer intimate organizations focus on anticipating the individual and personal needs of the customer, and effectively providing very tailored and customized products and services to meet those needs. In this category one would place the services of doctors, lawyers, financial planners, architects, and boutique clothiers. The final category of the Treacy/Wiersema model includes those firms that emphasize product or service innovation as their competitive objective, a grouping that would include such organizations as Apple and 3M, but also most

advertising firms, consulting practices, and of course institutions of higher education.

In applying the Treacy/Wiersema to information management, the NEU team considered the relationship between an organization's particular competitive competency (i.e. either operational excellence, customer intimacy, product leadership, or some blend thereof) and its information needs. These needs occur at three levels, namely the information required to transact (operate) with the customer, to manage and control operations, and to innovate and transform the organization for competitive advantage. We found that it was relatively easy to get undergraduate students to identify the competitive competency of an enterprise featured in one of our case studies, but more challenging to get them to differentiate the ways that an organization employed information at the three levels mentioned above to help realize that competitive competency. And yet, it was the student's ability to connect the strategic business needs of the organization to its information requirements that we saw as a critical take-away from our introduction to information management course.

Indeed, by characterizing a tier approach to information use within the enterprise, we encourage our students to better understand the enterprise at three levels of information processing needs: transacting, managing, and innovating.

1. **Transacting:** How does the organization operate? What processes do its workers execute to create value? What information do they need to succeed in these operational processes? Here we stress the use of information to operate the company more efficiently and effectively. To operate effectively and efficiently individual workers must have access to information that enables them to fulfill customer requests accurately, comprehensively, and in real-time. Before information systems, it would have been impossible to gather this comprehensive information along these lines in a timely manner.
2. **Managing:** How does the organization maintain control? What processes do managers engage to assess corporate value creation and performance? What

information do they need to succeed in these tactical processes? Here we explore the use of information to inform how we are doing relative to our expectations. To maintain control, managers need to know whether the organization is performing better or worse than expected (“are we doing things right”). Managers can then take appropriate action to correct any problems. Before information systems it would have been almost impossible to get this kind of integrated information in time to take effective corrective action.

3. **Innovating** (corporate learning, transforming and competing): How does the organization learn? What processes do leaders initiate to identify new streams of value? What information do leaders need to succeed in these transformational (or strategic) processes? Here we emphasize the use of information to provide feedback regarding the results of research and experimentation (“are we doing the right things”). To facilitate learning and transformation requires the ability to measure the outcomes of experiments rapidly and continually - and this can be done efficiently and effectively only with use of information systems.

Identifying and understanding these connections does not come easily to the undergraduate student whose exposure to the real working world is somewhat limited. Through the repetitive use of the framework across numerous business case studies over the duration of the academic term, the student develops a clearer understanding of the connections between the goals of the business and its information needs, as well as the ability to apply our model in any business setting that he/she might encounter in the future. Note too that up to this point our approach has not taken up the question of the role of specific information technologies within the enterprise. Instead our conversation with students has focused on the requirements of the business and its uses of information more generally.

With these connections firmly established, case study discussion in class may next move towards a consideration of how the required information is collected, aggregated, analyzed, and shared across the enterprise. Here the emphasis is first on the organization’s core business processes and then upon the enabling information processing infrastructure (people, processes and IT) that complement those core business processes. This approach lends itself towards emphasizing the need for alignment between business processes and their supporting application-specific software and a number of other key learnings that are not at all apparent to students with only limited corporate work experience, including:

- a core business process may be supported by any number of application-specific software products;
- these software products clearly align with one or more components of the process;
- more often than not, these information systems must pass data to one another as part of the business process that they enable; and
- any given information system may serve the information needs of the enterprise at any or all three levels, i.e. transacting, managing, and innovating.

While these observations may be all too apparent to our readers, we found that they were revelations to our students.

In aligning particular corporate business processes and their associated information systems with the three tiers of enterprise information processing needs, we complete our integrative model as depicted in *Exhibit 1*. As drawn, the *MIS Integrative Learning Framework* represents a closed loop of activities. From right to left, the organization’s business needs *drive* its information requirements - that in turn drive investments in business process design, information technology, people, and organizational structures. We recognize the role of environmental influences on organizations, but include those influences in the business demands of the organization and the organization’s strategic response.

From left to right, the *MIS Integrative Learning Framework* indicates that effective processes, information systems and so forth *enable* the collection, manipulation and sharing of information

that in turn enables the business to achieve its goals and objectives. When all of these moving pieces are properly integrated, then organizational alignment is expected. In the absence of the right choices regarding business demands, information requirements, or information systems investments, then misalignment and corporate dysfunction is expected. To reinforce the fact that this framework reflects dynamic activities, we added a flow at the bottom labeled “business results and lessons learned.” The framework does not assume that business processes are autonomic (i.e., not self-correcting), but that organizational leadership will refocus goals and refine business processes according to information gathered at the transacting, managing, and innovating levels.

As a teaching approach the *MIS Integrative Learning Framework* offers four benefits. The first benefit involves parsimony. Like its predecessor Porter and Treacy/Wiersema models, it takes a complex set of organizational dynamics and summarizes them - while at the same time emphasizing the most important elements of those interactions. The second benefit involves internal validity. For our introductory MIS course, whose main themes are alignment, integration and innovation within the enterprise, the framework fits perfectly and reflects all three of these themes. The third benefit involves external validity. As a template, the framework may be readily applied to each and every case study in the course without forcing the issue or seeming repetitive - a point the authors will demonstrate below as we employ the framework in the teaching of four different case studies. The fourth and last benefit involves flexible conformity. The framework serves as a mechanism to ensure that our part-time faculty members cover a common body of content - while still affording individuality in addressing the particulars of the course syllabus.

