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Article

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Strategic change: a journey towards new meaning? Semantic analysis of corporate communication

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Abstract

Strategic change, infused with new data, perspectives and concepts may change the inherent meaning of the central tenets in an existing strategy. It taps into the cognitive aspects of a journey where language, in verbal and written form, aids in the process of communicating, understanding and creating new meaning. Hence, it comes as no surprise that communication is argued to be an important means of forming and executing strategy, particularly if that strategy involves change. Thus far corporate communication has been the objective of extensive and predominately qualitative analysis of written content, with a focus on identifying and demonstrating strategic intent or reorientation. The objective here is to take a different route, not yet explored in the field of strategic management and change. Leaning on a previously conducted, longitudinal and qualitative case study of strategic change the aim is twofold: Firstly, to propose a method for quantitative analysis of semantic content of texts and statistically test the semantic development over time in the same case. Secondly, to evaluate and discuss the results of a quantitative semantic analysis in relation to previous and qualitative findings. By applying latent semantic analysis (LSA), we quantified the semantic content of annual reports and press releases between 2001 and 2010, derived from a case study of one company in the paper packaging industry. Using this method, we statistically analysed significant changes in semantic content across the ten-year time period studied. The results indicate interesting avenues for continued and wider use of quantitative semantic analysis in contributing to the understanding of semantic development and strategic change.

Keywords: strategic change, communication, cognition, latent semantic analysis, paper packaging industry

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1 INTRODUCTION

Strategic change is a challenging endeavour requiring everything from a new organisational structure to underlying culture (Mintzberg & Quinn, 1992; Markides, 1997). Communication is one suggested lever, argued to be important in the formulation and implementation of strategy and strategic change (Simons, 1995; Porter, 1996; Quinn, 1996; Higgins & Mcallaster, 2004). Communication plays a role both in terms of manipulation and control, and for creating new meaning and practice (Brown, Collins, & Newman, 1989; Hartelius & Browning, 2008; Rogers, Gunesequera, & Yang, 2011). The use of a common, and preferably unpretentious language is, for example, argued to facilitate in closing the strategy-to-performance gap, and to enhance learning, change and strategic innovation (Pfeffer & Sutton, 1999; Marshak, 2002; Jacobs & Heracleous, 2005; Mankins & Steele, 2005). Communication and dialogue are likewise argued to be integral parts of strategic control through interactive control systems, and for discussions on performance, risk, and business ethics (Simons, 1995; Quinn, 1996; Melnyk, Hanson, & Calantone, 2010).

The value and use of rhetoric, dialogue, narratives and metaphors in verbal and written communication in this context are well explored from multiple perspectives. Language, being one of our most important means for communication, influences and is influenced by situations, negotiations and activities within an organisation and its surrounding environment (Brown et al., 1989; Györi, 2002). Reflective dialogue is considered to be a prerequisite for changing mental models, and an enabler of strategic change and innovation (Markides, 1997; Jacobs & Heracleous, 2005). A necessary first step for critically reviewing mental models is to render them visible through the use of language and metaphors: *“During such inquiry, a collective language is likely to emerge. It is through this common language that emergent, new mental models can take shape”* (Jacobs & Heracleous, 2005, p. 347).

At the other end of the communication spectrum are written artefacts such as employee magazines, corporate brochures, press releases, annual reports and more. These are in turn important tools for forming an organisation’s identity and managing perceptions and expectations in relation to internal and external stakeholders (Fiol, 1995; David, 2001; Prasad & Mir, 2002). An organisation’s language, made up of its choice of words expressed in verbal or written forms, is an important cultural artefact in itself. Homburg and Pflesser (2000) found that an organisation aspiring to be market oriented will not exhibit behaviours to this end without a market-oriented language.

Given that language is an important marker of cognitive and cultural change, how can it be studied and measured in relation to strategic change? Thus far, the growing interest in communication and rhetoric in the management literature is often dealt with in relation to manipulation and control: *“Specifically, rhetorical studies and management are concerned with power as it relates to language”* (Hartelius & Browning, 2008, p.14). Previous studies in the area and in relation to strategy are predominately qualitative, applying content analysis and word frequency counts to interview transcripts and public documents. For example, Landrum (2008) shows how strategic intent and posture are revealed in letters to shareholders using a qualitative narrative analysis. Rutherford (2005) examines rhetorical ploys and Pollyanna effects by studying narratives in corporate annual reports using word frequencies as a tool of analysis and a linguistic based approach.

The aim here is to take a different route, which to the authors’ knowledge has not yet been explored in the field of strategic management and change. Seeing the importance of language as a tool for communicating strategy or a new strategic direction, and a potential marker of certain behaviours, we address the question of how language, and more specifically the semantic content in an organisation’s written communication, can shed light on the understanding of a strategic change process. We applied a quantitative analysis method for measuring semantic content, which is the underlying meaning of words and narratives. We did this based on findings from a longitudinal case study of strategic change, and the notions put forth in the literature that an organisation’s language is a tool as well as a result of a cognitive processes (such as strategic change).

