A Context-based Multi-Dimensional Corporate Analysis Method

Abstract:

This paper presents a context-based multi-dimensional corporate analysis method that evaluates companies based on user-specified contextual settings. The contextual settings are translated and decomposed into distinct spaces, finance, technology, and brand, each of which consists of a subspace containing multiple parameters. The contextual settings determine the relevance of each of such parameters in evaluating companies by assigning appropriate weight to the parameter. The important feature of this corporate analysis method is that it allows the user to analyze companies seamlessly only with the contextual settings without the knowledge of multi-dimensional decomposition.

1. INTRODUCTION

Companies play a central role in economic value creation in today's industrialized societies, and they have created many social participants or stakeholders such as investors, lenders, suppliers, customers, and employees. Companies provide information about themselves in the form of financial statements, as mandated by government authorities, and they are the primary source of information for stakeholders. Financial statements can provide significant information about the company but they fail to give appropriate information to answer diverse questions each stakeholder is concerned with. Moreover, with ever increasing significance of corporate intangible assets in recent years, financial statements alone can no longer describe the state of the company adequately, even under the latest international accounting standard. We build an analytical model that evaluates companies for stakeholders in accordance with their distinct contextual information. And in evaluating companies, we incorporate not only the conventional financial information but also company's intangible assets to provide more complete view of companies. We introduce a Context-based Multi-Dimensional Corporate Analysis Method that provides the user with capabilities of analyzing and evaluating companies in multi-dimensional spaces. And the important feature of our analysis method is that it uses the user's contextual settings only alleviating the need to have the expert knowledge in those domains. We utilize the Mathematical Model of Meaning (MMM) [5][8][9] in translating user's contextual settings into specific set of objectives and conditions to be used for the analyses.

2. BACKGROUND

Corporate stakeholders need to make well-informed intelligent decisions to excel in their interactions with companies. However, stakeholders face various difficulties from identifying relevant information, acquiring it, and digesting the information to their advantage. First, stakeholders may not know what kind of relevant information may be available, where they may exist, and how to get access to them. Second, stakeholders may not know how to integrate such diverse information as each category of information exhibit different characteristics from each other. And third, stakeholders may not know how to interpret and make optical use of the information. Each of these challenges needs to be addressed. The Context-based Multi-dimensional Corporate Analysis Method helps stakeholders accomplish the second and the third challenges.

With respect to the second point, information readily available to stakeholders in public domain presently is financial reporting. Financial reporting is a well-standardized documentation under generally accepted accounting principle in many industrialized counties. The principal part of the reporting consists of balance sheet, income statement, and statement of cash flow. The balance sheet shows company's assets as well as its financing methods for those assets at the end of the reporting period. The income statement, also known as profit & loss statement, shows the financial flow of the company's activities during the period on an accrual basis – the amount of revenue, the amount of expenses, and the amount of profits or loss. And the statement of cash flow shows inflows and outflows of cash by company's activities in three categories – operation, investment, and financing.

Outside of the corporate financial information, there is public and private information pertaining to company's intangible assets. Corporate intangible assets include technological strengths, brands, customer base, internal business systems, supply chain network, etc. In this paper, we include two major intangible assets – technology and brand. Technology and brand were chosen because these constitute companies' very significant and increasing portions of intangible assets that are not well-captured in the aforementioned financial reporting under today's accounting standards. We use patent-related data to represent company's relative technological advancement. Patents are legal rights on new technologies that allow the patent owner to exclude others to use. Therefore patents can be extremely powerful competitive advantage against others particularly for technology-oriented companies. We use brand value to assess acceptability of company's products and services by general markets. The relative strengths of these intangible assets are indication of company's strengths and thus suggest growth potential of companies' revenue. They also suggest higher profitability due to real and perceived superiority of profits and services. The aforementioned very different information, namely financial information, technology information, and brand information need to be integrated and made available for evaluation in accordance with the stakeholder's interest. And it means such evaluation must be made by criteria relevant to the stakeholder's distinct context.

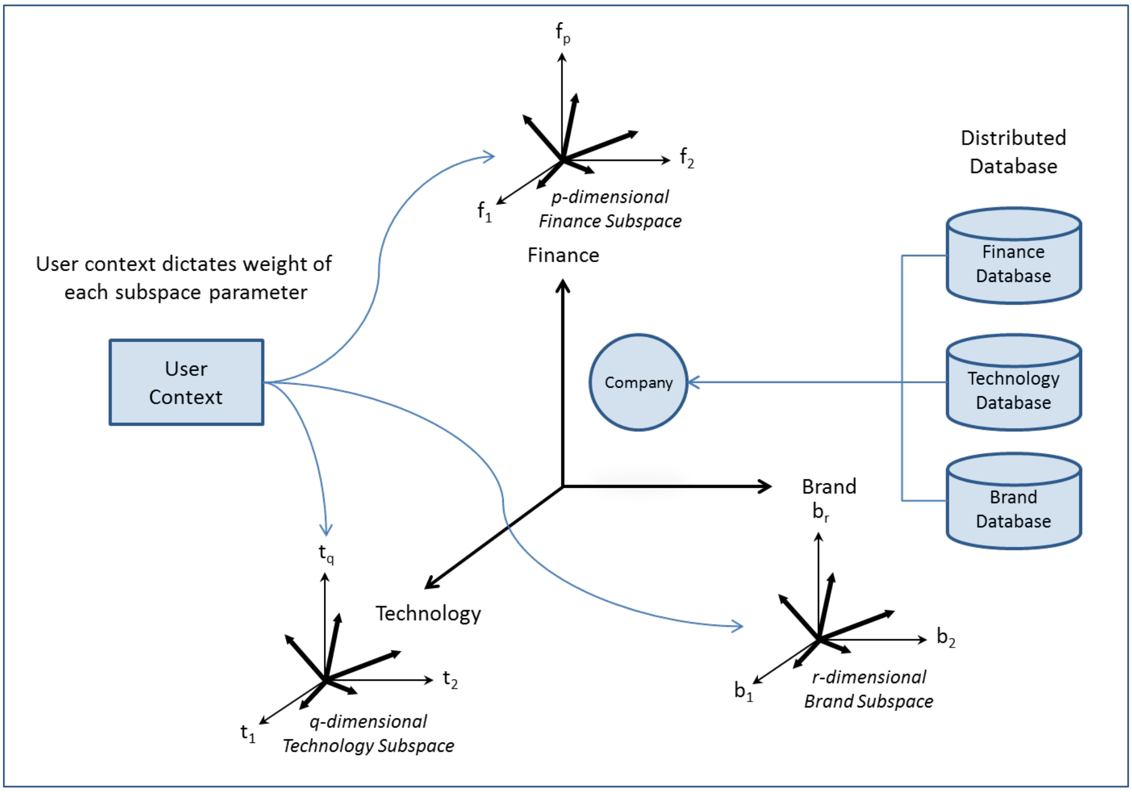

Figure 1 An Overview of Context-based Multi-dimensional Corporate Analysis Method

3. SYSTEM ARCHITECTURE

A typical system architecture of a Context-based Multi-dimensional Corporate Analysis Method is described below. The system consists of four major components: an external Application Software, Corporate Analyzer Subsystem, Context/Query Qualification Subsystem, and external Distributed Databases.