APPLYING THE INTEGRATIVE LEARNING FRAMEWORK

In this section, the authors employ our *MIS Integrative Learning Framework* in the teaching of four representative case studies that appear in NEU/DMSB *MISM 2301, An Introduction to Information Management in the Enterprise*. This course is typically offered through twenty-four class sections each academic year, reaching approximately one thousand business school undergraduates annually. Most of the students

taking *MISM 2301* are second or third year students, only 30-35% percent of whom have had their first co-operative experience working for an off-campus employer prior to taking the course. The four cases below help highlight the four benefits noted above (parsimony, internal validity, external validity, and flexible conformity). The cases are listed below in accordance with their sequence in the *MISM 2301* course schedule in order to highlight the progressive level of sophistication in student learning that the framework facilitates.

The Case of Progressive Insurance A Study in the Use of Computer Hardware

Introduction: The *Progressive Insurance Case* is employed in *MISM 2301* as the case study for the class session concerning computer hardware and its business-related benefits. As such it is one of the early cases where the framework is employed as part of the teaching process. This case was adapted by Prof. Mike Zack from the “The Check is in the Car,” *Business 2.0*, article July 2003, pp. 44-45. It was subsequently revised by Professor Richard M. Kesner for use in the standard course template used by *MISM 2301* instructors.

The Case Study: If you’ve ever been in a car accident, you know how it feels to wait for your claim payment to arrive. Insurance companies love to hold the money as long as possible to keep every penny of interest. Progressive Insurance is the notable exception to the industry rule. It tries to pay as quickly as it can - by getting claims adjusters out of the office and onto the street where they can interact with clients. The logic behind such a radical notion? Happier customers and more productive claims reps will more than make up for the lost interest revenue.

At Progressive, that radical notion is based on its “immediate response vehicles” (IRV’s) - a fleet of SUVs loaded with enough communications gear - laptops, printers, and cell phones - to allow adjusters to settle claims right at the scene of the accident. That’s a big improvement over the scenario that still pervades the industry, namely: to wait a week or two to see the car and make hand written notes, snap photos, drive back to the office, type it all into the mainframe computer, and issue a request for a check.

In 1993, the IRV initiative involved just 10 adjusters in Florida. By 2003 more than 18,000

mobile claims reps shared a fleet of 2,600 IRVs. Not only did the program help improve customer retention by 20% last year; it has helped Progressive shave labor costs. Progressive's mobile adjusters can handle nearly twice the workload they could a decade ago. IRVs have also helped revenues climb from \$1.8 billion to more than \$9 billion during that period.

A wireless laptop provides around the clock access to Progressive's mainframe computer. An adjuster can type a claim while sitting in a body shop and go over it with the policy-holder right on the screen. The laptops also let agents use fax machines around the country as printers when a satellite office needs a hard copy instead of e-mail.

Agents spend hours every day talking to clients, auto shops, and other adjusters on their cell phones, but it's the two-way radio feature that gets the most use. Dispatchers monitor agents' locations, sending the closest adjuster to investigate a scene. Digital cameras let agents snap as many pictures as they need, upload them to Progressive's computers for storage, and share them with managers if necessary. Some adjusters even film short videos that are used to document traffic patterns at accident prone intersections. Each IRV includes an ink-jet printer to spit out paper copies of estimates, claims, and, of course, checks.

The Application of the MIS Integrative Learning Framework: In teaching the Progressive Insurance case, we employ our framework in several different but related ways. First we use it to introduce the company to the class by asking students to identify Progressive's key business drivers and success factors. We then ask them to identify the information needs of the company in terms of the three processing levels listed in the middle box of the framework. With this conversation as context, we have the class walk through the various steps in Progressive's IRV-enabled claims process, identifying among other things the information needs and the enabling computer hardware employed in each process step.

We then return to the framework (see *Exhibit 2*) where we review the connection between the deployment of well-integrated, low-cost computer hardware in the IRV and the IT-enabled collection of information at the transactional, managerial and innovational levels within the enterprise's claims process. Our goal here is to get our students to associate the aligned investment in computer hardware with the realizations of