The aim was twofold: Firstly, to propose a method for quantitative analysis of semantic content of texts and statistically test the semantic development over time in one organisation. Secondly, to evaluate and discuss the results of a quantitative semantic analysis in relation to qualitative findings of the same organisation.

We start with a theoretical discussion on strategic change, the role of communication and how different methods are used for studies thereof. Then we briefly present previous findings from a qualitative case study, followed by a description of the methods used here. The results from the quantitative semantic analysis are presented and discussed in relation to previous qualitative findings. This is followed by conclusions, implications for theory and practice and suggestions for the continued use of similar methods in contributing to the understanding of semantic development and strategic change.

2 STRATEGIC CHANGE, COMMUNICATION AND RESEARCH APPROACHES

Normann (2001) argues that “*The core process of a company in the long term is to form new ‘dominating ideas’*” (ibid., p. 149). Describing the evolution of strategic paradigms, Normann (2001) shows how the competitive dominance or edge has moved from the industrial economy where resource transformation, standardisation and production were at the heart of business logic and management, to an economy where the crucial competence is to organise value creation where the customer is not only an important source of business but regarded as a co-producer. Simons (1995) similarly describes the differences between ‘old’ and ‘new’ strategic paradigms from ‘top-down strategy’, ‘standardisation’ and ‘according to plan’ to ‘customer/market-driven strategy’, ‘customisation’ and ‘continuous innovation’. Simon goes on to argue that a shift or co-existence between the old and the new reflects a deeper tension between basic philosophies of management and control. For industries that originate from the industrial economy, this may imply a dramatic conceptual and real change in how customers are viewed and how value is created.

According to Mintzberg and Quinn (1992) the most difficult challenge in managing strategic change is the move from a familiar domain to one that is less well-defined. It can take place through continuous and incremental improvement, or through a more radical renewal of the business (Quinn, 1978; Normann, 2001). This is a process that in turn can be reactive or proactive, temporal (different phases of stability and change) and spatial (separated from the rest of the organisation) (Baden-Fuller & Volberda, 1997; Normann, 2001). The process of forming new ‘dominating ideas’, or changing mental models underlying the strategy paradigm of an organisation is foremost a cognitive challenge (Markides, 1997; Normann, 2001; Jacobs & Heracleous, 2005). For an organisation going through strategic change, new perspectives, competencies, tools and models may come in the form of new concepts with new meaning that has to be addressed. For example, an organisation aiming for a competitive advantage through a strategy of ‘differentiation’, coming from one of ‘cost’ (Porter, 1985; Porter, 1996), or heading for a ‘Blue Ocean’ (Kim & Mauborgne, 2005), will instil new meaning (and practice if successful) in relation to terms like ‘value’, ‘customer orientation’, and ‘innovation’.

Johnson (1992) argues that “...a change in emphasis from control of costs to an emphasis on monitoring effective customer service, is not simply a means for monitoring the progress of a changing strategy, it is also a major signal of a change in corporate culture” (Johnson, 1992, p. 35). Corporate culture where language systems and metaphors are central ingredients in forming an organisation’s value systems and norms, are in turn important levers in strategic change. As put by Higgins and McAllister (2004): “*If strategy and cultural artifacts are not aligned, then employees are uncertain which messages are real – the old familiar, comfortable ones supported by lots of well-known cultural artifacts, or the new messages about a new strategy that are in conflict with the old, still in place cultural artifacts*”. Homburg and Pflesser (2000) show that a market-oriented language, being a cultural artefact, is a prerequisite for market-oriented behaviour.

Seeing that language plays an important role in conveying and creating new meaning and behaviour, it is not surprising that communication is argued to be an important ingredient in leadership and strategic management in general and for change and innovation in particular (Porter, 1996; Markides, 1997; Mankins & Steele, 2005; Jacobs & Heracleous, 2005; Groysberg & Slind, 2012).

Thus far research has provided important insight into the relationship between corporate communication, language and control as well as rhetorical choices for communicating strategic intent and posture (Landrum, 2008). Bryman (1989) points to the increasing interest in studying language in the organisational context and how communication is used and the consequences thereof. In a recent qualitative study by Rogers et al. (2011), they examined textual components in strategic statements over time, showing how managers may use language to articulate shifts in strategy. However, according to Rogers et al. (2011) there is limited research on the linguistic development within an organisation over time. There is equally, to our knowledge, no quantitative research on the semantic content of an organisation’s communication, over time, contributing to this field.

