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***Sustaining Intellectual Capital  
through  
Business Intelligence***

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5,940 words

## **A Business Lens on Business Intelligence: Sustaining Intellectual Capital**

**Keywords:** *business intelligence, social capital, interrelationships, collaboration*

**Abstract:** *Many organizations are data rich and knowledge poor. In a case study, a collaborative knowledge-sharing process, supported by business intelligence tools, helped British Columbia parks staff set management priorities. This case study was driven by the need to effectively manage a rapidly expanding system of parks and ecological reserves. The project captured, in a data warehouse infrastructure, information shared by individuals about to retire, and management decisions made collectively by diverse specialists. Computer-literate staff members can explore and analyze these and dozens of related data sets in meaningful ways; others can easily access reports tailored to particular management decisions. When used as a catalyst for open dialogue and enhanced tacit knowledge, these tools have the potential to build bridges from mechanistic organizational structures of the past, to the more systems-based approaches of the future. (MacGillivray 2000)*

### **Introduction**

The greatest obstacle to the sustained development and use of intellectual capital in organizations may be the vertical boundaries we have been trained to build around administrative units, perspectives and disciplines. Periodicals are often written for either academics or practitioners. Invisible lines are drawn across campuses implying no relationship between mathematics and music, nor ecology and management. Careers are with the “real business” of an organization, or in peripheral fields such as finance or information technology. Performance measures focus on either production or people. Data are attribute or spatial; knowledge tacit or explicit. Each of these seemingly useful and normal distinctions can limit the growth (Senge 1999, p.60) of the integration, collaboration and sharing that are often needed to build and sustain intellectual capital.

What is business intelligence? Successful business intelligence (BI) systems provide an integrated view of business, extend analytical capabilities to users, and leverage a corporation's data and expertise, to help organizations make faster, better, and more-informed business decisions. (Gill 1999, p.1) Recent research by MacGillivray shows that the theme of reducing organizational boundaries is pervasive in predicting the success of business intelligence projects.

This paper addresses the value of business intelligence in the public sector, describes a public sector case study in which the authors collaborated, shows how the findings of a survey support the case study approach, and places this work in the context of a broader literature review.

## **Business Intelligence in a Public Sector Context**

Many authors relay success stories from large organizations with sophisticated information technology and performance management systems. Relatively little has been written about intellectual capital, knowledge management or business intelligence in government.

Three attributes of the public sector are particularly relevant to business intelligence in general, and the case study in particular. Public sector services often cross disciplines (Mintzberg 1999) and involve “complex trade-offs between competing interests.” (Mintzberg 1996, p.77) Secondly, governments are increasingly accountable to taxpayers, and expected to do ‘more with less’. A publicly traded company takes on new responsibilities only when there is a reasonable likelihood of short or long term profit. Government often takes on new responsibilities, such as increased health care for an aging population, because it is seen as the right thing to do, regardless of whether there is any assurance of a commensurate increase in revenue. Thirdly, many government employees’ personal values are aligned with those of their organizations. The public does not hear much about the evenings and weekends volunteered by government workers because they believe in health, education or environmental conservation. Aligned value systems often create stable workforces with long-term employees holding considerable tacit knowledge.

This combination of factors suggests that public sector decision makers need to consider explicit and tacit knowledge, including a range of potentially contradictory perspectives, while making decisions efficiently and defensibly. The potential of business intelligence in this environment is enormous, but it

must be approached differently than it would be in a company trying to maximize sales of a product to customers.

## **The Case Study Organization**

The three attributes of the public sector described above apply to the case study organization, which manages the provincial park system of British Columbia. In this paper, we will use the generic term “park” to refer to all designations of protected land for which the organization is responsible. Park management is interdisciplinary; it is like managing a microcosm of society. The three pillars of sustainability: economic, social and environmental, are all important. In their roles as customers, clients, citizens and subjects, the public experiences the many varied aspects of park management. (Mintzberg 1996, p.78)

British Columbia’s provincial parks include over 13,000 campsites. Thousands of businesses, in and out of parks, benefit from park-related tourism: the overall impact of British Columbia’s provincial parks is \$521 million on a GDP basis (Ministry of Water, Land and Air Protection, p.9). In a social context, residents consider that “parks are an integral part of British Columbia’s unsurpassed quality of life.” (Ministry of Environment Lands and Parks 1999, cover). Natural areas have health benefits from a global through to a personal level, and parks host hundreds of educational programs each year. From an environmental perspective, British Columbia is the most diverse province in Canada, and the park system conserves a wide range of features, forest types, habitats, and rare species. Because of these economic, social and environmental factors, park organizations typically collect or use data about dozens of subjects including revenue and expenditures, commercial services, facilities, education programs, visitors, demographic data, customer satisfaction, safety and security, forest types, wildlife, and water quality.