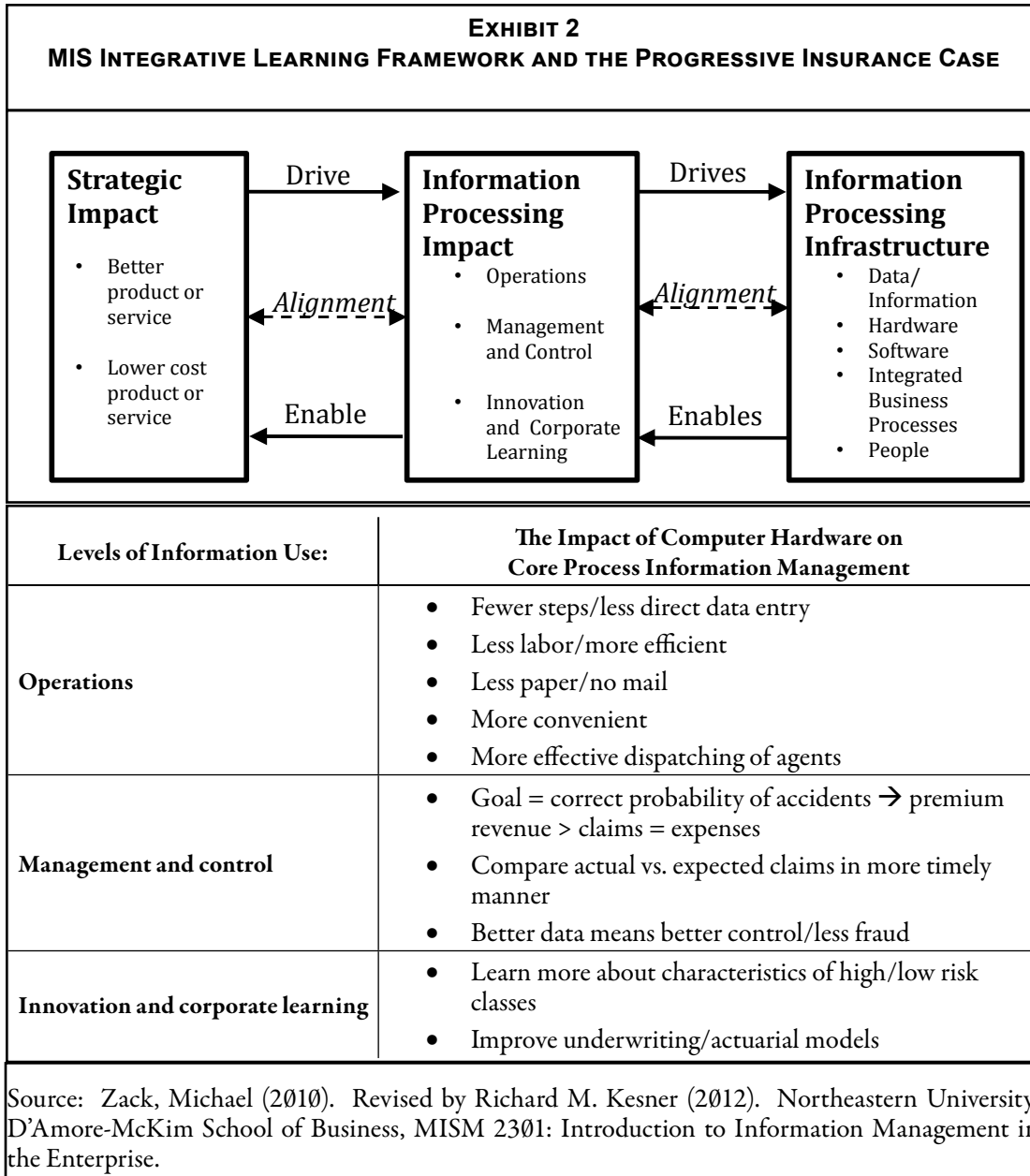
Progressive's business goals and objectives. Given the early positioning of this case in the course syllabus, the instructor typically leads the students through this exercise but because the case itself is so accessible, students are already building their skills with and appreciation of the framework as a learning tool.

The Case of Brose Automotive A Study in the Use of Enterprise Systems

Introduction: The *Brose Automotive Case* is employed in MISM 2301 in the first class session devoted to the use of enterprise software within a global enterprise. This case initially drew upon a 2004 Brose news release www.brose.de/en/pub/company. It was subsequently revised in 2010 by Professor Richard M. Kesner, drawing upon www.brose.firmenverzeichnis, for use in the standard course template used by MISM 2301 instructors.

The Case Study: The Brose Group supplies windows, doors, seat adjusters, and related products for more than 40 auto brands. Major customers include General Motors, Ford, DaimlerChrysler, BMW, Porsche, Volkswagen, Toyota, and Honda. Founded as an auto and aircraft parts manufacturer in Berlin in 1908, the company today has facilities in more than 48 locations in 25 different countries and including a world-wide workforce of 14,000 employees. Revenues for 2009 exceeded 2.6 billion euros.

In the 1990s, Brose enjoyed rapid growth- some of it coming from the acquisition of existing companies and some of it coming from the organic expansion of Brose's own facilities. As it grew Brose inherited or acquired a wide range of functional software applications; including accounting, human resources, manufacturing, and supply chain management applications. But as their business grew and became both more complex and more interdependent, Brose Group management found that existing information systems were unable to support the company's emerging operational, control, and planning/innovation needs. Too many different information systems meant a lack of standardization and hampered communication among suppliers, plants, and customers. Brose decided to standardize operations on R/3, an ERP application licensed by SAP that supports more than a thousand different business processes. There were distinct advantages for the corporation in making this choice:



1. The SAP suite of enterprise software applications aligned nicely with Brose business processes – although in a number of instances Brose reengineered and standardized established business processes to make better use of SAP ERP capabilities.
 2. The SAP package afforded better oversight and measure of Brose business processes through real-time report and process value chain integration.
 3. The software suite also allowed Brose to accumulate comprehensive and accurate data about key processes and business performance that was subsequently employed to learn about organizational weaknesses and best practices (leading to process improvements and better enterprise business forecasting and long-term planning).
- Brose's conversion of its core information management systems to the SAP ERP system has contributed to dramatic improvements in enter-

prise-wide productivity. In 1994, Brose achieved sales of 541 million euros with 2,900 employees, or 186,000 euros per employee. Ten years later, in 2004, Brose attained sales of 2 billion euros with 8,200 employees, or 240,000 euros per employee. In terms of expenses, over its lifetime the ERP adoption also lowered the total cost of information management and information technology investments. And in 2009, despite a world-wide economic downturn and the nearly doubling of its size, the Brose Group has maintained these impressive numbers.

In terms of the formidable challenge in implementing SAP across Brose, the Brose/SAP consulting team decided on a pilot approach. The first installation was conducted at a new plant in Curitiba, Brazil. The team constructed the implementation to be used as a prototype for installations at additional plants. Developing the first implementation was no small feat, because it involved information systems for sales and distribution, materials management, production planning, quality management, and financial accounting and control. Once the initial system was operational at the Curitiba plant, the prototype was rolled out to additional facilities. The second implementation, in Puebla, Mexico, required just 6 months for first operational capability, and the next implementation in Meerane, Germany, was operational in just 19 weeks.