Public documents like annual reports and executive statements are important media by which companies communicate with their shareholders, the stock market and society at large (Fiol, 1995; Prasad & Mir, 2002). Prasad and Mir (2002) argue that “...the texts of annual reports and letters to shareholders contain important symbolic meanings that need to be unveiled through interpretation” (ibid., p. 110). Even though these may be written in a way to convey a certain intentional message, Fiol (1995) argues that future research comparing different forms of communication is important.

Applying a quantitative semantic analysis in an organisational context offers another potential route. By addressing the need for increased understanding of how shifts in strategy are reflected in language, we wanted to measure if and how the semantic content of an organisation’s written communication changes over time by applying latent semantic analysis (LSA). LSA is a mathematical method for computer modelling and simulation of the meaning of words and passages by the analysis of representative corpora of natural text. It is also a method for analysing the underlying semantic content. It has primarily been used so far in cognitive science and educational research (Landauer & Dumais, 1997). A few recent organisation and management studies have used LSA to examine verbal communication in design teams, showing how semantic coherence within teams creates shared understanding, and how this computational tool can be used to detect how teams function (Dong, 2005;

Yang & Helander, 2007). Wallemacq and Jacques (2009), albeit not using LSA, introduce the software *Evoq* to visualise the semantic meaning of words drawn from qualitative texts.

As a strategic change process progresses, one could assume that a new language is used and developed not only in lexical terms (i.e. new vocabulary) but also in semantic terms (i.e. the inherent meaning of words and narratives) hence leading to less semantic coherence over time measured in quantitative terms. Given the inherent meaning of, and link between, strategy, market orientation and innovation (Frambach, Prabhu, & Verhallen, 2003; Dobni, 2010) and the cognitive and cultural aspects of strategic change (Homburg & Pflessler, 2000; Normann, 2001; Dufour & Steane, 2006) – it could be assumed that an organisation pursuing strategic change towards increased market orientation and innovation will develop a new and measurable semantic content expressed through language.

Hence, our research is based on the notion that strategic change; such as moving from an old' towards a 'new' strategic paradigm, requires cognitive change where communication (use of language) is vital. We raise the question how language and more specifically the *semantic* content in an organisations corporate communication can shed light on the understanding of a strategic change process over time. Given the role of communication and language in strategy and strategic change, and the successful application of quantitative semantic analysis in other areas, we hypothesised that: an organisation going through strategic change will display a change in language and more specifically a significant change in the semantic content – the underlying meaning of words or narratives – over time.

3 STRATEGIC CHANGE IN PRACTICE – FINDINGS FROM A QUALITATIVE CASE STUDY

The study presented here is linked to a longitudinal qualitative case study (Olander-Roese & Olsson, 2007; Olander-Roese, 2008; Olander Roese & Olsson, 2012). A brief introduction of the study and prior findings is in place.

One company in the Swedish forest and paper packaging industry was studied between 2004 and 2010 with the overarching purpose to explore and contribute to the understanding of strategic change, and the link between strategy, customer orientation and innovation. The research, based on a qualitative and interpretive approach (Alvesson & Sköldbberg, 1994; Gummesson, 2000; Patton, 2002), focused on challenges and enablers of strategic change, the process in itself and the related managerial actions, decisions and organisational reactions. The data collection consisted primarily of in-depth interviews, observations and participation as well as studies of the company's written material.

The company, a manufacturer of paper packaging material named Billerud (now BillerudKorsnäs), was formed in 2001 through a merger of three existing Swedish paper mills and introduced on the Stockholm Stock Exchange. The Swedish forest industry, of which the paper packaging industry is central, is one of Sweden's most important primary industries and makes up 12% of the nation's GDP. It is characterised by capital intense processes and products with high knowledge content. Efficient production processes, volume output and cost focus have been at the core of the forest industry paradigm. After the formation in 2001, Billerud spent the first three years streamlining the activities of the founding mills and developing a strategy. In 2004 Billerud revised their strategy and the next step was to be taken. An *increased market orientation* and *new product development* were central themes of the strategy. In 2005, the founding CEO was replaced, followed by a review and change in the company's objectives, financial targets and strategy. This time around an increased focus was placed on the direction set out in 2004, combining *world class process efficiency* and *customer focused development*. Processes for innovation and market learning were developed, the organisation restructured, new ventures launched, and the 'offering' extended beyond the physical product (Olander Roese & Olsson, 2012). In summary, the journey of strategic change studied between 2004 and 2010 can be described as a move from a production oriented, cost-focused business towards a more market and customer oriented one. The new financial targets set in 2006 were reached in 2010.

In Table 1, the introductory words of CEO statements as communicated in annual reports further depict the strategic journey from 2001 to 2010 along with turnover and margin statistics. One could conclude, when comparing the fluctuating financial developments over the years with the qualitative findings thus far, that the financial results are limited. However, given the importance of communication and language in strategy and strategic change suggests measures for other outcomes beyond profit maximisation, such as semantic development (See e.g. Whittington, 1997; Dufour & Steane, 2006). This inspired the present study.