Accountability and efficiency are also important. BC Parks’ operations have become more complex. The amount of land managed has almost doubled; the budget has not. The organization now manages over

800 pieces of land, accommodating over 20 million visits each year, on a land base more than five times the size of Massachusetts, and almost as large as England. This is done with a staff of fewer than 400. So for each employee, including receptionists, financial officers, and directors, there over 60,000 annual visits and 30,000 hectares of land to manage. As a result, employees try to work creatively and efficiently; the case study project, for example, had a direct cost of approximately \$10,000.

Finally, the graying of North American society is mirrored in BC Parks' staff of loyal individuals. The average manager joined the organization in the 1970s, when typists used carbon paper, and requests for information were mailed across the province using six cent stamps. Travel in parks was an essential part of the job, and the individuals who managed parks knew them in an intimate and personal way that recent recruits can only imagine. However, that intimate knowledge did not translate to the hundreds of discrete land additions to the park system, and a wealth of knowledge was about to disappear through retirement, moving succession planning to the forefront.

## **The Case Study**

In this context of a government organization with expanding, interdisciplinary responsibilities, perched on the brink of a retirement wave, the first author was given an intriguing challenge: to design a tool to manage each piece of land, old or new, as part of a single system. Her project team members believed that effective leadership and management are contextual and that long-term vision and day-to-day operations must inform each other. They also supported a principle of the most recent reorganization (unpub.): to get expertise and information into the hands of front-line decision-makers. Initially, team members were unaware they had zeroed in on two of three descriptors of business intelligence: developing an integrated view of business and extending analytical capabilities to front-line decision makers.

The project had three stages. The first was to ensure the project team understood the organization's needs and expectations in order to produce approved outcome and objective statements. The second was to design the tool to meet those objectives and move towards the outcome. The third was to find a way of making the tool operational, without its being a new and separate task draining valuable time and resources.

The first stage: development of an approved outcome and objectives, went smoothly. Rather than investing management effort based on history, this tool was to "help the staff plan effort based on the relative significance of values, risks and issues." (MacGillivray 1999, p.6). Although the executive discussions did not touch on information technology, 'database' was implicit in several project objectives.

The second stage: the design and testing of the tool, took many months of effort. The tool had business and technical components. From a business perspective, it began as a framework and template to guide decision-making in a province-wide context. Most of the major business decisions were made first, with technical support following. Typical business questions were "How much detail should be recorded about risks to each park?" and "Should measures of progress towards goals be based on inputs, outputs or outcomes?" Much of this stage was synthesis rather than creation. For example, the government had initiated a major, systematic land use planning strategy a few years previously to replace the valley-by-valley fights about whether land should be logged, developed or protected. That strategy included policies and procedures for assessing the natural, cultural heritage and recreation values of land. Where these assessments could be accessed, the project team encouraged their use. Otherwise, simplified instructions were provided for preliminary analysis.

Traditional desktop technologies were inadequate for the testing of design improvements. Success would depend on technologies that could integrate data from several operational databases, which stood side by

side like silos, mirroring administrative structures. (MacGillivray 2000, p.1-1) Yet no one in the organization had heard of such technologies. When cross-functional analysis was needed, employees normally printed reports from different systems and re-keyed data into spreadsheets. Analysis options were poor, and results frozen in time.

However, while the first author was developing the business side of the tool, the second author was developing a business intelligence infrastructure to provide an integrated view of business and to support decision-making. Each was unaware of the other's accomplishments. Faulkner's work built a bridge for technical advances (the development of asset capital in the form of integrated databases) and for collaboration. However, previous attempts to communicate the potential of the technical work had been ineffective; the time was not right. Information systems authors refer to the role MacGillivray played as that of the business champion. With an urgent business need, executive support, a team of committed early adopters, and concrete ideas ready to test, her project team was ready to cross the bridge into what normally would have been intimidating territory. Business and technology expertise were now linked, and the project could proceed.