The Application of the MIS Integrative Learning Framework: As with many of the case studies employed in MISM 2301, our students are obliged to read the Brose case in advance of the session and to answer a series of questions, including what does Brose do and what factors are critical to its success. They are also asked about the role of information resources in enabling operations, management, and competitive advantage at Brose. This preparatory work facilitates the initial case discussion that focused on relating what the class knew about Brose to the three elements represented in the framework.

At the next level of analysis, the class drilled down on particular roles within the Brose organization- including those of the chief financial officer, the directors of procurement and logistics, a typical factory manager, and the vice president of human resources. For each of these roles, the instructor asked the class to identify the responsibilities of each job, the information required to perform that role, and the Brose source informa-

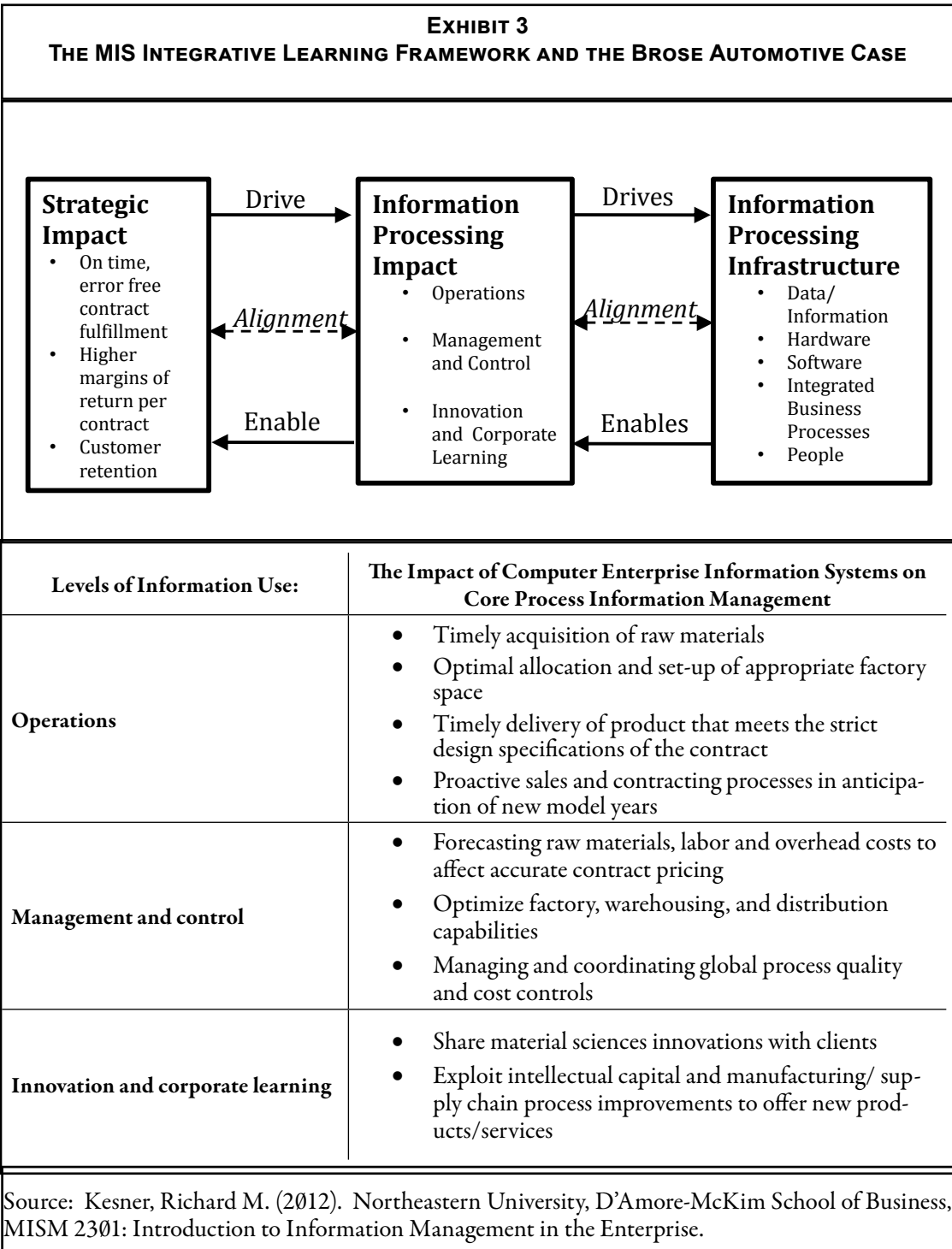
tion systems. The point here was to get the class to appreciate the interconnectedness of these various functions within Brose and their need to share information. Once the description of each role was detailed on the chalk board in class, it was easy for all to see the connections. The high level learning from this particular conversation is summarized below (and in *Exhibit 3*).

- To succeed Brose needed to ensure the alignment of its information systems with particular business functions and the core needs of the organization.
- It was critical that Brose operations and management could access and share information across global geographies.
- It was also critical that Brose integrated its business processes and therefore the information required for/generated by these processes.
- The deployment of single (standardized) information systems across numerous company functions and departments enabled significant improvements in process coordination and information sharing.
- These same systems provided the measurement mechanisms needed for process improvement, optimization of resources, and risk management.
- Finally, the data generated by these systems provided the means for near- and long-term forecasting of product and process costs so critical to the success of Brose's contract negotiations with customers.

The reader will hopefully agree that these are fairly sophisticated observations coming from students without any real hands-on experience within a global supply-chain-driven enterprise. Our framework clearly contributed to their ability to draw these and similar conclusions from a facilitated discussion of the case study.