Table 1. CEO statements, turnover and margin between 2001 and 2010 (Billerud, 2011).

| YEAR | CEO STATEMENT IN ANNUAL REPORTS 2001-2010 Introduction (text in bold by author) | TURNOVER Net sales, Msek | MARGIN |
|------|---|-----------------------------|--------|
| 2001 | “The new Billerud – The past year was dominated for Billerud by the merger of the three mills at Gruvön, Karlsborg and Skärblacka. Extensive work was required to co-ordinate production and find models for co-operation between the mills. During the year we have also formed functions for the head office and established a sales organisation with offices in seven European countries”. | 6910 | 19% |
| 2002 | “The past year was Billerud’s first full year as a listed company. While work in 2001 was dominated by efforts aimed at creating an efficient business, our focus in 2002 was on realising the plans made when we formed the company. As we have worked to establish ourselves on the market we have seen confirmation of the fact that the Billerud brand, thanks partly to its long tradition, is a strong name in the forest industry. Together with our strategy of focusing on niches where we are already strong, the name has undoubtedly contributed to the large interest shown in Billerud both by the market and by investors”. | 7067 | 17% |
| 2003 | “At the formation of Billerud we produced a plan for the first three years where the focus was on establishing the company and consolidating our business. During this first phase our work has focused on creating procedures for our working methods and on realising the opportunities for organic growth and increased efficiency that were created through the co-ordination of three mills within a single company. Now that this phase is over I can state that Billerud is well established on the market and as a listed company. We have created a strong base, both financially and as an organisation, for the next phase of Billerud’s development”. | 6992 | 16% |
| 2004 | “During its first years since formation Billeurd has co-ordinated the activities of its three Swedish mills and thereby created a niche business and established listed company focus on packaging paper. Synergies have led to increased production capacity, which has meant a significant rise in deliveries. Following the successful start it is now time to move to the second phase, in which the focus will be on increased market orientation. This will enable Billerud to meet new demands from customers and end-users. Increasing efficiency within the business will be equally important, and this will be done by cutting costs”. | 7159 | 11% |
| 2005 | “A renewal has begun. Billerud’s results were disappointing. Continued weak economic conditions and the dramatic rise in costs for energy, raw materials and chemicals affected us negatively. We have now implemented strong measures to transform our results and build a more modern, more efficient company”. | 6823 | -3% |
| 2006 | “Billerud undergoing change. After several years of faltering profitability, Billerud’s earnings trend was turned around in 2006. Prices could be raised slightly higher than costs increased. Combined with greater efficiency this meant a strong improvement in profits”. | 7369 | 7% |
| 2007 | “The hard work continues. In 2007 we worked very hard and successfully to develop markets, customer relationships and products, to reduce costs and improve efficiency. Over the past 12 months we have raised prices and reduced our energy costs. However, increases in wood costs and currency changes impacted negatively on earnings. We will continue working intensively on our chosen course to make improvements”. | 7758 | 8% |
| 2008 | “A changed reality. Billerud’s positive development continued at the start of 2008. We were successful on the market and our customers appreciated our new business concepts and products. In the middle of the year a weakening in the industrial business cycle became more obvious, and by the end of the year the financial crisis had struck and the downturn was a fact. We were forced to face up to further challenges”. | 7792 | 4% |
| 2009 | “The resurgence. Describing 2009 in brief is almost impossible. We were plunged into a financial crisis and an economic slump with falling demand, plummeting prices and a financial market that practically stopped working all together. However, we handled the situation and bounced back very strongly at the end of the year. I think that in 2009 we really showed Billerud’s inherent strength”. | 7760 | 4% |
| 2010 | “Strong position for Billerud. I am pleased, happy and impressed with the progress that we made in 2010. Demand for our products rose very strongly over the year, resulting in an operating margin of 12%. I interpret that as proof of how strong our customer offering is”. | 8828 | 12% |

4 METHOD

The data analysed for this paper was retrieved from the Billerud company and consist of the written content of annual reports and press releases from the period 2001 to 2010. The semantic content was assessed quantitatively by applying latent semantic analysis (LSA). LSA generates a high dimensional semantic representation (semantic space) from a large corpus of natural language using information of co-occurrence words. The texts are then inserted into this space, so that the statistical tests can be applied to the semantic representation that is associated with the texts. The method is described below. The analyses were conducted using *SemanticExcel*, a web-based software for scientific and statistical analysing of semantic representation (www.semanticexcel.com).