For those who have not worked with a data warehouse, the authors will attempt to describe how it differs from more traditional technologies. Three types of data are ideal for storage in a data warehouse:

1. core business data "trapped" in legacy system with limited accessibility or reporting capability;
2. a data set that would add value to existing warehoused data; or
3. a data set that would gain value through integration with existing warehoused data.

Initially focus should be on work supported by the business area responsible for the data, that will bring the best return for the effort. In the case study organization, most employees knew very little about relevant data from other agencies, and viewed each BC Parks database as a distinct entity. Each was

“owned” by a different individual or branch, contained different data, and was “trapped” in a legacy system. Their separateness, administratively and technically, reinforced thinking about subject areas in isolation from each other. The term warehouse is an effective metaphor. One can envision each database as being stored in a truck, and each night the trucks go to the warehouse and deliver any items picked up that day. The workers in the warehouse arrange the items on logical shelves, sometimes adding new labels to communicate exactly what the items are. Then the customer can choose a combination of items, regardless of which trucks they came from, to construct a useful product. With a data warehouse, data are copied rather than “delivered” and the “workers” who unload the trucks are automatic scripts, but the idea is the same. Yes, this is very simplified, but the point is that if the technical background work is done well, it looks simple to the customer, or “end-user” of the computer world. This technology enabled the project team to test the tool, refine its design, create draft reports and communicate clearly with the executive.

In its final form, the template and supporting technology focused discussions and documentation around four questions: Why is this piece of land important? What could compromise those things of value? How do we believe this land should be managed to maximize values and minimize risks? and What specific progress will we plan for next year in the context of the system’s most significant values, risks and issues?

However, the template and technology were of little value without a thoughtful and practical way of making them operational. District team members saw a partial overlap in the intent of this tool, and a faltering “annual management planning” process. The team’s operations officer went to his peers, who owned that planning process, and described benefits of the new approach: it was more systematic, strategic and inclusive. The executive quickly endorsed operations officers’ recommendation to replace the old process with the new tool. An annual management plan was no longer a one year operational document



drafted by one individual (followed by sequential and often contradictory edits). Now the full team, representing different and potentially conflicting responsibilities, sat around a common table. They shared tacit and explicit knowledge, and collectively planned how each piece of land should be managed as part of a system, regardless of how much progress could be achieved in the coming year. Sometimes outside experts or stakeholders participated. District teams commented that they liked “the replacement of a ‘create and defend’ approach to writing the plans with an approach that builds a shared understanding of each piece of land in a larger context.” (MacGillivray 1999, p.6). This observation was important in light of the most recent reorganization. That restructuring had removed the middle, regional, layer of the organization, and placed specialist advisors out in what had been operational or “line” offices. This new planning process provided a needed forum to develop the new teams, i.e., to build social capital.

### **Case Study Success Factors**

Interwoven with these three stages, were several factors and events which the authors believe were critical in enabling progress. These included:

1. **Trust:** BC Parks has the reputation of having an inclusive and relatively decentralized culture, so a tool designed for information sharing and consensus-building was a comfortable fit.
2. **A critical business need:** The project addressed a business need identified by district managers, and supported and clarified by the organization’s executive. The project had a clear outcome statement, objectives and other supporting documentation.
3. **A business champion:** The project sponsor was an executive member; the project leader committed to the outcome, and the project team made up of diverse and respected early adopters.
4. **Metacontent:** As soon as the team began to use data warehouse technology, almost all domain business owners documented information about the meaning of each data table and column.

5. **Collaboration:** The project team was made up of individuals from all major sections and levels of the organization. The collaboration extended beyond BC Parks to include information technology experts, some external experts and stakeholders.
6. **Information technology experts understood business basics:** This enabled them to ask relevant questions about reporting needs. Their understanding of relevant data sets from outside BC Parks added particular value to these discussions.
7. **Project leader learned technology basics:** This enabled budget/workload planning, identification and removal of barriers, testing of design options, production of reports and communication with the executive. It is important to note that this learning would not have been possible without technology professionals who valued a shared understanding of the project's benefits and potential.
8. **Networking leadership:** Team members championed the new tool and process, communicating horizontally through the organization, to augment formal vertical communication channels.
9. **Communications media:** Different media were used; newsletters with quotes from staff members across the province were particularly popular.
10. **Communications techniques:** Stories and metaphors were effective devices. Communication about technology was particularly challenging. It was difficult to avoid being cryptic and/or patronizing in a room of individuals whose expertise with information technology varied widely. The team needed to reassure individuals that data integration tools didn't corrupt data, compromise decisions about technical infrastructure, or cost a lot of money. They needed convey the significance of time savings to persons who rarely used computers. Language was also important. In the lexicons of business and information technology, deceptively familiar words include legacy, system, application, view, normalizing and client. When team members sensed apparent agreement with probable differences (or disagreement with likely consensus), they asked questions to encourage clarification and elaboration.