The Case of CDM/Smith, Inc. A Study in the Use of Knowledge Management Systems

Introduction: The *CDM/Smith Case* serves several purposes within the MISM 2301 curriculum. It introduces students to a different type of business – an engineering/consulting firm. It



provides a context for the consideration of a topic that is somewhat remote from the undergraduate student experience, namely: the process of knowledge management. Also, it nicely reinforces the need for the system alignment, integration, and innovation to strengthen the overall performance of the enterprise. Professor Kesner's asso-

ciation with CDM, Inc. (then Camp, Dress, and McKee, Inc.) goes back to 1992. In consultation with this global environmental engineering firm, he assisted in the evolution of their MIS organization (Kesner 1996). Since then he has worked directly with CDM/Smith on numerous decision support and knowledge management proj-

ects - including those described in the case that follows. In 2011, Professor Kesner developed the *CDM Case* for used by MISM 2301 instructors.

The Case Study: CDM was founded as a partnership in 1947 by Thomas R. Camp, Herman G. Dresser, and Jack E. McKee. In its early years and throughout the 1950s, the partnership established its reputation in New England as an engineering practice specializing in water supply and water pollution control. Many early clients in Maine, New Hampshire, and Massachusetts remain CDM clients today. In the 1960s, CDM expanded globally and in 1970 moved from a partnership to a corporate governance model.

During the 1980s, while continuing to build on its traditional base of water and wastewater expertise, CDM made an entry into the hazardous waste management field as a program manager for one of the Environmental Protection Agency's first major Superfund contracts. To meet the unique service and contracting requirements of work in the federal sector, CDM established a wholly owned subsidiary, CDM Federal Programs Corporation, in 1986. These developments were followed in the early 1990's by a move from delivering consulting services into more extensive design-build, construction, and general contracting projects. At the same time, the firm expanded its capabilities in transportation, operations, information management, and geotechnical services. Today, CDM is a consulting, engineering, construction, and operations firm providing exceptional service to public and private clients worldwide. The firm has about 4,500 employees across 100+ offices globally, and annual revenues of more than \$1 billion. As a professional services firm, CDM is an intense user of information systems and related technologies but even more so, the firm prides itself on hiring and retaining the best and the brightest scientists and engineers in the field of environmental engineering. Each year CDM executes from 4-6,000 projects for its clients – some costing \$10,000's and lasting but a few weeks, other worth \$100's of millions and running over several years or even several decades. It is paramount to CDM's success as a consulting/engineering firm that it achieves the following:

- identify best practices in the execution of projects;
- leverage its engineering knowledge across its global portfolio of engineering projects;

- continue to refine, clarify, and validate its technical knowledge;
- establish discrete project teams for each new client assignment that bring to bear the most appropriate expertise from across the firm;
- mentor incoming junior engineers; and
- monitor all projects to moderate project risk and achieve the most positive outcomes in terms of the quality, timeliness, and cost-effectiveness of client deliverables.

Initially, CDM's knowledge management practices were not particularly formalized. New hires received orientation training and were assigned to local mentors in their assigned office. A corporate library housed CDM publications on technical subjects and each field office maintained a library of what they deemed best-practice client deliverables (e.g. reports, studies, drawings, and the like). This approach worked well enough when the company was small and most employees knew one another. But as the firm grew in the late-1980's and 1990's, this informal approach proved untenable. To reach out, the staff employed "Dispatcher," literally an e-mail with an engineering or scientific question address to the entire firm requesting input. For years, Dispatcher served as the firm's primary knowledge-sharing platform.

In more recent years, the firm has institutionalized communities of practice, creating two dozen or more so-call "Technical Disciplines." Each Technical Discipline focuses on a body of knowledge (e.g. waste water management, soil reclamation, geophysics, drinking water management, and so forth) and maintains its own Intranet portal of explicit knowledge complete with a library of specific management, trade, and technical content, as well as guidelines, frameworks, case studies, templates, and examples of best practices. All content housed on each site is vetted by so-called "technical experts," who are senior members of their respective Technical Discipline communities. These portals also facilitate the sharing of tacit knowledge through discussion forums, meeting and conference event notices, Technical Discipline e-mail accounts, and a directory of contact information on technical experts.

CDM has for many years maintained Oracle's e-Business Suite as an enterprise resource planning

(ERP) system for operations and project management. This software suite monitors the data generated for project delivery, resource consumption, expense generation, profitability and the like. To this set of systems, CDM has now added econometric modeling to measure and assess individual project performance against live project data drawn from the firm's aforementioned ERP system. This decision support platform assesses patterns of performance across the thousands of projects executed by the firm annually and employs this data to monitor and as necessary revise corporate processes and reassess Technical Discipline and overall project management best practices. In this manner, best-practices knowledge is applied, measured against actual project delivery outcomes and then continuously improved and reapplied to work processes.

The Application of the MIS Integrative Learning Framework: The initial challenge with this case is that its business context is fairly inaccessible to most undergraduates. As a global environmental engineering firm, running projects mostly for government agencies of one kind or another, and competing for work through request for proposal (RFP) responses, CDM is very different from other ventures that business school students might encounter. And yet the CDM business model, their core processes, and their need to manage firm intellectual property (IP) offer a rich context for course discussion and learning.