4.1 Creating a semantic space

Semantic spaces are generated by applying computational methods to large text corpora. This space is a representative frame of reference for the meaning of different words (Landauer & Dumais, 1997). For this paper, an English semantic space was created. The texts generated by the subjects (i.e. the annual reports and press releases) were not sufficiently large to construct a high quality representation. Instead we collected a corpus based on 1.6 GB of English news articles from 2007. The latent semantic analysis was generated by the *Infomap* software (<http://infomap-nlp.sourceforge.net/>), using the following parameters settings: the number of words in the space (15k), the number of context columns (20k), the context size (± 15 words), the number of SVD iterations (500), and the number of dimensions in the semantic representation (100). The result of this analysis was a semantic quantification of the 120k most frequent words in the corpus, where each word is described by a 100 dimensional vector. Words that are semantically similar (synonyms) have similar representation in this semantic space.

4.2 Empirical data – texts to be analysed

The empirical data consisted of written expressions in the form of annual reports and press releases from the years 2001 to 2010, in total ten annual reports and 194 press releases in English. The particular organisation was selected based on a previous qualitative and longitudinal case study of strategic change (Olander-Roese, 2008; Olander Roese & Olsson, 2012). With the limited reference to similar studies and applications of LSA, it was important to choose an object of study where we could relate to data and findings beyond the ones in focus here in order to evaluate and discuss the results of LSA. The material for analysis – annual reports and press releases – was selected based on public access and to ensure representation of comparable texts for all years. The annual reports cover (excluding financial statements): statements from the CEO/president, a summary of the year's major events and descriptions of business concepts, vision, strategy, targets, markets and trends, production, product and business areas, human resources, environmental issues, production and investments, risk analysis, etc. The press releases include communications of financial reports and market outlook, product launches and changes in production or number of employees, etc. As already noted, the annual reports and other public documents are an important means for corporate communication. One limitation put forward by Fiol (1995) in addition to the potential of formulations aimed at conveying a certain and particular positive image of the events, is that annual reports are often produced by external consultants. Nevertheless, the information and language employed should, to our knowledge and personal experience, adhere not only to legal requirements but also the voice of the organisation and the people interviewed for content.

4.3 Data preparation and procedure of analysis

Annual reports (10) and press releases (194) from the years 2001 to 2010 were downloaded from the website of the case company or sent as PDFs from the company. All documents were transferred to unique text files (txt.), 204 files in total, and prepared for analysis by removing financial statement tables, figures, images and data such as contact information, telephone numbers and links to other documents. Each file was named with the corresponding date.

The analysis encompassed three steps: First, each document (i.e. text file) was transformed to a semantic representation. This was done by adding the semantic representation of the words that were presented in each document, and by normalising the length of the resulting vector to one. This generated one semantic representation for each document, with the same number of dimensions as the original semantic space.

Second, we created a semantic scale spanning two sets of documents. This semantic scale measures how semantically similar one document is to two sets of documents. The scale spans from -1 (maximally similar to set 1) to +1 (maximally similar to set 2), and where a value of zero indicates that it is equally similar to both sets. We summarised each set of documents by aggregating all semantic representations in the set, and normalised the resulting vector to one. Then we created a "difference" vector, where the vector representing the second set was subtracted from the vector representing the first set, and where the resulting vector was normalised to one. Finally, we measured the semantic similarity between the difference vector and the vector representing a document that we wanted to measure on the semantic scale. The semantic similarity between the

vectors is measured as the cosine of the angle of the vectors. Since the lengths of the vectors were normalised to *one*, the cosine of the angle was calculated as the sum of the pairwise multiplication of each semantic dimension. Hence, if the vectors were identical the value was +1 and if exactly opposite the value was -1, and if unrelated, zero. Thus, 1 signifies extremely high similarity/relatedness, and 0 signifies no relatedness. However, while calculating the difference vectors, we removed the document that we wanted to measure on the semantic scale. This was necessary to avoid bias that otherwise would occur when the document to be measured was included in the difference vector. Thus, the difference vector was slightly different for each document that was measured. The semantic scale of each document was simply the semantic similarity between this document and the difference vector, where a positive value indicate a resemblance to set one, and a negative value a resemblance to set two.

Third, we calculated the appropriate statistic on the semantic scale. To measure whether the two sets of documents differed in the semantic scale we used a two tailed t-test, where $p < 0.05$ indicated a significant result. To measure the size of the difference we calculated z-values (z), by subtracting the mean value of the second set from the mean value of the first set and dividing the resulting value by the pooled standard deviation.

