

# IBM Research Report

## Making the Intangibles Visible: How Emerging Technologies Will Redefine Enterprise Dashboards

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**Making the Intangibles Visible**  
**How Emerging Technologies Will Redefine Enterprise Dashboards**  
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**Making intangible assets visible in the enterprise**

Intangible assets include licenses, franchises, patents, trademarks, brands, know-how, market competences and human resources. Intangibles constitute most of the value of modern corporations, as measured by stock market valuations, investment level, or their perceived importance<sup>1</sup>.

However, as “nonphysical claims to future value” intangibles are more difficult to grasp. As a consequence, the measurement and accounting of intangible assets – that is the primary prerequisites for managing them – are at best spotty, and the systematic management of intangible assets is almost non-existent.

In this paper, we discuss the problem of systematic access to information about intangibles. We observe that 80 to 90% of all intangibles can be systematically analyzed using the new technologies of text mining, data mining and information integration. This analyzed data can be presented in the form of an enterprise dashboard displaying data about all their relevant attributes. As next generation enterprise dashboards make intangibles visible, proper measurement and management processes for intangibles will follow.

Perhaps surprisingly, both leading corporations and technology vendors seem to be well positioned to implement monitoring systems for intangibles. The technical infrastructure for accessing all types of content exists (information integration); enterprises have substantial experience with using software to manage financial and physical assets (e.g. supply chain management and enterprise resource planning software); the technology for extracting relevant data points from relational databases and text documents is relatively mature (though not pervasive); and, as we observed in our previous work<sup>2</sup>, the number of relevant data points is limited: a comprehensive list of intangibles (as used by analysts, in academia or in mergers and acquisitions) has only about a hundred entries<sup>3</sup>.

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<sup>1</sup> For example, Harvard Business Review, June 2004, p.108 states: *Everybody knows that in the modern corporation intangible assets are the source of greatest value.(...) The nonmanagement of intangible assets has measurable costs.*

<sup>2</sup> W. Zadrozny. “Text Analytics for Assets Valuation” IBM Research Report RC23311. Available at [http://domino.watson.ibm.com/library/cyberdig.nsf/papers/53DB610E53FB409B85256F020068FB33/\\$File/rc23311.pdf](http://domino.watson.ibm.com/library/cyberdig.nsf/papers/53DB610E53FB409B85256F020068FB33/$File/rc23311.pdf)

<sup>3</sup> We also observed there that the vast majority of them can be mined for investment analysis using existing technologies.

## Enterprise portals can spotlight intangibles for better strategy execution

Management of intangible assets requires access to organized information about them. However, information about most of intangible assets has none of the prominence of financial measures like earnings, cash from operations or ROI. Returns from investing in intangibles seem difficult to measure, and processes for managing intangibles are typically ad hoc.

Executives are aware of the problem. Accenture/Economist Intelligence Unit<sup>4</sup> “confirmed that today’s senior executives see managing intangible assets as a major issue. Fully 94 percent consider the comprehensive management of intangible assets important; 50 percent consider it one of the top three management issues facing their company”. Furthermore, as Harvard Business Review observes, “managers are starved for reliable information about intangible assets”<sup>5</sup>.

Therefore, if organized information on intangibles were available and presented in a portal or a dashboard, such a major change would be welcomed by CEOs and CFOs<sup>6</sup>. What is visible can be measured, and therefore it would facilitate proper management of intangible assets.



**Fig. 1** Enterprise Reporting Applications (source Actuate Q3 2004 Investor Presentation<sup>7</sup>)

<sup>4</sup> Accenture: <http://www.accenture.com/xdoc/en/services/sba/hotidea/value.pdf>

<sup>5</sup> Harvard Business Review, June 2004, p.108.

<sup>6</sup> Harvard Business Review, Feb 2004 pp.52- 63. Kaplan and Norton discuss the incorporation of managing intangibles as part of a company strategy.