3.1. Application Software

Application Software manages the user presentation layer of the system. It manages the user interface for context word input as well as query word input. For input and output, it should have graphical user interface for easier input and better presentation of the results. It should also allow real-time interactivities between the input and output to allow the user to reach optimal results.

3.2. Corporate Analyzer Subsystem

Corporate Analyzer Subsystem manages the interface with the Application Software, Context/Query Qualification Subsystem, and external distributed databases via the wide-area computer network. It consists of the following three components:

3.2.1. User I/O Processing Module

The User I/O Processing Module takes in the user context and query words from the application software, inquires the Context/Query Qualification Subsystem for a set of appropriate context and query specifications.

3.2.2. Data Analysis Module

The Data Analysis Module takes in context specifications, query specifications, and data set from external distributed databases to evaluate companies and generate the results which are passed to the User I/O Processing Module for user consumption.

3.2.3. Data Fetch Module

The Data Fetch Module receives the location information of each of the line item from the Corporate Analyzer Subsystem and issues inquiry to receive appropriate data from the distributed databases. Once proper data is received, it returns it to the Data Analysis Module.

3.3. Context/Query Qualification Subsystem

Context/Query Qualification Subsystem accepts context and query words from the User I/O Processing Module and returns context specifications and query specifications to it. The subsystem utilizes the Mathematical Model of Meaning (MMM) to extract the meaning of user-specified context words and query words in reference to field-specific terms and generates context specifications and query specifications. Context specification contains two types of data - one is a set of objectives in association with companies and the other is a set of conditions and restrictions to be considered in evaluating companies. Query specification is a list of target company names to be evaluated. These specifications are passed to the Data Analysis Module.

3.4. Distributed Databases

Distributed Databases are the sources of data that constitute information to be used in the corporate analyses. Databases include both public and private domains and span many kinds of category.

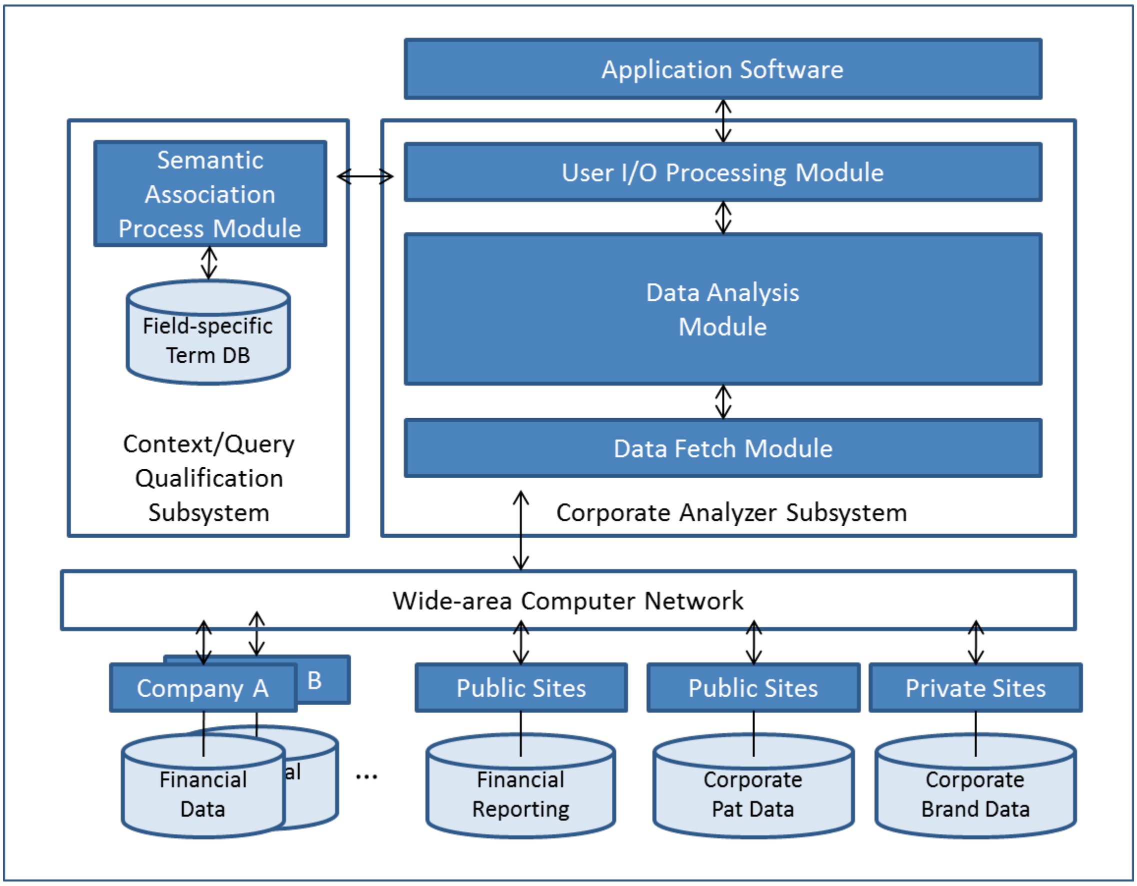

Figure 2 A typical system of Context-based Multi-dimensional Corporate Analysis Method

3.5. Detailed Description of Data Analysis Module

The Data Analysis Module of the Corporate Analyzer Subsystem is described more in detail to explain what constitutes the data analysis.