5 RESULTS AND DISCUSSION

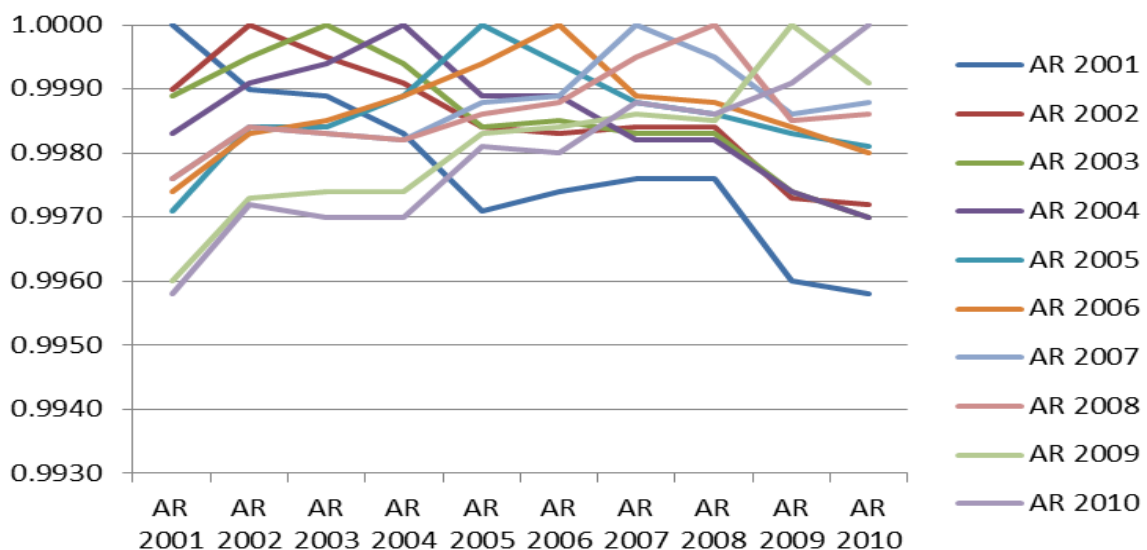
The following results are presented and discussed: first, the semantic similarity between annual reports and annual summaries of press releases respectively, comparing all pairwise years and the consecutive development; second, the identification and measurement of significant keywords of pairwise years.

5.1 Semantic similarity of annual reports

In analysing the annual reports we used words rather than documents as the underlying unit of analysis simply because statistics could not be based on a single data point as only one report is related to each year. For example, if year 2005 consisted of 10,000 words then a set of data (e.g. set 1) consisted of the 10,000 semantic vectors representing these words. The results are presented by all pairwise combinations of years (Figure 1) and by changes across consecutive years (Figure 2).

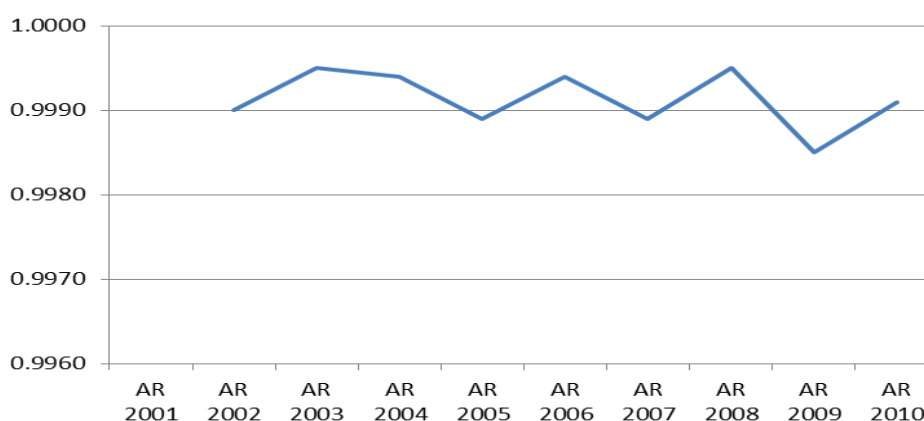
First, the results show that the semantic similarity scores (s) diminish gradually over time between the annual reports (AR) from 2001 to 2010, indicating a change in the semantic content (i.e. inherent meaning of words and narratives) across time. Figure 1 illustrates the semantic similarity score of each year in relation to the preceding and following years as well as in relation to itself ($s=1.0$). The semantic content of annual report 2001 (AR 2001) is identical to itself ($s=1.0$), highest in similarity to AR 2002 ($s=0.9990$), and lowest in similarity compared to AR 2010 ($s=0.9958$). The results show high significance. The similarity score between 2001 and 2010 rendered a p -value of 0.000 and z -value of 86.697. The analysis further shows that the semantic similarity between directly preceding or following years is the highest: AR 2004 is most similar to AR 2003 ($s=0.9994$) and 2009 to 2010 ($s=0.9991$). The semantic content in annual reports between 2001 and 2004 have the lowest similarity to AR 2010, and the annual reports between 2005 and 2010 have the lowest similarity with AR 2001 (i.e. the semantic distance becomes greater relative to the first year and progressively closer to the last year).