Perhaps the biggest communications challenges were in dealing with the unknowns: exactly how would the tool evolve in terms of budgets and parallel decision-making processes owned by administrative units?

11. **Balance of abstract and concrete:** The strength and diversity of the project team enabled them to regularly test concepts to ensure they were practical and of value. This sometimes included the creation of draft reports to inform key business decisions.

12. **Integration of explicit and tacit knowledge:** The blending of explicit and tacit knowledge flowed in both directions. Patterns and trends revealed through the technology informed discussion, judgment and innovation. Conversely, tacit knowledge was captured to some degree as explicit information. For example, if one team member were aware of a cultural heritage site in a park, it would be documented, with coding to indicate its nature and significance. If a gap were found in the rare species inventory managed by another agency, documentation would be forwarded. When dealing with judgments, rather than facts (e.g., reducing a risk through an enforcement strategy in one park vs. an education strategy in another) the management choices were coded and documented for retrieval as needed.

During an anonymous evaluation of the interdisciplinary reports, one long-term staff member made a connection between this knowledge capture and succession planning: “Those about to retire can do a lot of brain dumping; the database becomes their knowledge bank, recorded using tools which are a good fit for new, younger recruits to BC Parks.” (MacGillivray 2000, p.4-50).

13. **Architecture:** Many options are possible; the following table shows the case study approach. Time and resources to develop a cohesive architecture should not be underestimated.

| <b>Component</b> | <b>Attribute Data<br/>(numbers, text etc.)</b> | <b>Spatial Data<br/>(map-based)</b> |
|------------------|--|-------------------------------------|
| Client           | ICA Client                                     | ICA Client                          |
| Deployment       | NT terminal servers                            | NT terminal servers                 |
| Application      | Oracle Discoverer                              | GOAT (customized ArcView tool)      |
| Data             | Oracle 8i                                      | ArcInfo and images                  |

*Table 1: Technical Architecture for Case Study Project (MacGillivray 2000, p.C-1)*

14. **Training:** Participants who participated in preliminary training valued the fact that it was timely and tied to relevant data, processes and business issues. Instructors did not use any generic manuals or training scenarios.

All change initiatives require ongoing support, and the case study project will be no exception. The authors suggest a number of strategies for the ongoing monitoring and support of BI initiatives. (Faulkner & MacGillivray, 2001) These include

- implementing knowledge management core competencies, and providing appropriate learning interventions to maintain them;
- ensuring data collection standards and practices facilitate integration;
- spending no more than 25% of effort on data collection and storage, and no less than 75% on building and applying knowledge;

- leveraging expertise and initiatives, such as industry standards, training, tutorials, changes in business direction and in-house knowledge;
- monitoring indicators of collaboration across sections of the organization. Are parallel processes or databases proliferating? Is metacontent stored in several locations (e.g, library, file room, databases about databases), and if so, is it being consolidated or integrated?
- monitoring impediments to information access such as multiple “usernames”, “firewalls” and awkward desktop configurations; and
- establishing and supporting mentors, coaches and leaders.

## **Survey of Business Intelligence Professionals:**

During the case study implementation phase, MacGillivray conducted an on-line survey of BI professionals to research their perspectives on BI success factors. This survey touched on connections in several ways. The results should be put in the context that the majority of respondents believe business intelligence to have far more potential than is indicated by practice. The 90% response rate from British Columbia ministries may indicate that respondents were anxious to renew efforts for progress in their own organizations based on a better understanding of success factors. The results therefore indicate what experts think would work, as much as what has worked.