<sup>7</sup> p.11 of Actuate Q3 2004 Investor Presentation: [http://media.corporate-ir.net/media\\_files/NSD/ACTU/q304presc.pdf](http://media.corporate-ir.net/media_files/NSD/ACTU/q304presc.pdf)

Fig. 1 shows a summary of typical enterprise reporting functions. They include financial and non-financial data (e.g. “Call reports” in “Sales management”). Such reporting functions can easily be augmented with new categories focusing on intangibles (e.g. “Innovation management”) and subcategories (e.g. “Employee loyalty” in “Human resource management”), as corresponding data becomes available. In this report we are planning to show that text and data mining technologies enable access to these new classes of data.

Executive dashboards leverage enterprise reporting applications to display financial measures, alerts, links to projects information, etc. Fig. 2 shows example of an executive dashboard. Not much attention is paid to intangibles: we can see some human resources parameters (voluntary and involuntary attrition), but the focus of the portal is on sales, operations, finance, development and marketing. Clearly, if other data, like information on last week brand perception, patent licensing opportunities, or development of new competencies was available, it could be displayed there.

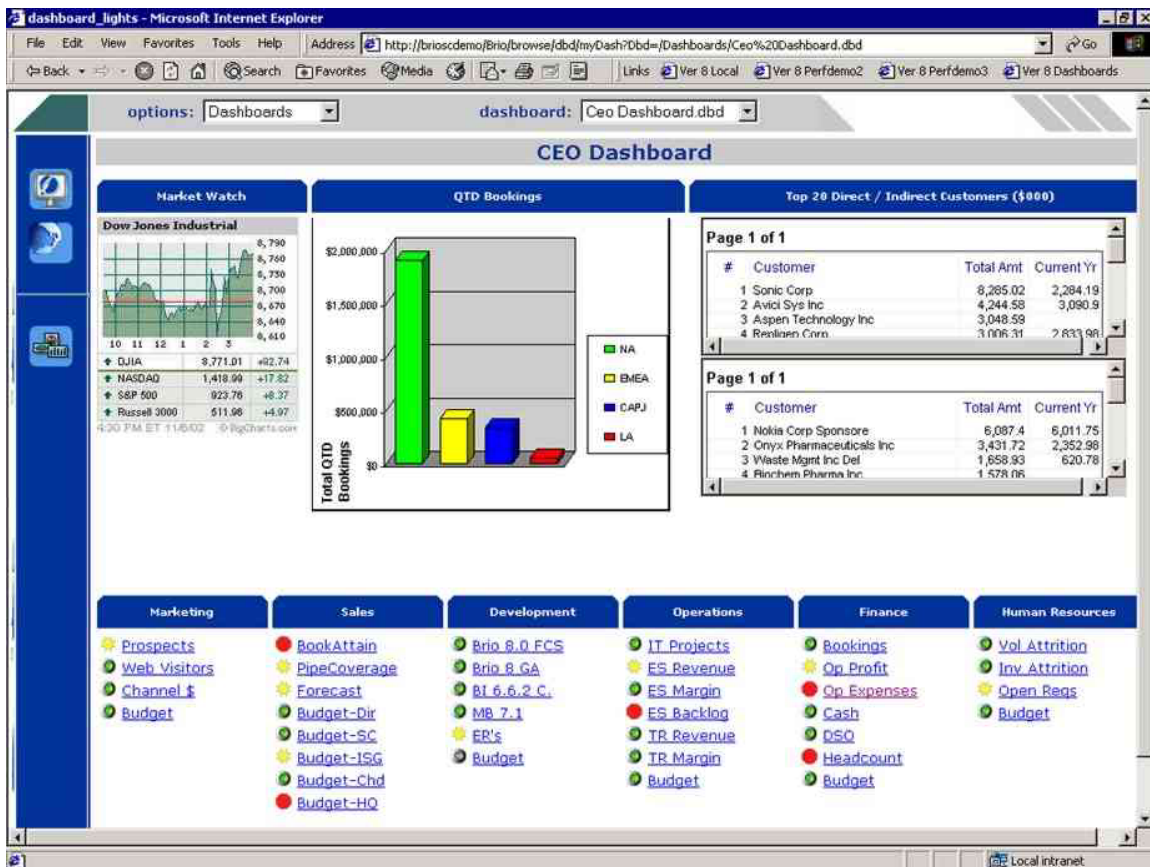


Fig.2. Example executive dashboard from Hyperion (image source: Northdoor plc<sup>8</sup>).