Figure 1: Semantic similarity scores (s) of annual reports (AR) 2001-2010



Second, Figure 2 shows that changes in semantic content across consecutive years differ. The semantic similarity scores between years can be seen as a measure of semantic change, sometimes called “coherency” (Foltz, Kintsch, & Landauer, 1998). Figure 2 illustrates the semantic similarity of consecutive years, where each year is related to the following year. Hence, the semantic similarity score between 2001 and 2002 is $s=0.9990$, between 2002 and 2003 is $s=0.9995$, etc. The results show a higher semantic similarity between 2002-2003 ($s=0.9995$) and 2007-2008 ($s=0.9995$), and lower similarity between 2004-2005 ($s=0.9989$) and 2006-2007 ($s=0.9989$). The lowest similarity score is between 2008 and 2009 ($s=0.9985$), which shows a significant value ($p=0.000$; $z=38.5$).

Figure 2: Semantic similarity scores (s) of consecutive years, annual reports (AR) 2001-2010



In summary the semantic development in annual reports yielded a gradual variation of the semantic content ranging from $s=0.9958$ to 1.000. If we compare the results of the quantitative latent semantic analysis (LSA) with the findings from interviews and documentation in the qualitative study (see brief summary, section 3) the low semantic similarity between 2001 and 2010 (as shown in Figure 1) and gradual shift (Figure 2) may not be surprising. The semantic distance does become greater relative to the first year and progressively closer to the last year. Seeing the company’s semantic development over the years, also considering the financial results, this could be interpreted as a continuous or incremental strategic change.

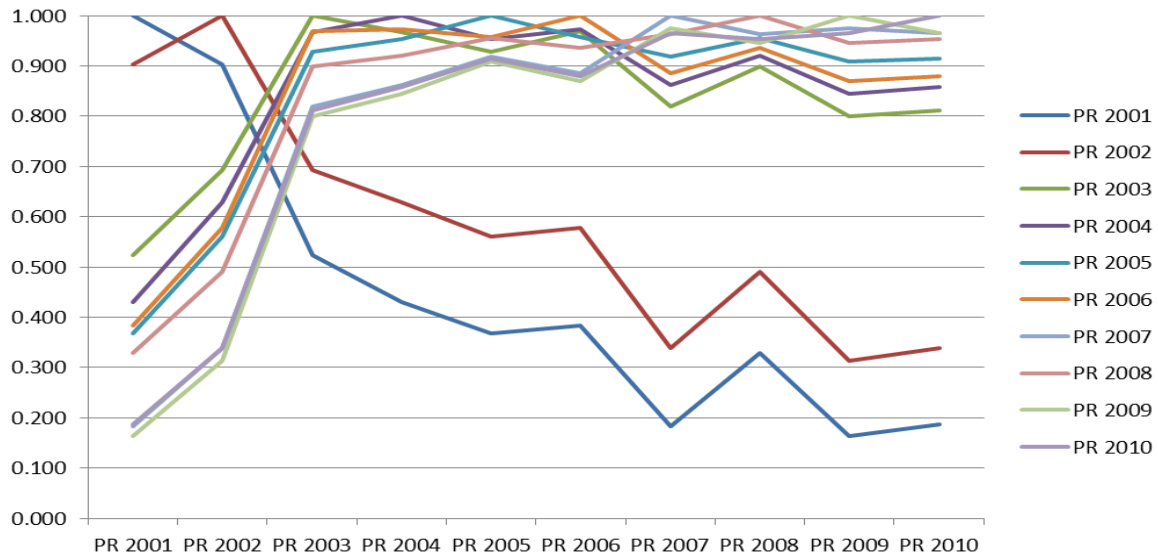
An examination of the actual content of the annual reports reveals that there is a notable difference in terms of themes, expressions and highlights that are in line with the results of the consecutive development (Figure 2). The three lowest points of semantic similarity between the years shown in Figure 2 are of interest (see 2005, 2007 and 2009). Firstly, in 2004 in line with the revised strategy, ‘market orientation’ was emphasised for the first time with a separate chapter in the annual report on ‘Customer focus’. In the following year, 2005, a new CEO arrived and the company experienced a decrease in turnover and negative margins. This indicates that the lower similarity can be explained by the difference in semantic content between the years (and the ‘dip’ in 2005). It could also be interpreted as the focus on ‘market orientation’ becoming secondary in times of organisational changes and financial turbulence. 2006 (similar to 2004) was characterised by the introduction and communication of a new strategy with an increased emphasis on customer-focused development. The following year’s annual report, 2007, communicated the efforts to implement the new strategy, with an increased focus on environmental and sustainable development issues and new business initiatives. The low similarity with 2006 was therefore surprising; however, a closer look revealed the equally continued concentration on production efficiency and cost reductions, which are prerequisites, but not drivers for market orientation per se in terms of customer focused language. Finally, 2009 is the year after the 2008 financial crisis, and the time when the company communicated their vision and sustainability targets for the first time, as well as launching a new product, which was much communicated.