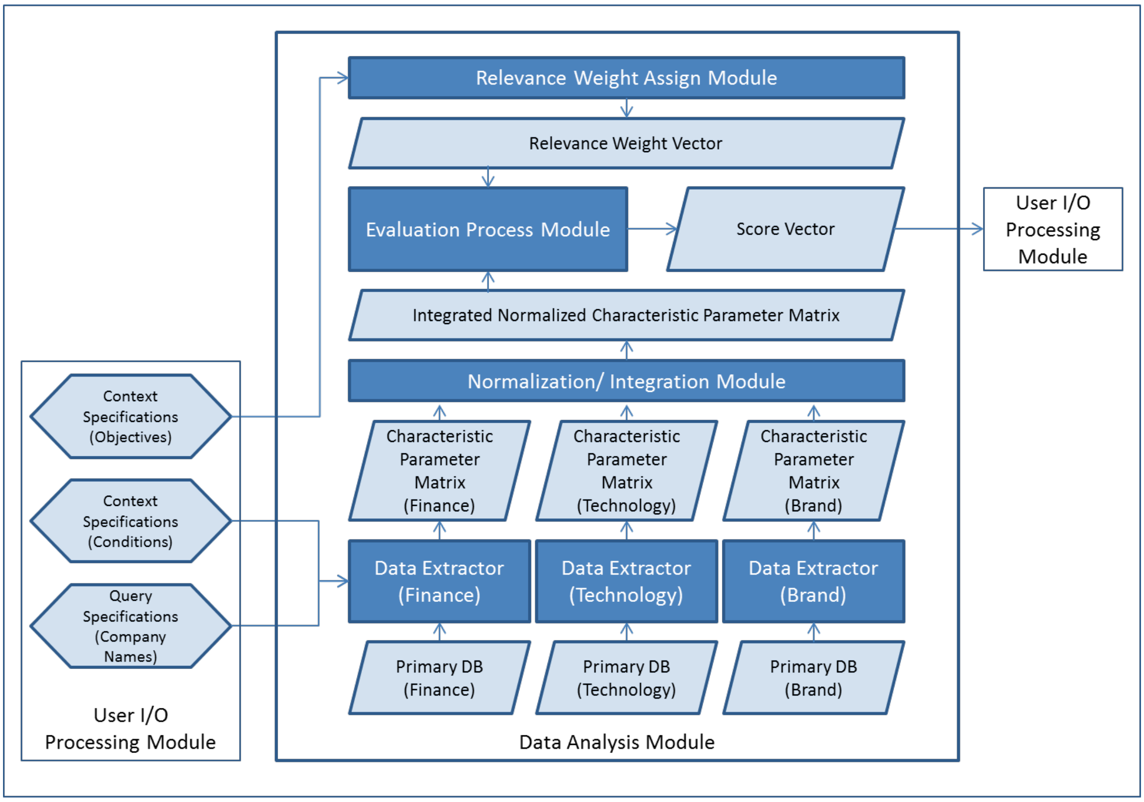

Figure 3 A Detailed Architecture of the Data Analysis Module

3.5.1. Primary Database

The Primary Database is a cashed replica of all relevant data acquired from the distributed database sources through the Data Fetch Module. It takes the role of universal data set necessary to conduct the analyses. Thus the Primary Database include wide range of data including time series of each line item per category. It is kept updated on a regular basis to maintain entirety and the current state.

3.5.2. Data Extractor

The Data Extractor extracts relevant data for analyses from the Primary Database in each category. It accepts two inputs from the User I/O Processing Module – one is the Query Specifications and the other is the Context Specifications for conditions. The Query Specifications list all target company names for the analyses and evaluation. The Context Specifications for conditions qualifies the target companies and may deselect the ones that do not meet the conditions set forth. For example, if a minimum revenue size is specified for the most recent revenue as a condition, then companies that did not satisfy such criteria are deselected even when the Query Specifications include such company. After the Data Extractor selects appropriate data, it constructs the Characteristic Parameter Matrix for the given category. Characteristic Parameter Matrix consists of elements each of which is a result of certain algorithmic function taking inputs from the Primary Database. For example, financial ratios are elements of a financial Characteristic Parameter.

3.5.3. Characteristic Parameter Matrix

The Characteristic Parameter Matrix is one of the key elements of the Context-based Multi-dimensional Corporate Analysis Method. The Characteristic Parameter Matrix is an implementation of the distinct set of domain spaces (Finance, Technology, and Brand) that further consist of multi-dimensional parametric subspaces. The matrix contains i x j elements where i is the number of target companies determined by the Query Specifications and Context Specifications for conditions as described above, while j is the total number of parameters in all evaluation subspaces. Thus these elements in Characteristic Parameter Matrix serve as the basic representation of company characteristics.

As an illustration, we create Characteristic Parameter Matrix for three categories for m companies as below. The three categories may be finance, technology, and brand, for example.

For Category-1: Finance

$$\left.\begin{array}{l} CP_{comp\text{-}A} = (k_{A\text{cat-1 }1}, k_{A\text{cat-1 }2}, \ldots k_{A\text{cat-1 }p}) \\ CP_{comp\text{-}B} = (k_{B\text{cat-1 }1}, k_{B\text{cat-1 }2}, \ldots k_{B\text{cat-1 }p}) \\ CP_{comp\text{-}C} = (k_{C\text{cat-1 }1}, k_{C\text{cat-1 }2}, \ldots k_{C\text{cat-1 }p}) \\ \quad\ldots \\ CP_{comp\text{-}X} = \underbrace{(k_{X\text{cat-1 }1}, k_{X\text{cat-1 }2}, \ldots k_{X\text{cat-1 }p})}_{p\ elements} \end{array}\right\} m\ companies$$

For Category-2: Technology

$$\left.\begin{array}{l} CP_{comp\text{-}A} = (k_{A\text{cat-2 }1}, k_{A\text{cat-2 }2}, \ldots k_{A\text{cat-2 }q}) \\ CP_{comp\text{-}B} = (k_{B\text{cat-2 }1}, k_{B\text{cat-2 }2}, \ldots k_{B\text{cat-2 }q}) \\ CP_{comp\text{-}C} = (k_{C\text{cat-2 }1}, k_{C\text{cat-2 }2}, \ldots k_{C\text{cat-2 }q}) \\ \quad\ldots \\ CP_{comp\text{-}X} = \underbrace{(k_{X\text{cat-2 }1}, k_{X\text{cat-2 }2}, \ldots k_{X\text{cat-2 }q})}_{q\ elements} \end{array}\right\} m\ companies$$