<sup>8</sup> This picture was taken from <http://www.northdoor.co.uk/products.solutions.services/partners/partners.hyperion.htm> More on Hyperion dashboards at: [http://www.hyperion.com/downloads/news\\_events/solutions\\_2004/508\\_enterprise\\_dashboards.pdf](http://www.hyperion.com/downloads/news_events/solutions_2004/508_enterprise_dashboards.pdf)

Thus reporting applications and dashboards can accommodate additional data on intangibles. First, however, these data points would have to be extracted. Therefore in the next two sections we will address the mechanics and complexity of extracting data on intangibles. We will briefly return to portals and enterprise reporting at the end of this paper.

### Providing information about intangibles

How does one extract information on intangibles? Currently, with difficulty. Often in a tedious process of sifting through mountains of data, for instance, records of customer interactions. But, as we observe below, human analyst capabilities can be amplified and augmented by technology. We can see in Fig. 3 that data mining and text mining can provide quality information on intangibles<sup>9</sup>. Even though only five examples of direct analysis of intangibles are presented in the table, they suggest other intangibles might be analyzed in a similar fashion using text and data mining. And indeed in the next section we will show that 80-90% of intangibles are subject to such analysis.

Attribute	Technology Used	Description or Comment
Brand perception	Text mining of Internet content and data mining of the results of text processing.	IBM WebFountain <sup>10</sup> used Internet data to see trends in brand value perceptions and alert companies to emerging problems. It showed that text and data analytics on the Internet data can be combined with internal company information, e.g. to measure effects of a marketing campaign.
Management experience and quality	Data analysis	Barr&Siems 1996 <sup>11</sup> used statistical data analysis for bank failure prediction. The main variable they measured was “management quality”. Their model detected “a bank’s troubled status up to two years prior to insolvency using publicly available data.”
IT Investment, Joint ventures, Marketing alliances	Text mining <sup>12</sup>	Temis’ <i>Online Miner</i> <sup>TM</sup> extracts the principal areas of investment of a company, the agreements signed by different companies, etc. from targeted public sites as well as press reports
Compliance (Quality of internal processes)		Inxight’s <i>Smart Discovery</i> for Sarbanes-Oxley can provide random sampling for compliance with internal policies such as revenue recognition.
Patents value		At Dow Chemicals, Clearforest’s text mining solution helped in “identifying licensing and M&A opportunities around new product development”.

**Fig. 3. Examples of direct analysis of attributes of business value**

<sup>9</sup> Source: W. Zadrozny. “Text Analytics for Assets Valuation” IBM Research Report RC23311

<sup>10</sup> [www.almaden.ibm.com/webfountain/](http://www.almaden.ibm.com/webfountain/) see also [www.spectrum.ieee.org/WEBONLY/publicfeature/jan04/0104comp1.html](http://www.spectrum.ieee.org/WEBONLY/publicfeature/jan04/0104comp1.html)

<sup>11</sup> <http://faculty.smu.edu/barr/pubs>

<sup>12</sup> [www.temis-group.com/](http://www.temis-group.com/), [www.inxight.com/pdfs/SOX\\_ApplicationOverview.pdf](http://www.inxight.com/pdfs/SOX_ApplicationOverview.pdf), [www.clearforest.com](http://www.clearforest.com)

Successful wide-scale deployment of new analysis tools requires access to raw data containing information of interest. It also requires clear proof points of the advanced capabilities of the new technologies. Finally, the ease of installation and use of the new technology improves the rate of its acceptance.

The three fundamentals are already in the marketplace, but typically have not been leveraged together. Raw data is available in databases and on-line textual documents. Organized access to them can be secured through information integration, which is a relatively mature technology, with several large vendors selling content management solutions. The ease of installation benefits from the emergence of service oriented architectures (SOAs) and experienced vendors with proved deployment methods. Even though newer than information integration, SOAs are beyond the venture capital stage. Finally, the advanced capabilities of text and data mining technology are quickly moving to mainstream<sup>13</sup> increasing the number of proof points and the amount of experience with every deployment. Their state of the art, as relevant for analyzing information on intangibles, is discussed below.