Respondents rated the importance of three business intelligence success factors which had been highlighted in a recent periodical. The factors were: architecture and standards, a business plan and a business champion. The business champion factor speaks most directly to the importance of connections: specifically collaboration between information technology and business professionals. Over 90% of those who self-identified as working primarily with the business of the organization considered this factor very important, and the most important of the three. Over 60% of those who self-identified as working primarily with the information technology of the organization considered this factor very important, but the least important of the three. The significant difference between the perceptions of these two groups deserves further research in relation to measurable successes.

Other success factors for business intelligence work were also explored. Those which relate to the links across cultures, organizational boundaries or time are shown below, ranked by their relative importance as perceived by the survey respondents who stated they worked primarily with the business of their organizations.

**"Very Important" Ratings of Business Intelligence Success Factors Which Speak to Relationships or "Bridges"**  
by Respondents' Roles in Organizations

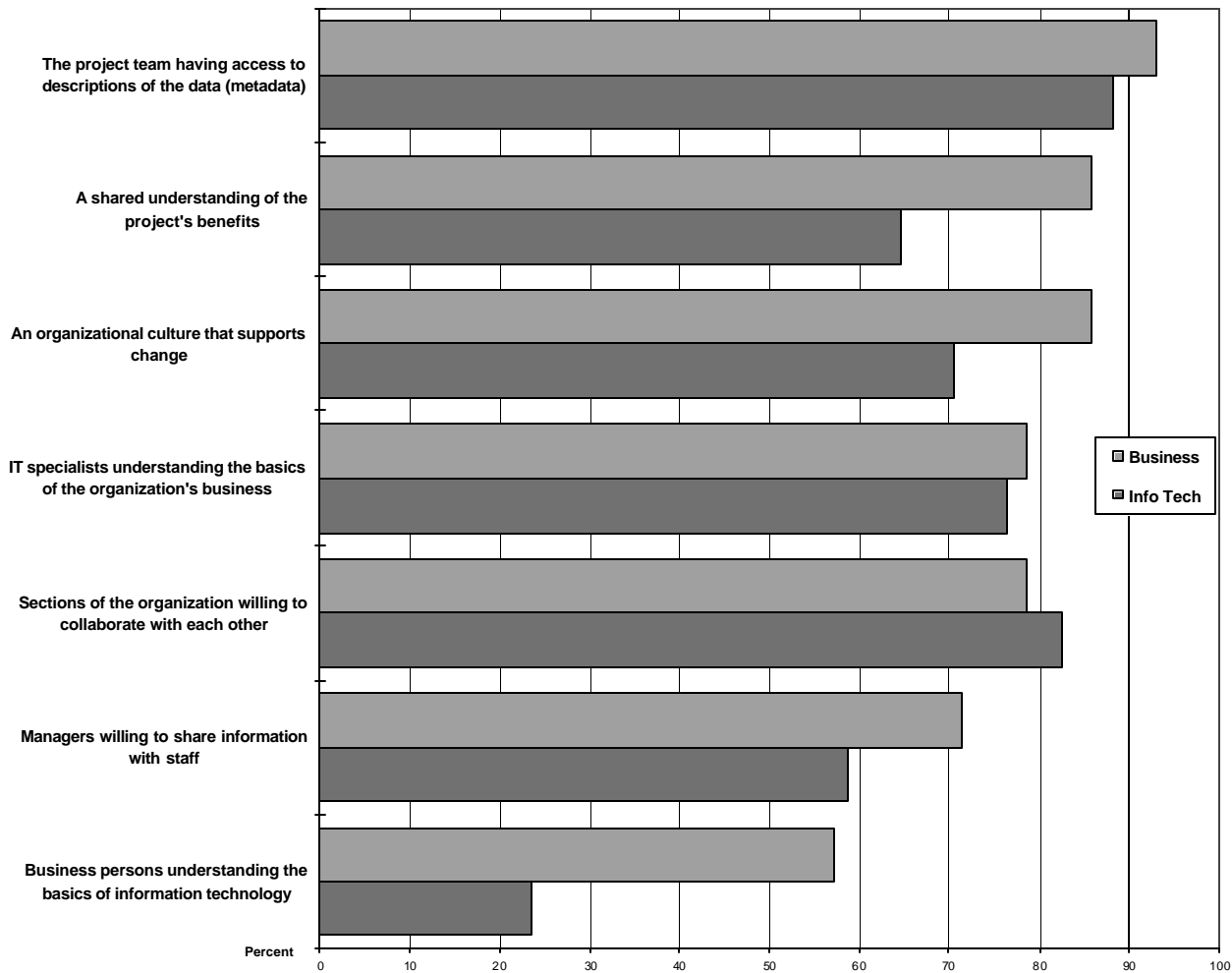


Figure 1

**n = 31  
(17 & 14)**

Some of these factors deserve comment. Metadata, or metacontent which includes both technical and business information about the data, (Kucera & Faulkner 1998) is critical, because business intelligence initiatives provide integrated views of business and extend analytical capabilities. Integration and extension encourage individuals from new sections and levels of the organization to use data previously analyzed by a few experts. These experts need to share metacontent, to clarify the meaning, potential use, and shortcomings of the data for all to understand. Information technology employees will use this information

to build links amongst related data, pre-build common calculations, and ensure expected queries can be run efficiently. End users will view metacontent to help them analyze business issues. The historic analyzers of the data will feel considerable ownership of the system. They may be anxious about a loss of control, because they feel valued for the information they dispense, or they may be afraid new users will make errors. Another challenge comes from the fact that many of these domain experts will not have seen the data in their raw form. They may find it difficult to relate to the way items are structured in tables, or to behind-the-scenes names of fields. They may be convinced the technical expert is wrong about how the database is designed. High quality, shared metacontent therefore requires both respectful dialogue and good technology.

Respondents' perspectives about whether information technology professionals should understand business basics, and whether business professionals should understand technology basics, are also interesting. Regardless of respondents' roles, almost 80% agreed that it is very important for technical persons to have some grasp of the business. When the question was reversed, most business experts (57%) considered it very important for their peers to understand information technology basics, whereas fewer than one in four (24%) of information technologists shared this view. This, too, deserves further research. Based on the case study