For Category-3: Brand

$$\left.\begin{array}{l} CP_{comp\text{-}A} = (k_{A\text{cat-3 }1}, k_{A\text{cat-3 }2}, \ldots k_{A\text{cat-3 }r}) \\ CP_{comp\text{-}B} = (k_{B\text{cat-3 }1}, k_{B\text{cat-3 }2}, \ldots k_{B\text{cat-3 }r}) \\ CP_{comp\text{-}C} = (k_{C\text{cat-3 }1}, k_{C\text{cat-3 }2}, \ldots k_{C\text{cat-3 }r}) \\ \quad\ldots \\ CP_{comp\text{-}X} = \underbrace{(k_{X\text{cat-3 }1}, k_{X\text{cat-3 }2}, \ldots k_{X\text{cat-3 }r})}_{r\ elements} \end{array}\right\} m\ companies$$

3.5.4. Normalization/ Integration Module

Each element of the Characteristic Parameter Matrices is normalized according to its data characteristics. The normalized value has a range between -1 and +1. After the normalization, as the elements have become comparable, multiple matrices are combined to create an integrated Characteristic Parameter Matrix. Three matrices are horizontally combined to form an intermediate integrated data structure in the following example.

	Category-1: p elements (Finance)	Category-2: q elements (Technology)	Category-3: r elements (Brand)
$CP_{comp\text{-}A}$ =	$(k_{Acat\text{-}1\ 1}, k_{Acat\text{-}1\ 2}, \ldots k_{Acat\text{-}1\ p})$,	$(k_{Acat\text{-}2\ 1}, k_{Acat\text{-}2\ 2}, \ldots k_{Acat\text{-}2\ q})$,	$(k_{Acat\text{-}3\ 1}, k_{Acat\text{-}3\ 2}, \ldots k_{Acat\text{-}3\ r})$
$CP_{comp\text{-}B}$ =	$(k_{Bcat\text{-}1\ 1}, k_{Bcat\text{-}1\ 2}, \ldots k_{Bcat\text{-}1\ p})$,	$(k_{Bcat\text{-}2\ 1}, k_{Bcat\text{-}2\ 2}, \ldots k_{Bcat\text{-}2\ q})$,	$(k_{Bcat\text{-}3\ 1}, k_{Bcat\text{-}3\ 2}, \ldots k_{Bcat\text{-}3\ r})$
$CP_{comp\text{-}C}$ =	$(k_{Ccat\text{-}1\ 1}, k_{Ccat\text{-}1\ 2}, \ldots k_{Ccat\text{-}1\ p})$,	$(k_{Ccat\text{-}2\ 1}, k_{Ccat\text{-}2\ 2}, \ldots k_{Ccat\text{-}2\ q})$,	$(k_{Ccat\text{-}3\ 1}, k_{Ccat\text{-}3\ 2}, \ldots k_{Ccat\text{-}3\ r})$
	…	…	…
$CP_{comp\text{-}X}$ =	$(k_{Xcat\text{-}1\ 1}, k_{Xcat\text{-}1\ 2}, \ldots k_{Xcat\text{-}1\ p})$,	$(k_{Xcat\text{-}2\ 1}, k_{Xcat\text{-}2\ 2}, \ldots k_{Xcat\text{-}2\ q})$,	$(k_{Xcat\text{-}3\ 1}, k_{Xcat\text{-}3\ 2}, \ldots k_{Xcat\text{-}3\ r})$

3.5.5. Integrated Normalized Characteristic Parameter Matrix

A general description of an Integrated Normalized Characteristic Parameter Matrix can be given as below where the number of rows indicates the number of target elements to be evaluated and the number of columns indicate the number of Characteristic Parameters of all relevant categories.

$$CP = \begin{pmatrix} k_{1,1}, k_{1,2}, k_{1,3}, \ldots k_{1,j}, \ldots k_{1,n} \\ k_{2,1}, k_{2,2}, k_{2,3}, \ldots k_{2,j}, \ldots k_{2,n} \\ k_{3,1}, k_{3,2}, k_{3,3}, \ldots k_{3,j}, \ldots k_{3,n} \\ \ldots \\ k_{i,1}, k_{i,2}, k_{i,3}, \ldots. k_{i,j}, \ldots k_{i,n} \\ \ldots \\ k_{m,1}, k_{m,2}, k_{m,3}, .. k_{m,j}, .. k_{m,n} \end{pmatrix}$$

3.5.6. Relevance Weight Assign Module

Relevance Weight Assign Module gives a weight factor to each of the Characteristic Parameter element to reflect Context Specifications for objectives. The assignment is controlled not only by the type of objectives but also the priorities of such objectives.

3.5.7. Relevance Weight Vector

The Relevance Weight Matrix is constructed by the Relevance Weight Assign Module and has the same size as the Characteristic Parameter Matrix as illustrated below.

$RW = (w_1, w_2, w_3, \ldots w_j, \ldots w_n)$

3.5.8. Evaluation Process Module

All data has been prepared to conduct data operation to produce score for each of the target element. The inner product operation is conducted on each row of the Characteristic Parameter Matrix and the Relevant Weight Vector to yield each element of the Score Vector.

$$\mathbf{SV} = \mathbf{CP} \cdot \mathbf{RW}$$

3.5.9. Score Vector

The results of the inner product operation by the Evaluation Process Module produce an m x 1 vector. Each element is compared and ranked and passed on to the User I/O Interface Module for presentation to the user.

$$\mathbf{SV} = \begin{pmatrix} s_1 \\ s_2 \\ s_3 \\ \ldots \\ s_i \\ \ldots \\ s_m \end{pmatrix}$$

4. IMPLEMENTATION and EXPERIMENT

Because the Data Analysis Module is the core of the Context-based Multi-dimensional Corporate Analysis Method, we implement this module and experiment it to test its viability. We make certain assumptions in this particular implementation.

a) Context/ Query Qualification Subsystem is assumed functioning and thus the conversion of context words and query words into Context Specifications and Query Specifications respectively is correctly accomplished. We use manually made Context Specifications and Query Specifications.
b) The Data Fetch Module functions well and result in diverse set of data that is enough to experiment multiple settings of context and query words by the user. We use the following data:
    a. Financial - Financial statements of the past 10 years [3], [11]
    b. Technology – Patent data of the past 10 years [12]
    c. Brand – Brand value estimate for the past 10 years + most recent “Green Score” [13][14]

4.1. Context Specifications

Examples of Context Specification for objectives are listed in Figure 4. As indicated by connecting lines, each stakeholder has its own interest and objectives of multiple kinds at various degrees of priority.