Intuitively, some types of information are easy to extract and some can be difficult. Thus we can expect that the scale of difficulty in extracting data on an intangible attribute will form a spectrum from an easy “database lookup” to “human judgment required”. Somewhere between these two extremes we will have attributes that can be extracted using “commercially available” technologies and some that require “advanced research” technologies.

In some cases the data might be easily mined with a small change in an existing enterprise reporting process. For example, when “value added per customer” is known and the attribute of interest is “value added per professional customer”. In this case the change requires additional data collection, that is, finding whether which customers are “professional”. This task can be accomplished e.g. by adding appropriate questions to a customer survey.

Other cases, such as “customer satisfaction”, typically require more complex data extraction and creation of a new capability, e.g. to extract information from comments recorded by customer agents. Difficult attributes like “brand management” require both deployment of advanced technology and a strategy for deciding which data should be relevant.

Several soft attributes like “innovation”, “codified knowledge” or “tacit knowledge” cannot be automatically mined. Thus, given our focus on executive dashboards, they would belong to the category “human judgment required”. However, it is worth noting that management initiatives to monitor and manage innovation, find expertise or better use tacit knowledge can benefit from new technology tools. For example new search technologies leveraging text mining (called “conceptual” or “semantic” search) use the meaning of words and phrases to index documents and search for them. Such

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<sup>13</sup> See e.g. “Taming text” Computer World, June 21 2004.  
<http://www.computerworld.com/softwaretopics/crm/story/0,10801,93968,00.html>

technologies can be applicable e.g. to classify areas of expertise of employees and find experts in real time. In addition, the above initiatives can be indirectly monitored through benchmarking, and data for benchmarking might come from traces of these activities measured through data extraction from relevant activity-related documents.

Consequently, given the proven potential of new technologies to improve enterprise performance with respect to these soft attributes<sup>14</sup> (e.g. when deployed in employee portals), and the potential for monitoring those attributes (through enterprise reporting applications), we created for them another category of “partial solutions”, and reserved the label “human judgment required” for a few attributes where in our opinion current text and data mining technology seem to provide no help (e.g. “plant flexibility” or “tradability of facilities”).

Based on the above discussion, we can argue that the access to data, technology capability, and enterprise readiness leads to a natural division of intangibles into six classes shown in the next table (Fig. 4).

Technology class	Solution Characteristics	Example attributes and technologies for mining them (in [ ])
Database	Internal data is already available or can be produced from standard reporting applications	Cash burnout rate, On-line revenues, Productivity gains, Customer acquisition costs, Market share growth, Value added per employee... [database lookup]
Commercial out of the box text mining or data mining	Requires rudimentary data or text mining, and/or a small change in data gathering process, for instance collecting of additional data points	Stickiness and loyalty [on-line behavior measurements and text mining of open ended surveys <sup>15</sup> ]; Profit per professional customer [more detailed customer data]; Value added per professional [might require HR reporting software]; Software [comprehensive view of installed software]
Complex commercial <sup>16</sup>	Medium complexity of text mining. Typically a more advanced commercial technology requiring major changes to business process	Customer loyalty and satisfaction [CRM software with advanced text mining]; Top management experience [advanced text mining and information integration], Employee experience [advanced text mining], Quality of corporate governance [advanced text mining and information integration]
Very specialized commercial or Academia <sup>17</sup>	Very advanced text and data mining, possibly with crawling	Brand management; Organizational reputation [crawling, text mining, information integration]
Partial solutions	Driven by a process that can benefit from new text analysis tools., e.g. in to provide data for	Tacit knowledge, Codified knowledge [search with text analytics]

<sup>14</sup> Lotus Discovery Server was an early attempt to address search and expertise location <http://www.redbooks.ibm.com/redbooks.nsf/0/d9896e0e4afa034085256bcd0042a894?OpenDocument>  
Currently dozens of vendors provide services in this space:  
[http://www.findarticles.com/p/articles/mi\\_zdcis/is\\_200407/ai\\_ziff131159](http://www.findarticles.com/p/articles/mi_zdcis/is_200407/ai_ziff131159)

<sup>15</sup> Several vendors, e.g. SPSS: [http://www.spss.com/textanalysis\\_surveys/capabilities.htm](http://www.spss.com/textanalysis_surveys/capabilities.htm)

<sup>16</sup> TAKMI can be example of a scalable complex commercial technology; see IBM Systems J. Volume 40, Number 4 (2001). Text analysis and knowledge mining system by T. Nasukawa, T. Nagano.