work, the first author hypothesizes that this factor is dramatically underrated. This may come from a service ethic ("we can make this so simple you don't need to understand the technology") combined with a genuine lack of appreciation for how closely an understanding of the technology is linked to an understanding of benefits and barriers. It was interesting to note that in an open ended question: "If you could change one thing in order to increase the success of business intelligence projects, what would that be?" the majority of comments about knowledge and skills had to do with business persons gaining a greater understanding of technology. And in response to the statement "Technical issues cause more problems than business issues in ensuring the success of business intelligence projects," 75% replied: "strongly disagree" or "disagree".



It is interesting to note that about half the survey respondents represented British Columbia ministries, and about half worked elsewhere: some in well-known private sector companies. Responses of these two groups were very similar.

## Connections in a Broader Context

There is a large body of literature from the business world and the natural and physical sciences speaking to the importance of connections. Peter Senge is one of many authors including Helgesen (1990, 1995) and Kelly (1999) to call attention to the convergence of perspectives from post-Newtonian physics and/or ecology and business:

“From a very early age, we are taught to break apart problems, to fragment the world. This apparently makes complex tasks and subjects more manageable, but we pay a hidden, enormous price. We can no longer see the consequences of our actions; we lose our intrinsic sense of connection to a larger whole. When we then try to see the big picture, we try to reassemble the fragments in our minds, to list and organize all the pieces. But as physicist David Bohm says, the task is futile -- similar to trying to reassemble the fragments of a broken mirror to see a true reflection. Thus, after a while we give up trying to see the whole altogether.” (Senge 1990, p.3)

Helgesen (1995, p.16) discusses how moving away from the notion of the organization as a great machine may help us reverse the estrangement of human beings from nature that took root in the Industrial Revolution. This insight may be particularly profound for organizations with environmental conservation responsibilities, who want to lead and model more holistic world views. Helgesen (1990, p. 14) shares insights into the management climate from which North America is emerging: the climate in which many of our information systems were developed. In referencing Mintzberg's early management research she described information flowing up through hierarchies, where top managers were more apt to hoard the information than disseminate it. Such a culture is a perfect match for discreet mainframe databases.

GE CEO Jack Welch, who developed a passion for cross-functional co-operation, stated: “We no longer have the time to climb over barriers between functions like engineering and marketing...” (Slater 1994, p.106). Waitley (1995, p.29) speaks to the challenges of transition. “Management by command and control seemed everlasting – which is why shifting away from power over others to *empowering* others is proving so difficult.” If the organizational culture has not shifted from power over others to empowering others, processes and tools which support information sharing and empowerment will be met with resistance.