For example, following Role – Objectives combinations are possible:

Investor – Income gain, Social acceptance, Pride, Employment opportunity

Customer – Good product, Social acceptance, Innovative technology, Large customer base

An objective is translated into multiple Characteristic Parameters as exemplified in Figure 3.

In addition to the Context Specifications for objectives, Context Specifications for conditions may be added to qualify target companies to be listed by Query Specifications. Examples include:

(Revenue > $10 Billion) AND (5-year CAGR on Brand Value > 15%)

(# Employees < 10,000) AND (Beta < 2.0) AND (3-year CAGR on NI > 20%)

Only companies that meet these criteria remain as target companies for further analyses.

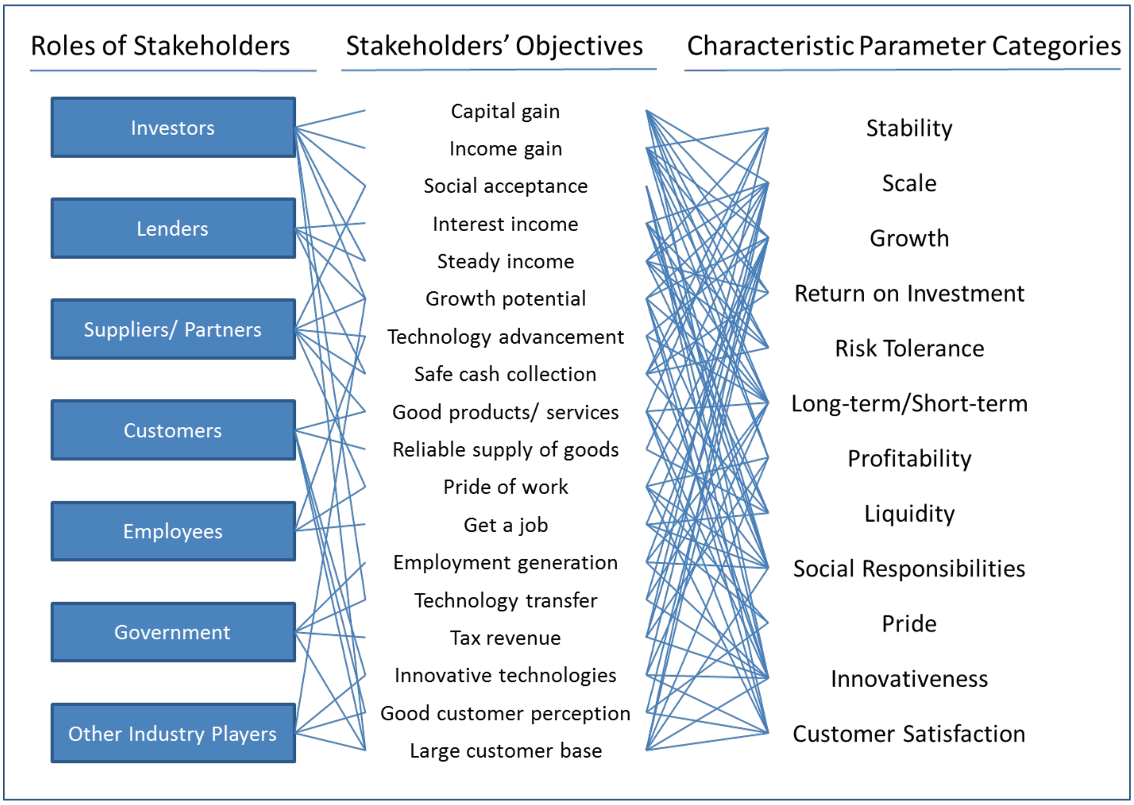

Figure 4 Examples of Context Specifications for Objectives

4.2. Conversion examples of Query Words to Query Specifications

Query words can be actual listing of company names. Or they can be names of industry sectors or other descriptive words that can relate to and define company names by Context/ Query Qualification Subsystem.

4.3. Characteristic Parameters

Characteristic Parameters are driven by each stakeholder's role and objectives and their priority order. We list Characteristic Parameters by category as below.

Financial

Basic	Rev, EBITDA, EBIT, NI, Diluted EPS, Market Cap, Cash & Short-term Inv, TEV
Profitability	ROA, ROE, RO Common Equity
Margin	GM%, EBITDA%, EBIT%, NI%
Turnover	Total Asset Turnover, Fixed Asset Turnover, AR Turnover, Inventory Turnover
Liquidity	Current Ratio, Quick Ratio, Cash from Ops/Current Liabilities
Solvency	D/E, LTD/E, Total Lib/Total Assets
Growth-1	Rev., EBITDA, EBIT, NI, Cash from Ops., CapEX
Growth-3 (CAGR)	Rev., EBITDA, EBIT, NI, Cash from Ops., CapEX
Growth-5 (CAGR)	Rev., EBITDA, EBIT, NI, Cash from Ops., CapEX
TEV	TEV/Rev, TEV/EBITDA, TEV/EBIT
Volatility	Beta
Stability	Variance (Rev)/Rev, Variance (NI)/NI

Technology

Basic	#Total Active Patents, #Top 10%-class Patents, #Total Litigation Cases, $R&D
Tech Capabilities	#Top 10% Pats/# Total Active Pats
	#Top 10% Pats/ $R&D
	#Plaintiff Cases/ #Defendant Cases
Resource Allocation	$R&D/ Total Rev
	CAGR-1yr ($R&D), CAGR-3yrs ($R&D), CAGR-5yrs ($R&D)

Brand

Social Acceptance	$Brand Value 2011, Green Score 2011
Growth-1	$Brand Value
Growth-3 (CAGR)	$Brand Value
Growth-5 (CAGR)	$Brand Value

4.4. Experiment

We experiment the validity of Data Analysis Module with fifty-eight global companies of a number of sectors with their headquarters located in the USA, Germany, France, Finland, Canada, Japan, Netherland, Taiwan, and Korea. The sectors cover business services, software, financial services, electronics, internet services, automobile, FMCG (Fast Moving Consumer Goods), restaurants, luxury items, etc.

We use the following settings for the model experimentation. For Characteristic Parameters, we use the following data from respective sources to construct the Characteristic Parameters in each of the category.