<sup>17</sup> WebFountain would be an example

	benchmarking	
Human judgment required.	No clear way of leveraging mining technologies	Structural appropriateness of the enterprise; Tradability of facilities

**Fig. 4.** Intangibles can naturally be divided into six classes based on the ease of applying technology to monitor them.

The table also shows examples of attributes in each category. The color codes in first column will be used to create a map of the technology with regard to its potential to monitor data on intangibles (Fig.5).

Ability to attract talented employees. Losing talent.	Competence: Index, Turnover,	Employee experience	Investments in Internal Structure	Online Revenues	Productivity Gains	Records and Drawings (i.e. Proprietary databases)	Software	Technology Purchase
Access Rights	Competence-Enhancing Customers	Environmental Performance	IT Acquisitions	Online Supply Channels	Professionals Turnover	Regulatory imposts	Stickiness and Loyalty Traffic Measures	Top management experience
Alliances	Credit ratings	Eyeballs (usage traffic)	IT Development	Organic Growth	Profit per Employee	Relative Pay.	Stranded assets	Top management quality
Borrowing capacity	Customer Acquisition Costs	Formal alliances (e.g. JVs, supply agreements)	Know-how	Organization Enhancing Customers.	Profit per Professional, customer,	Research and Development	Strength of stakeholder support including opinion leaders	Tradability of facilities
Brand (investment, stature, support)	Customer Contracts	Formalized processes	Leases	Organizational reputation	Proportion of Big Customers.	Retention	Structural appropriateness	Training and Education Costs.
Capabilities	Customer Loyalty, Satisfaction	Franchise Agreements	License agreements	Patent/Know-how Royalties	Quality of corporate governance	Revenue Growth by Segments	Subscriptions	Undrawn facilities
Cash burnout rate	Devoted Customers Ratio	Frequency of Repeat Orders.	Market Potential/Growth	Patents, Trademarks, Copyrights	Quality of earnings	Revenues from Alliances	Supplier/ Customer Integration	Value Added per Employee
Clinical Tests, FDA Approvals	Diversity	Informal processes	Market Share/Growth	Plant flexibility	Quality of processes, products or services	Reverse Engineering—Spillovers	Support Staff Turnover.	Value Added per Professional.
Codified knowledge	Employee loyalty	Innovation	Marketing Alliances	Plant infrastructure	Quality of supply contracts	Right to tender, right to compete, right to design	Systems	Values/Attitudes Index
Communities of Practice	Employee Training	Investment in IT	Mastheads	Plant modernity	R&D Alliances/Joint Ventures	Rookie Ratio.	Tacit knowledge	Win/Loss Index.

<b>Technology maturity color codes</b>	Existing Database	Commercial out of the box	Complex Commercial Technology	Very Specialized Commercial,	Partial solutions	Human Judgment Required.
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**Fig. 5.** Commercially available technologies can already help monitor 80% of intangibles.



## Creating a comprehensive picture of intangibles

We labeled a comprehensive set of intangible attributes of value according to the capabilities of current technologies to extract information about them. The set of ninety attributes covers all types of intangibles as mentioned in a broad range of books, papers and reports on valuation of intangible assets.<sup>18</sup> We used the categories of Fig. 4 as the labels. The result of our analysis is presented in Fig 5.

Fig. 5 shows that enterprises have an opportunity to build dashboards that provide access to information about intangibles. Significant opportunity exists already: 80% of intangible attributes can be monitored using commercially available technologies. Information integration alone can provide data on about 30% of attributes. Commercially available text and data mining can provide basic data on the next 40% of intangibles. Very advanced (“bleeding edge”) text and data mining techniques can already handle another 10-15%. About half of the remaining 15-20% would probably benefit from text and data analysis tools. The remainder seems to require human judgment.