In this instance, the framework helps to introduce the students to a firm that competes on product and service leadership and whose competitive advantage is based almost entirely on the track record of its engineers, scientists, and project managers (See *Exhibit 4*). The information needs of CDM revolve around two separate but related bodies of content. On the one hand, project delivery entails access to and the use of the deep scientific and technical knowledge of CDM engineers and scientists. On the other hand, it concerns access to project performance data; work schedules, Gantt charts, bills of materials, project budgets, and the like. The latter content resides in the firm's enterprise resource management systems (i.e., ERP) for finance, human resources, and project management. The former knowledge content was not as easily captured and managed through IT until the firm established a series of knowledge portals on the corporate Intranet as supplemented by various social networking tools. The CDM case addresses the

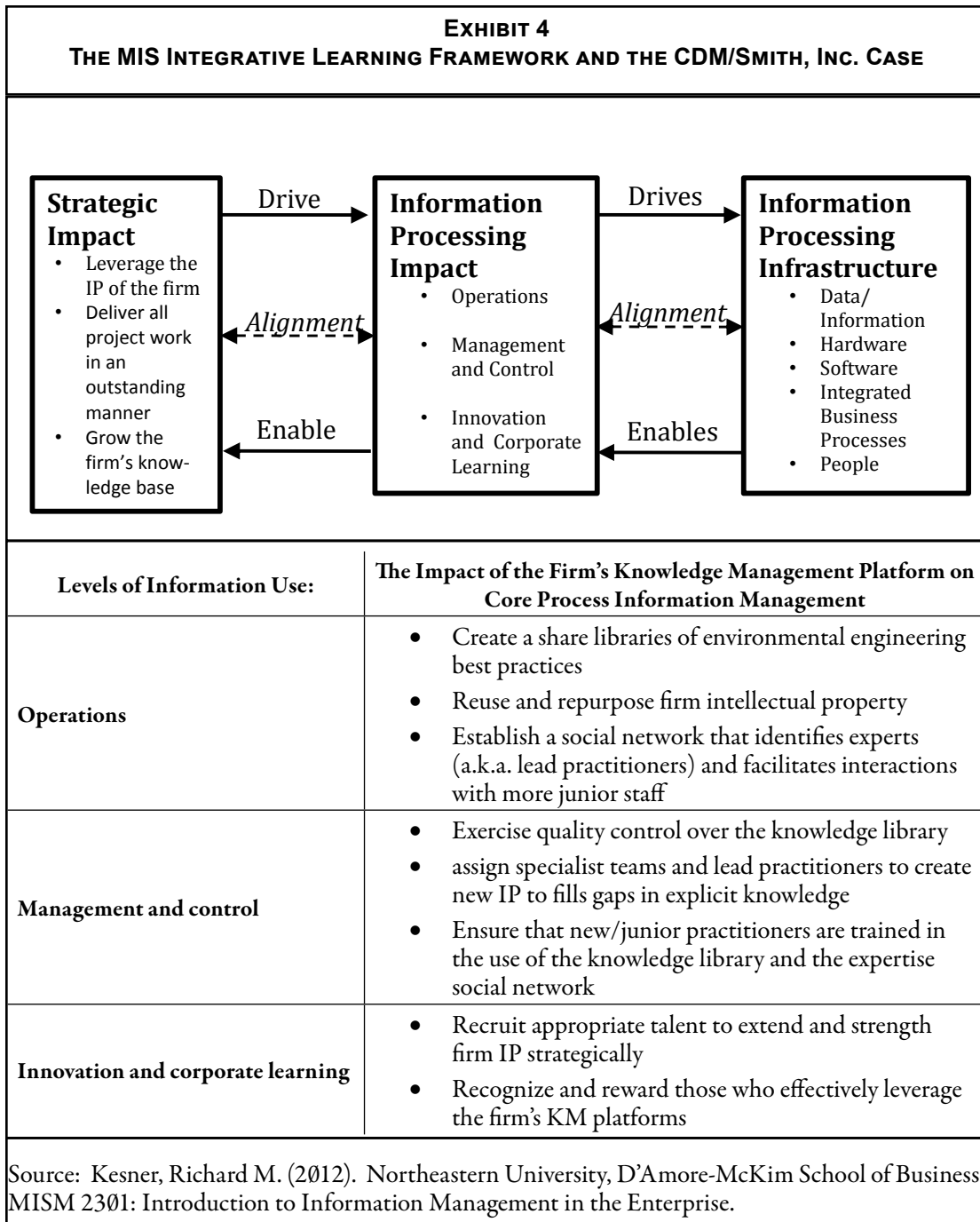
more challenging task of managing the technical knowledge of CDM personnel and the specialized information systems in place to facilitate the capture, documentation and exchange of both explicit and tacit knowledge.

The framework helps the course instructor and his/her students to isolate the information needs of the engineer operating within a project team, the project manager overseeing project delivery, and corporate management balancing the overall profitability and risks of CDM's project portfolio. As with the other cases discussed in this article, our focus in these discussions is on the core business processes of the firm and their associated information needs. From here we would move into a consideration of the respective roles of CDM's knowledge management and ERP systems in satisfying these needs.

The Case of PepsiAmericas A Study in the Use of Data for Corporate Transformation

Introduction: The *PepsiAmericas Case* is employed towards the end of MISM 2301 when we address the subject of decision support systems but might be used at other junctures as well since it so beautifully illustrates the transformational role that effective information management can play within the enterprise. The original case study comes from MIT's Center for Information System Research (CISR) which regularly publishes outstanding studies concerning the role of information systems in business. Their PepsiAmericas white paper is a fine example of this genre (Beath and Ross, 2010). Professor Richard Kesner employs the complete case in his graduate MIS course and has also adapted the case below for use in MISM 2301.

The Case Study: PepsiAmericas (PAS) is the world's second largest manufacturer and distributor of Pepsi beverages, operating in nineteen mostly Midwestern states in the U.S. (69% of sales), central and Eastern Europe (26% of Sales) and the Caribbean (5% of sales). Net sales in 2008 totaled nearly \$5 billion or 20% of PepsiCo's total US beverage sales. In 2009 a recession hit the U.S. economy, but PepsiAmericas was also faced with two more important long-term challenges: (1) a declining U.S. market for carbonated soft drinks, and (2) increasingly powerful retailers who were squeezing PAS profit margins. In addition, PepsiAmericas product line had moved



from 35-40 products in the mid-1990's to nearly 400 products by 2009.