Finance: Financial data from corporate financial statements
Sources: Capital IQ [3], Mergent Online [4]

Technology: Patent-related data
Source: Innography [12]

Brand: Brand economic values and scores
Source: Interbrand Best Global Brands 2006, 2007, 2008, 2009, 2010, 2011 [13]
Source: Interbrand Best Global Green Brand 2011 [14]

<Context Specification>

Role-Objective Specification

RO_1: Investor – Income gain, Eco-conscious, Long-term, Risk-averse, Non-tech, Socially accepted

RO_2: Investor – Capital gain, Short-term, Innovative, Risk-taking

RO_3: Customer – Pleasure of ownership, Stable, Growing, Innovative

RO_4: Job Seeker – Well-known, Socially accepted, Growing, Somewhat stable, Large, Well-managed

RO_5: Supplier – Cash-rich, Stable, Growing, Innovative, Profitable, Efficient

RO_6: Business Acquirer – Innovative, High-quality patent-rich, Not heavily leveraged, Efficient

Query Specification

Large global companies of all industries

<Characteristic Parameters>

Finance

Basic: Market Capitalization, Revenue, Gross profit, Net income, R&D Expense

Liquidity: Cash and equivalent, Current ratio, Quick ratio

Solvency: Total debt-equity ratio, Long-term debt-equity ratio

Volatility: Beta (1 year), Beta (2-year average), Beta (5-year average)

Profitability: Gross margin, EBITDA margin, Net income margin

Efficiency: Return on asset, Return on common equity, Total asset turnover

Growth: Revenue growth (1 year, 3 years, 5 years), EBITDA growth (1 year, 3 years, 5 years)

Income: Dividend yield

Technology

Total active patents

Total top-10% active patens, Top-10% ratio

Top-10% patent generation with priority date in 2001 – 2002

Top-10% patent generation with priority date in 2003 – 2006

Top-10% patent generation with priority date in 2007 – 2010

<u>Brand</u>

Brand economic value in 2011

Brand economic value growth – 1 year

Brand economic value growth – 5 year

Brand economic value growth – 9 year

Global ranking 2010, Global ranking 2011

Green score 2011

We compile Characteristic Parameter data and normalize them to create Normalized Character Parameter Matrix. We assign relevance factor on each of the Characteristic Parameters for each of Context's Role-Objective specification and conduct the inner product operation to generate a score for each company in accordance to the contextual specification. Table 1 below indicates the resulting figures in terms of the scores and ranking for each of the fifty-eight companies.

Table 1 Resulting Score and Associated Ranking of Each Company Generated by Data Analysis Module for the Given Contextual Specification

			Score						RANK					
Sector	HQ Country	Company	OR-1	OR-2	OR-3	OR-4	OR-5	OR-6	OR-1	OR-2	OR-3	OR-4	OR-5	OR-6
Alcohol	Netherlands	1	4.0	1.6	1.5	3.6	4.2	3.0	50	46	56	54	40	56
Apparel	USA	2	3.3	0.7	0.7	3.7	3.6	3.6	56	55	58	51	54	47
Automotive	Germany	3	4.4	2.4	2.4	4.6	4.6	3.7	46	33	51	42	32	46
Automotive	Germany	4	6.0	1.9	4.3	5.9	4.3	3.4	18	41	26	21	37	54
Automotive	Germany	5	6.0	1.7	4.7	5.7	4.1	3.8	19	45	19	23	44	44
Automotive	Germany	6	6.1	2.7	4.1	5.8	5.3	3.9	17	27	29	22	17	40
Automotive	Japan	7	5.4	0.9	4.5	5.4	4.2	4.2	32	53	23	31	39	33
Automotive	Japan	8	3.1	1.9	2.0	3.1	3.9	3.8	57	42	53	57	47	43
Automotive	Japan	9	5.8	0.9	5.2	6.2	4.9	4.5	27	52	14	17	25	30
Automotive	USA	10	4.1	3.4	3.9	3.1	1.9	3.3	48	18	31	56	58	55
Automotive	USA	11	1.6	2.2	1.4	1.8	2.6	3.9	58	35	57	58	57	41
Beverages	USA	12	8.3	2.6	5.4	7.7	5.7	4.0	3	29	13	6	12	38
Beverages	USA	13	7.0	2.5	4.6	6.5	5.2	4.1	10	32	21	11	20	34
Bus Svc	Germany	14	6.8	4.1	5.1	6.4	5.8	5.4	11	9	15	13	11	15
Bus Svc	USA	15	5.7	2.3	3.1	6.0	4.6	4.7	28	34	42	20	30	24
Bus Svc	USA	16	6.4	3.7	6.5	6.5	5.7	5.9	12	12	7	12	13	11
Bus Svc	USA	17	7.9	4.7	7.9	8.3	6.7	6.6	4	6	3	3	6	4
Bus Svc	USA	18	6.2	5.1	5.9	6.2	6.4	6.3	15	3	9	16	9	7
Diversified	Germany	19	5.9	2.5	4.6	5.6	5.2	4.8	23	31	20	27	22	22
Diversified	USA	20	5.2	3.7	4.4	5.1	5.2	6.1	36	11	24	36	21	10
Diversified	USA	21	4.2	3.2	3.6	4.4	3.7	4.0	47	20	34	46	52	39
Diversified	USA	22	7.5	3.5	5.4	7.8	6.7	6.4	8	15	12	4	7	6
Electronics	Canada	23	5.2	3.0	3.5	5.6	4.9	4.9	35	23	36	24	24	19
Electronics	Finland	24	5.5	0.5	4.3	5.4	4.1	4.6	30	58	25	29	43	27
Electronics	Japan	25	5.5	3.4	5.7	6.0	5.5	6.5	29	17	11	19	14	5
Electronics	Japan	26	4.0	1.9	4.2	4.8	5.3	5.6	51	43	27	41	19	13
Electronics	Japan	27	4.0	0.7	4.0	4.9	4.1	4.6	49	56	30	39	42	26
Electronics	South Korea	28	7.1	4.0	6.8	7.5	7.1	6.2	9	10	6	7	3	8
Electronics	Taiwan	29	6.4	4.8	2.9	5.6	6.0	4.7	13	5	44	26	10	23
Electronics	USA	30	9.8	7.4	9.0	10.4	8.5	6.7	1	1	1	1	1	3
Electronics	USA	31	4.6	2.1	3.3	5.2	3.7	4.1	42	37	38	35	51	36
Electronics	USA	32	6.2	3.3	6.3	6.8	4.8	5.5	14	19	8	10	27	14
Electronics	USA	33	7.8	4.8	7.0	7.8	7.1	7.0	5	4	5	5	4	2
Electronics	USA	34	4.5	3.6	4.9	4.6	3.6	5.3	45	13	18	43	53	16
Energy	Netherlands	35	6.2	4.2	4.6	6.1	5.3	4.7	16	8	22	18	18	25
Fin Svc	France	36	4.8	0.7	2.6	4.3	3.1	2.7	41	57	45	48	55	58
Fin Svc	Germany	37	4.6	0.9	2.5	3.9	3.0	2.8	43	54	49	49	56	57
FMCG	France	38	5.8	1.6	3.3	5.3	4.7	3.6	25	48	39	34	28	48
FMCG	France	39	6.0	1.6	3.7	5.6	5.0	4.1	22	47	32	25	23	37
FMCG	Germany	40	3.8	1.1	1.6	3.6	4.3	3.5	53	51	55	53	38	53
FMCG	USA	41	4.9	1.4	2.5	4.5	3.7	3.9	38	49	48	45	50	42
FMCG	USA	42	5.4	2.7	2.6	5.0	4.9	4.5	31	28	46	37	26	29
FMCG	USA	43	4.9	2.1	2.5	4.3	4.0	3.6	39	40	50	47	45	51
FMCG	USA	44	5.9	3.6	5.0	5.4	6.8	6.2	24	14	16	30	5	9
FMCG	USA	45	6.0	1.4	3.2	5.3	4.1	3.6	21	50	40	32	41	52
Internet Svc	USA	46	5.3	3.4	5.7	6.2	4.5	5.1	33	16	10	15	35	18
Internet Svc	USA	47	4.8	3.1	3.4	4.5	4.4	4.1	40	22	37	44	36	35
Internet Svc	USA	48	7.7	4.6	7.3	7.5	6.6	5.6	6	7	4	8	8	12
Internet Svc	USA	49	3.4	2.8	2.5	3.2	4.0	4.5	55	25	47	55	46	28
Luxury	France	50	5.0	2.6	2.3	5.0	5.5	4.4	37	30	52	38	15	31
Luxury	France	51	5.8	2.1	3.7	5.5	4.6	3.6	26	38	33	28	29	50
Luxury	USA	52	3.6	1.8	1.6	3.7	3.7	3.8	54	44	54	50	48	45
Media	USA	53	5.3	2.1	3.5	5.3	3.7	3.6	34	39	35	33	49	49
Restaurants	USA	54	7.5	2.2	4.2	7.2	5.3	4.3	7	36	28	9	16	32
Restaurants	USA	55	4.5	2.7	3.0	4.8	4.6	4.8	44	26	43	40	31	21
Software	USA	56	3.9	3.2	3.2	3.6	4.6	4.9	52	21	41	52	34	20
Software	USA	57	8.6	5.7	8.1	8.5	8.0	7.6	2	2	2	2	2	1
Sport Goods	USA	58	6.0	3.0	4.9	6.3	4.6	5.1	20	24	17	14	33	17