How are the color labels assigned? As observed above, internal reporting systems can extract data about a large number of numerical attributes (like “Profit per Employee”, “Organic Growth”, and “Stranded assets”). Industry benchmarks often exist for several other numerical attributes (“Relative Pay”<sup>19</sup>). In many cases, data and text mining can enhance the quality of information, e.g. for “Win/Loss Index” – even though the number itself is available without mining, if any tracking of wins and losses is done: text and data mining can classify wins and losses along several predefined dimensions (size of company, industry, time of the year, reported prior events etc.). These are the easy cases.

For a large number of non-numerical attributes we use reported results of mining specific attributes (as in Fig. 3). In many others, the basis for the label assignment comes from the existence of commercial databases<sup>20</sup> with data about specific attributes (e.g. “Top Management Experience”) together with independently gathered examples of successful projects extracting this type of information.<sup>21</sup>

For a few intangible attributes, like “Ability to attract talented employees”, we use the existence of partial solutions, e.g. text mining on resumes<sup>22</sup>, surveys<sup>23</sup> and other text analytics to argue that appropriate metrics (e.g. of competitors are attracting current employees) could be derived from resumes, exit interviews, and other textual data. Finally, we used our judgment to place a few (3-4) more ambiguous attributes like

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<sup>18</sup> Our previous paper (“Text Analytics for Assets Valuation” IBM Research Report RC23311) lists the sources

<sup>19</sup> Salary benchmarks are available e.g. at <http://www.compensation-online.com/>

<sup>20</sup> E.g. Thomson Financial <http://www.thomson.com/financial/financial.jsp>

<sup>21</sup> Cf. e.g. <http://www.ai.sri.com/~appelt/ie-tutorial/IJCAI99.pdf> for examples and techniques (quality of result is better now than 1999).

<sup>22</sup> E.g. [www.resumemirror.com](http://www.resumemirror.com) and Amit Bagga and Joyce Yue Chai (1997) A Trainable Message Understanding System. In T.M. Ellison (ed.) CoNLL97: Computational Natural Language Learning, ACL pp 1-8.

<sup>23</sup> E.g. SPSS Text Analysis for Surveys [www.spss.com/textanalysis\\_surveys](http://www.spss.com/textanalysis_surveys)

“Organization enhancing customers”<sup>24</sup>, where arguments could be made for either of the two technology categories “Complex commercial” or “Bleeding edge”.

### How do we put it all together?

Service oriented architectures (SOAs) can support the management of intangibles, and the existing portal solutions could be expanded to do so. Fig. 6 presents a generic example of a portal architecture. Since in this architecture data from many databases can be integrated, transformed and presented to different constituents, other data sources can be added and leveraged with the set of existing services (e.g. security and portal services). Several SOA technologies can be use in this space. For example, Information Integration solutions from IBM<sup>25</sup> and many portals (such as WebSphere, or BEA Unified Portal Architecture Fig.6)<sup>26</sup> can help with linking information sources and presenting the results.