Many business authors give concrete ideas for how to implement change. Two decades after his groundbreaking study of managers' behaviors, Mintzberg writes:

“For companies to thrive in today's economy, management has to be put in its place – another place, that is. Not atop the chart – at least not in all but the most tightly controlled, highly programmed bureaucracies – but down into its essence, whether at a center, as a hub, or throughout, as a web.” (Mintzberg & Van der Heyden 1999, p.94).

Interestingly, these authors speaking to the importance of connections in business, rarely speak about the role of information technology in revealing those connections. The rare references to technology include concern that explicit knowledge and algorithms are promoted as superior to human intuition, creativity and judgment.

Meanwhile, on the other side of a formidable drawbridge, information technology authors are writing about the vast, largely untapped potential of technologies designed to provide holistic views of business: data warehousing, business intelligence, competitive intelligence and decision support. Their writing, too, has limitations. It isn't written for readers without technical training, and it often focuses on technical

conquests (“bigger, faster, better”). The rare references to business needs are typically abstract and fleeting. Nor is there recognition of the profound convergence of interests in connections, collaboration, and synthesis.

The literature also speaks to several of the specific success factors noted in the case study. Executive Communications Group Chairman Peter Giuliano, (quoted by Steen 1999, p.87) recommends storytelling as a way of making technical information “tangible and memorable.” When asked where to begin in preparing a story, he replies: “We work so hard to think as opposed to feel and imagine, and you've got to allow yourself to feel and imagine. Most of life's decisions -- personal decisions and business decisions -- are driven by emotions.”

George, Jones & Gonzales (1998) referencing Graham suggest that negotiators' proficiencies in each other's languages influences the success of the negotiations, partly because those who do not understand a language may feel threatened. Even confident individuals hesitate to ask for clarification, especially when terms seem familiar.

In terms of networking and leadership, Senge is one of the authors to speak to the importance of executive leaders (1999, p.18) and network leaders, who “are generally responsible for the organization's capacity to help itself,” (1999, p.106) and whose work complements that of local line leaders (1999, p.17).

In summary, the literature review showed a growing interest in the evolution of corporate cultures, specifically in terms of effectively sharing and using knowledge. These trends parallel the evolution of technologies, which have largely untapped potential to support organizations in which leaders are trying to minimize internal boundaries.

## Conclusion

This case study may seem like a modest success, but such is the nature of business intelligence in much of the public sector. The challenges in sustaining progress are more apt to be business challenges than technical ones; co-operation and integration across business units is not as familiar as building unit-specific processes and databases.

It is too early to assess the sustainability of this particular case study. However, the successes to-date have had the theme of connections over time, space or disciplines, and all have the potential to build and sustain intellectual capital. A new priority-setting tool helped to bridge the management transition from a relatively stable and well-understood park system to one much larger and less familiar. The new tool provided a more systematic approach to an older and faltering annual planning process. The process design encouraged acquisition and re-use of other important assessment processes and databases, many of which had previously sat outside the organization, and now added value to internal data. The business intelligence technology enabled the transformation of vast quantities of data from those sources, into information tailored to management decisions. By the end of the case study project, every staff member who requested it had desktop access to automatically updated reports tailored to specific business decisions, which could easily be modified for particular views of the information (e.g., by district or province, by year, or by other attribute). These reports provoked discussion and enriched tacit knowledge through district team discussions. Those discussions allowed participants to hear perspectives from several disciplines, such as economic, social and environmental, and factor them into decisions. This integration on the business side was supported by information technology tools designed to capture products of the consensus-building in knowledge repositories. In this way, background information about values, risks and issues was stored alongside decisions about management strategies and priorities, in a medium that would enable new employees with database skills to retrieve, analyze, learn and apply.

It is important to note that the reports did not dictate decisions, even when the data were of a scientific nature. The information in the reports supported decisions by teams of professionals: the knowledge workers who were adding their critical analysis to the process. The reports provided consolidated and integrated information, encouraged discussion about varied perspectives, and provided efficient ways to refine priorities. As Colin Powell (1995, p.274) said “something deeper and wiser than bits of data inform our instincts.”

Business intelligence tools produce interdisciplinary reports in seconds which would take days to create with more traditional technologies: computers do what they do best, while people use insight, intuition, creativity and judgment well beyond the capabilities of today’s technologies.

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