These developments forced PepsiAmericas to embrace a completely new operating model. In the past, distribution was handled by the local delivery person, who "owned" a particular route of retail customer stores. The delivery person would load his/her truck in anticipation of what was needed at each of his/her assigned locations.

Over time, the delivery person knew what to expect and could pretty much address customer needs on a day-to-day basis. However, as Pepsi moved from 35 to 400 products and as the packaging for these products became less uniform, it proved difficult to know about, let alone carry the right mix of products in the truck. Furthermore, chains like Wal-Mart, CVS Drug Stores, and Mobil Gas Stations, preferred centralized

procurement processes and annual, national contracts. Pepsi was therefore obliged to create a three-tier distribution platform that would address the needs of these large national and regional customers while serving the needs of their established local customer model.

In response to these pressures and challenges, PepsiAmericas invested heavily in supply-chain management (SCM) and manufacturing enterprise resource planning (ERP) systems. With these systems the firm integrated its core business processes (i.e. procurement, manufacturing, selling, and warehousing and distribution) and automated data capture at every key step along its value chain. To PepsiAmericas, one of the biggest benefits of its ERPs was the collection and measurement of business process outcomes for better management, control and planning of large and complex business processes. The company used these rich data resources and related process knowledge to negotiate better contracts for raw materials, lower supply chain operating costs, more accurately monitor consumer demand, and ultimately strike more profitable deals with its large retail customers. In effect PepsiAmericas employed customer data as a competitive asset, collecting vast amounts of data as part of daily operations (transacting) and then employing that data for management and control - as well as for innovation in product development and customer service.

This transformation process was dubbed the "Customer Optimization to the 3rd power – Planning + Selling + Delivery" program and was intended to reduce inventory management issues, increase productivity across PepsiAmericas' production platforms, and improve overall customer service. For example, national customers, like Wal-Mart, fed point-of sales data directly into PSA's distribution system, informing the detailed product mix and quantities going from PSA to particular sales locations. And at the other end of the spectrum, those PSA employees serving small local stores employed detail historical sales data to forecast the requirements and to provide the right daily mix of products.

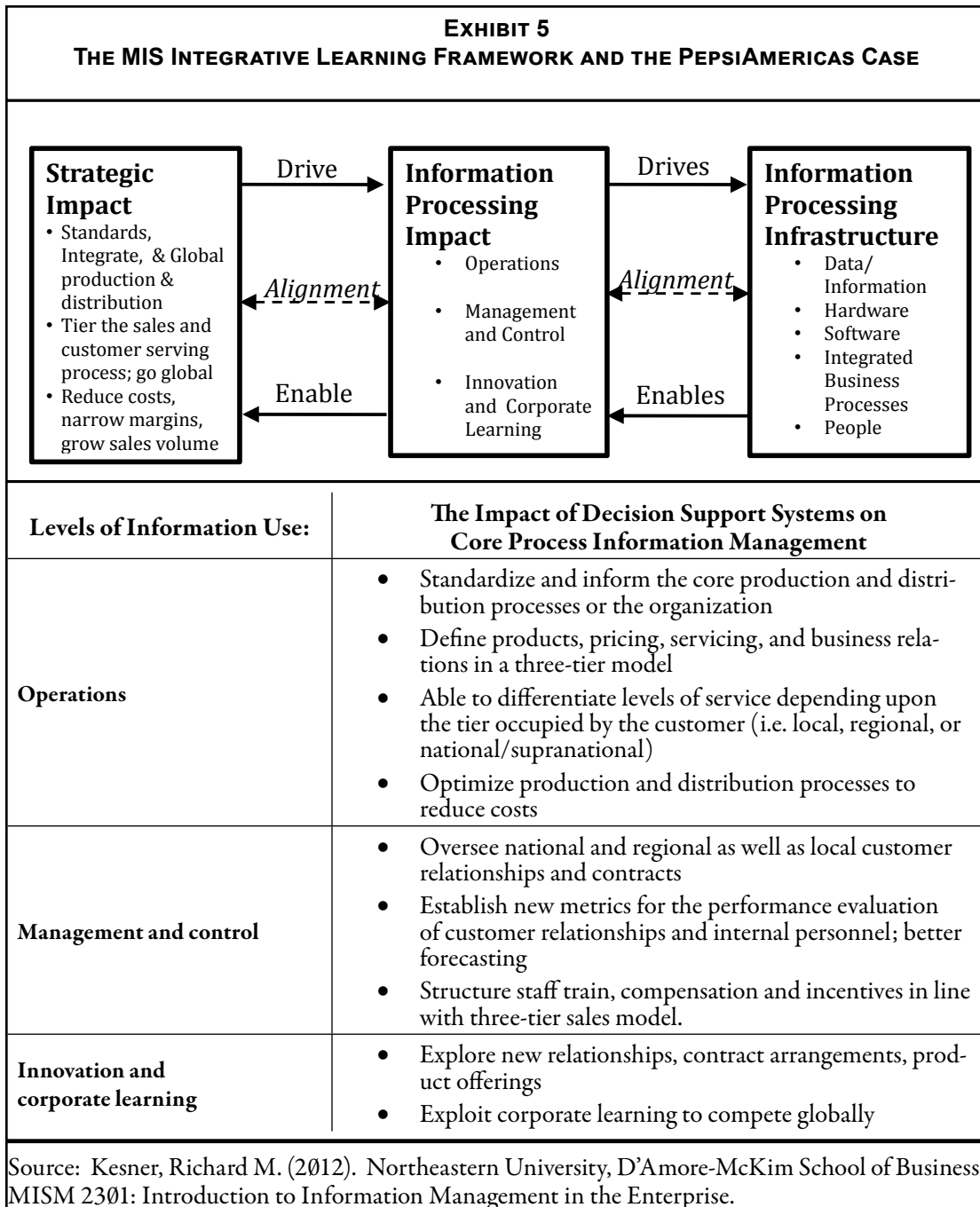
At yet another level, these continuous data feeds from PSA's back-end transaction systems to the firm's management and decision support systems provides PepsiAmericas executives with ready access to real-time data to fine tune business processes and to promptly address performance