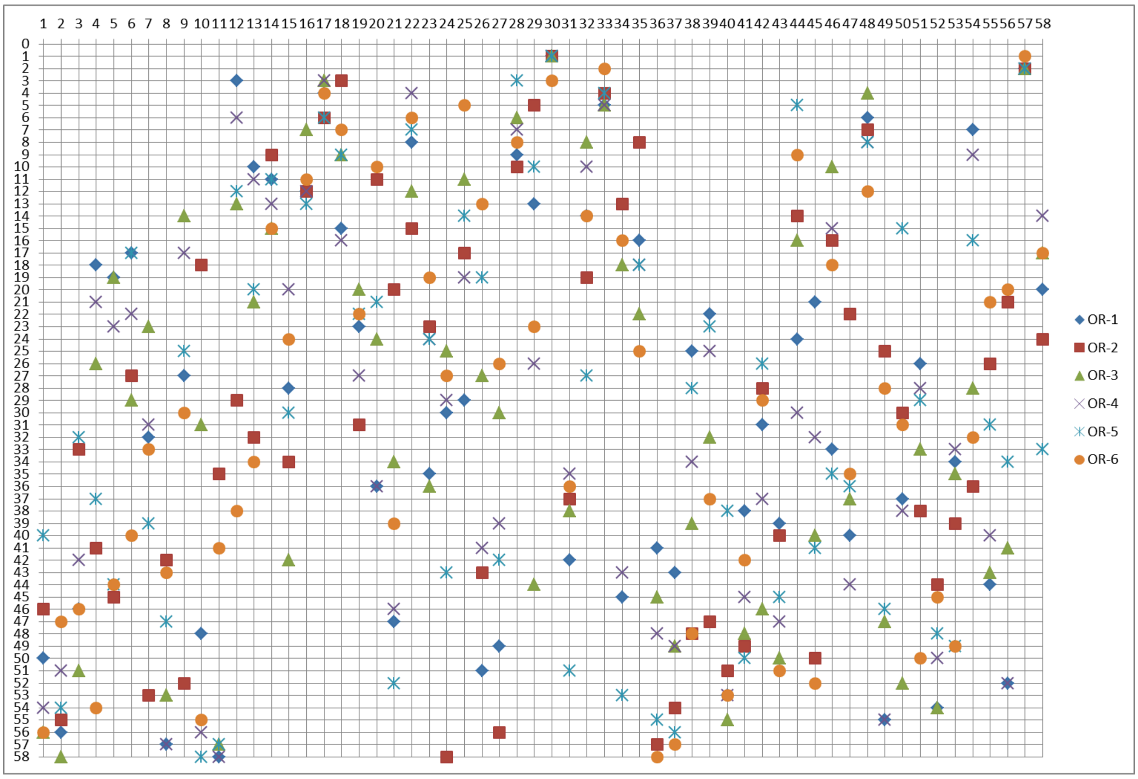

Figure 5 A Resulting Company Ranking According to the Contextual Specification OR-1 through OR-6 Indicating Diverse Preference of Companies *(Vertical axis indicates the ranking; Horizontal Axis indicates the Company)*

5. OBSERVATION

It should be noted that the corporate ranking results significantly vary depending on the contexts. We extract the best and worst rankings for all six context settings for each of the analyzed companies. We then make comparisons among companies by observing the degree of differences between the best ranking and the worst ranking. We note that there is a general positive correlation between the best ranking and the worst ranking. We interpret that company rankings tend to converge among all contextual settings – in general, high ranking companies tend to score high for all contextual settings while low ranking companies tend to score low for all contextual settings. Typical examples are indicated by large circles in Figure 6. On the contrary, there seem to exist certain groups of companies that exhibit significant differences between the highest ranking and the lowest ranking. Companies whose best rankings have higher rankings among all companies but their worst rankings indicate relatively low rankings are depicted by small circles in Figure 6. Technology-based companies such as electronics and automobile tend to dominate the second group of companies.