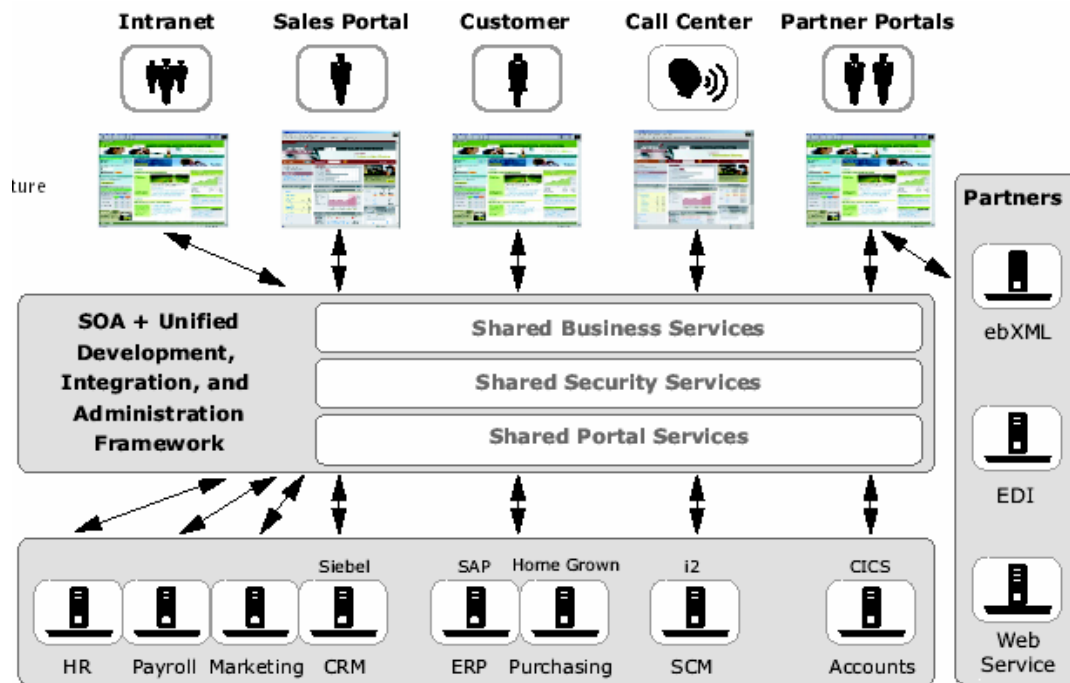


Fig. 6. Unified Portal Architecture (Source BEA<sup>27</sup>)

The core of text processing can be done on the basis of UIMA, IBM Unstructured Information Management Architecture<sup>28</sup>. UIMA can be viewed as a blueprint for putting

<sup>24</sup> “Organization-enhancing customers” are those that help build internal consulting capabilities or products

<sup>25</sup> E.g. <http://www-106.ibm.com/developerworks/db2/library/techarticle/dm-0407saracco/>

<sup>26</sup> cf. e.g. [http://media.corporate-ir.net/media\\_files/NSD/BEAS/presentations/BEAinFinancialServicesFinal.pdf](http://media.corporate-ir.net/media_files/NSD/BEAS/presentations/BEAinFinancialServicesFinal.pdf)

<sup>27</sup> Source BEA

<sup>28</sup> IBM Systems Journal: <http://www.research.ibm.com/journal/sj43-3.html> and <http://www.alphaworks.ibm.com/tech/uima> for downloading the software tool kit.

together text analytics modules. It specifies the interfaces different modules must adhere to, but otherwise views them as interchangeable. Therefore, they can come from different vendors and be applied to different attributes. They can also be replaced by new modules as the quality of text analyzers, search engines and available knowledge sources improves. Alternatively, text mining solutions can be built by piecing together technologies from one or several vendors around a content management platform.

Obviously the implementation of intangibles-oriented reporting functions will not be easy. The technical obstacles include the maturity of information integration and Service Oriented Architectures, quality and cost of text miners, and the lack of technical skills. The business obstacles include the perception that intangibles are “too soft“ to measure and manage<sup>29</sup> and the lack of legal obligation to disclose information on intangibles.

The Accenture/Economist survey quoted earlier observes: [...] *executives say performance measurement of intangible and intellectual capital assets insufficient or even nonexistent. Only 5 percent of surveyed executives claim their company has a robust system that measures and tracks all aspects of the performance of these assets. Sixty percent say they apply only some of these measures, and one third do not measure the performance of intangible assets or intellectual capital at all.*<sup>30</sup>

Note that if the survey asked about *using technology* to manage intangibles the corresponding numbers would likely be much smaller. Thus we can assume that no company has a comprehensive portal for informing on intangibles. Nevertheless, we dare to predict that within the next decade many enterprises will<sup>31</sup>. As it is often the case, a few who quickly introduce portals for managing intangible assets will likely gain a disproportionate competitive advantage.

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<sup>29</sup> E.g. Kaplan and Norton, Harvard Business Review, Feb. 2004 p.63.

<sup>30</sup> Accenture: <http://www.accenture.com/xdoc/en/services/sba/hotidea/value.pdf>

<sup>31</sup> The progress will be guided by slow increase of the process of monitoring of intangibles from the level of non-existent to managed and optimizing, as usual with a new technology. The levels of maturity and immaturity of are neatly summarized in <http://www.sei.cmu.edu/pub/documents/93.reports/pdf/tr24.93.pdf> and <http://www.cs.ucl.ac.uk/staff/A.Finkelstein/papers/immaturity.pdf>.