issues. This integrated approach also drove decisions concerning the acquisition of both additional production capabilities and new lines of products. It also contributed to the continuous improvement of business processes and services. Last but not least, the PepsiAmericas leadership employed their data assets to build competitive knowledge in three areas that were critical to their long-term success, namely: enhanced customer relationship management, greater supply-chain process/IT integration, and the increased use of data-driven managerial decision making. PSA continues to mine data across the enterprise as a means to measure business results and to inform best practices.

The Application of the MIS Integrative Learning Framework: More often than not typical MIS case studies focus on the implementation of major information systems and while the PepsiAmericas case does concern itself in part with acquiring new enterprise software, this story is actually about how the organization leveraged business process data to transform its competitive position in its marketplace. Though during the timeline of the case study, PepsiAmericas did expand globally, primarily in Eastern Europe and Central America, its core processes of bottling and product distribution did not change. What did change dramatically was how the organization began to use information in ways that allowed PepsiAmericas to overcome the challenges wrought by increasing product line complexity and the need to forecast and then commit to delivery schedules and pricing when negotiating with global retail chain customers.

To achieve this capability as an enterprise, PepsiAmericas was obliged to standardize both its processes and the data that they generated. Transactional data was integrated and aggregated for management and control purposes and then fed into a decision support system for the purposes of production and supply chain coordination and forecasting. Ultimately, this integrated data management approach enabled creative solutions in dealing with the firm's strategic partners and customers.

By the time that this particular case appears in the MIS 2301 curriculum, our students are well versed in the use of the *MIS Integrative Learning Framework*, allowing the instructor to ask more sophisticated questions concerning the role of information management in achieving



the desired operational, managerial and strategic outcomes within PepsiAmericas (See *Exhibit 5*). Once the students themselves establish the connections between the business focus of the organization and its information needs, they are then asked to identify and justify the enabling technologies deployed by the firm as it shifted from a local to a global distribution mindset and operating model. Here again, the themes of systems alignment, enterprise-wide informa-

tion integration, and business process innovation and transformation emerge as findings from the application of the framework to the facts of the case. This outcome is all the more satisfying in that the students themselves are now positioned to drive the conversation.

LESSONS LEARNED

The *MIS Integrative Learning Framework*, as deployed in NEU/DMSB's *Introduction to Information Management in the Enterprise (MISM 2301)*, has proven itself to be a highly beneficial tool in the teaching of MIS. With almost three academic years of field testing completed and over seventy-five sections and twenty-five-hundred students taught with the tool, Northeastern's MIS faculty are unanimous in their satisfaction with the framework. While the framework has produced four pedagogical benefits noted earlier (parsimony, internal validity, external validity, and flexible conformity), the student satisfaction impact is less clear. From the standpoint of student satisfaction with MISM 2301 course, we have noted only a modest improvement in the scores produced in our end-of-term student surveys. Similarly, we have witnessed only a small increase in the number of students from within the business school who have chosen to major in MIS. But there are many factors that enter into student opinion survey results and career choices - topics beyond the focus of the present article.

However, the findings for assurance of learning outcomes are supportive of the framework's efficacy. One very clear indicator of the effectiveness of the framework as a teaching tool comes from the results of MISM 2301's capstone case study assignment. This case concerns a global media company and includes an array of difficult questions about how this business operates, manages, and competes. Our introductory MIS course has always concluded with such a case, though the current assignment is intentionally more demanding than its predecessors. What is most striking here is the overall consistency and quality of student responses to this assignment. In the past, capstone case responses varied widely and were not particularly insightful. By contrast, in recent years as our faculty have embraced the framework in their teaching and as our students have come to master the framework as a learning aid in their MIS work, the capstone submissions have become both more consistent and higher quality. These successes have led to the introduction of the framework into most NEU business school undergraduate and graduate MIS.

The results in the capstone case submissions also speak to instructor-oriented benefits in the use of the framework. First, it is clear that with the framework in place, the cohort of faculty who in-

struct in MISM 2301 are doing a more uniform job in their coverage of course content and in their general approach to the teaching of those materials, leading to higher satisfaction among adjuncts and better performance ratings. Second, this has led to a more uniform learning experience for the student from section to section of the course, an important develop in light of DMSB decision to establish a competency exam for graduating seniors. Third, the faculty themselves have expressed increased satisfaction in terms of MISM 2301 teaching efficiency, the quality of class discussions, and the quality of work submitted by students. By all of these measures, the quality of delivery of MISM 2301 has improved and has also made it easier to attract and retain quality adjunct instructors for the course offering.

While the absolute measure of learning outcomes stemming from the application of our *MIS Integrated Framework* remain elusive, (Michlitsch and Sidle, 2002; Mukherjee, 2005; Chrysler and Van Auken, 2006) there is already both qualitative and quantitative evidence to suggest that our approach offers considerable benefit to those who study and those who teach information management in Northeastern's business school programs.

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