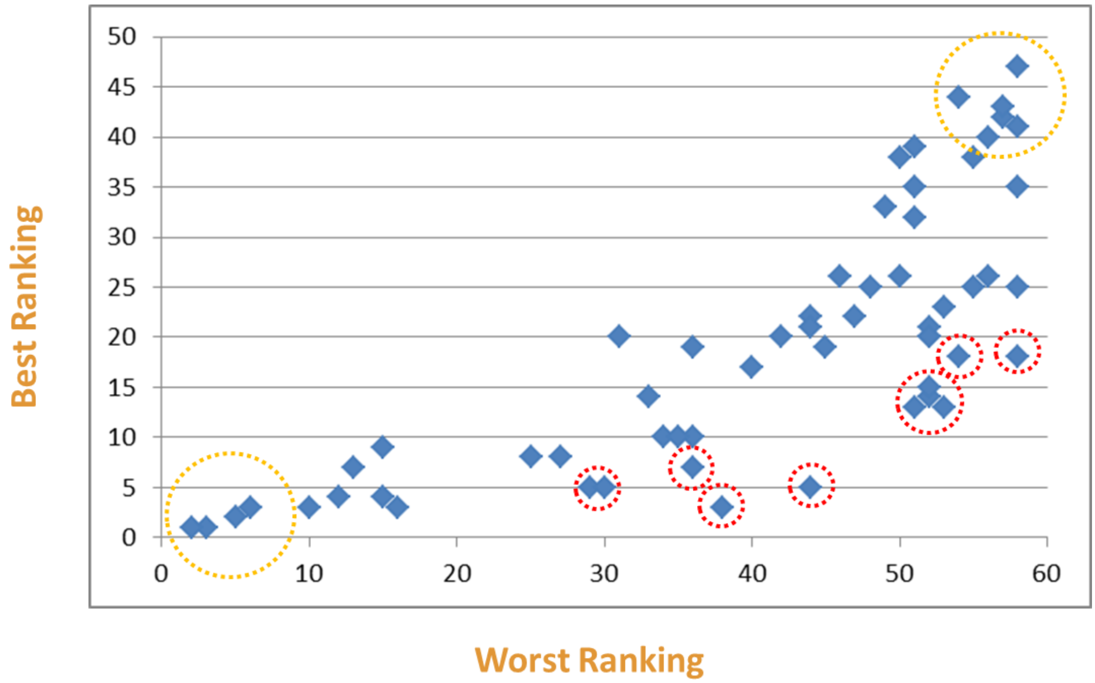

Figure 6 Best Ranking vs Worst Ranking among All Six Contextual Specifications for Each Company

(Smalerl numbers indicate higher rankings)

6. CONCLUSION

In this paper, we have presented a context-based multi-dimensional corporate analysis method that evaluates companies based on user-specified contextual settings. The contextual settings are translated and decomposed into distinct spaces, namely finance, technology, and brand, each of which consists of a subspace containing multiple parameters. The contextual settings determine the relevance of each of such parameters in evaluating companies by assigning appropriate weight to the parameter. With the experimental results, we have demonstrated the feasibility and applicability of our method with actual companies. The important feature of this corporate analysis method is that it allows the user to analyze companies seamlessly only with multiple contextual settings without having the domain expertise and the methodological knowledge of contextual decomposition into such domains. In our future work, we incorporate more characteristic parameters with higher precision in characterizing companies to achieve even higher reflection of corporate reality.

References

[1] Bodie, Z., Kane, A., Marcus, A., "Investments Second Edition," Ch 19 Financial Statement Analysis Richard D. McGraw-Hill, Inc. 2009

[2] Brealey, R., Myers, S., "Principles of Corporate Finance Fourth Edition", Chapter 29 Financial Analysis and Planning, McGraw-Hill, Inc. 2003

[3] Capital IQ online information services, a Standard & Poor's Business: https://www.capitaliq.com/home.aspx

[4] Damodaran, A., "Investment Valuation," John Wiley and Sons, Inc. 1996

[5] Kiyoki, Y. et al. 1994. A Metadatabase System for Semantic Image Search by a Mathematical Model of Meaning, ACM SIGMOD Record, Vol. 23, No. 4, pp. 34-41.

[6] Mergent Online, Mergent Inc., 2008: http://www.mergentonline.com/

[7] Sasaki S, Kiyoki Y and Hiroyasu A, "An application of Semantic Information Retrieval System for International Relations," Information Modelling and Knowledge Bases, Vol. XVIII, pp.62-79, May 2007

[8] Sasaki, S., Itabashi Y. Kiyoki Y, and Chen X. An Image-Query Creation Method for Representing Impression by Color-based Combination of Multiple Images. *Frontiers in Artificial Intelligence and Applications; Vol. 190, Proceeding of the 2009 Conference on Information Modelling and Knowledge Bases XX*, 2009.

[9] Takahashi, Y., Kiyoki, Y.: "A Meta-Level Career-Design Support System for Connecting Educational and Occupational Databases," IEEE International Symposium on Applications and the Internet(SAINT 2004) – the International workshop on Cyberspace Technologies and Societies(IWCTS 2004), pp.523--530, January 2004.

[10] White, G., Sondhi, A., Fried, D., "The Analysis and Use of Financial Statements," 1994 John Wiley and Sons, Inc.

[11] Yahoo! Finance: http://biz.yahoo.com/r/

[12] Innography: http://www.innography.com/

[13] Interbrand Best Global Brands 2006, 2007, 2008, 2009, 2010, 2011: http://www.interbrand.com/en/best-global-brands/BGB-Interactive-Charts.aspx

[14] Interbrand Best Global Green Brands 2011: http://www.interbrand.com/en/best-global-brands/Best-Global-Green-Brands/2011-Report/BestGlobalGreenBrandsTable-2011.aspx