5.2 Semantic similarity of press releases

We measured the semantic scale between all pairwise combinations of press releases aggregated over a year (i.e. 2001-2010), where the press releases were the unit of analysis. The results are presented in Figures 3 and 4. The preferred level of analysis for conducting the statistical analysis was on the level of press releases because it answers the question whether the results can be generalised across units of press releases. In the annual report analysis described above, it was not possible to use annual reports as the underlying units of analysis because there is only one annual report available each year, so that the pooled variance in the t-test could not be calculated.

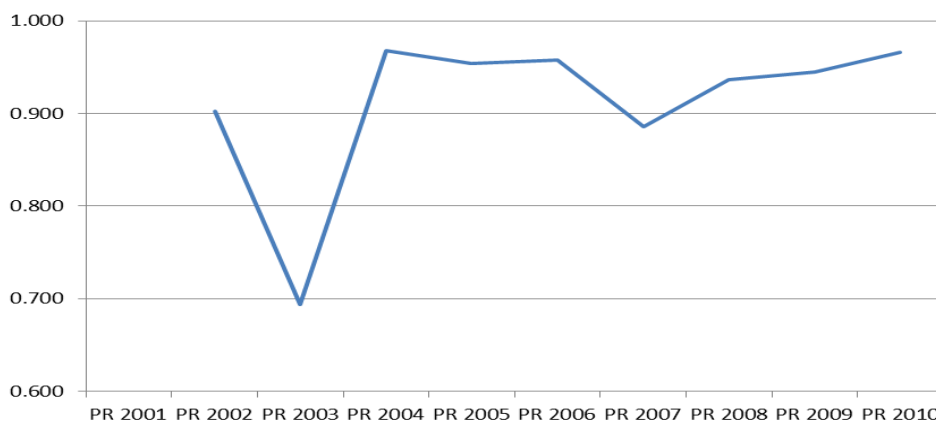
First we illustrate the semantic similarity score between the years based on the press releases for each year in relation to the preceding and following years as well as in relation to itself (Figure 3). Hence, the results show the semantic content of press releases 2001 (PR 2001) is identical to itself ($s=1.0$), highest in similarity to PR 2002 ($s=0.9024$), with the lowest similarity to PR 2009 ($s=0.1627$). The similarity score between 2001 and 2009 rendered a p -value of 0.000 and z -value of 9.099. In summary, the years 2001 and 2002 appear to be exceptions in semantic content compared to the other years. PR 2003 through PR 2010 all show the lowest similarity score in comparison with 2001 with appropriate levels of significance. Where the annual reports showed a gradual and limited change of semantic content over the years, the differences indicated through the press releases were more dramatic, considering also the greater variance of actual similarity scores ranging from $s=0.1627$ to 1.000 (compared to $s=0.9958$ to 1.000 for annual reports).

Figure 3: Semantic similarity scores (s) of press releases (PR) 2001-2010



The semantic similarity between consecutive years based on press releases yields an equally more varied picture (Figure 4) than the corresponding development in annual reports (Figure 2). As shown in Figure 4, there is a significant change in semantic similarity between 2002 and 2003 ($s=0.69$, $z=2.52$); however no other consecutive years show statistically significant differences. 2002 and 2003 were also statistically different from all subsequent years (2004-10). Finally, 2003 differed from 2007, 2009, and 2010, and 2004 differed from 2009 and 2010.

Figure 4: Semantic similarity scores (s) of consecutive years, press releases 2001-2010



In summary the semantic changes in press releases across years shows a significant change between 2002 and 2003, and there were no differences between other subsequent years (Figures 3 and 4). These results could not be directly compared with the results from the annual report, because the statistics in the annual reports were based on words as the underlying unit of observation.

However, studying the actual content of the press releases yielded a difference in themes and highlights, in line with the results of the consecutive development (Figure 4). The significant dip in 2003 with a low semantic similarity compared to 2002 can be understood through the sole focus on financial communication in the two preceding years. While financial communication is aimed for the (financial) market, the language is restricted in the sense that it has to adhere to the format for financial communication of a listed company. In 2003, an acquisition and product launch contributed to differentiating the semantic content. Interestingly, there is no dip in the consecutive semantic development in annual reports (Figure 2). A potential explanation for this is the differences in content and purpose of annual reports and press releases. Press releases are predominately financial statements, interim reports or related messages (128 out of 194 in the study) and limited in text aimed at relevant stakeholders, particularly on the financial market. The annual reports on the other hand allows for more elaborate descriptions and an opportunity to, in retrospect, prioritise areas to highlight with the exception of fulfilling legal requirements for the financial reporting. It is aimed at a broader audience. Furthermore, press releases are bound to show greater variance given that they are more event driven whereas annual reports provide summaries. The dip in 2007 (i.e. low semantic similarity with 2006), even if not significant, corresponds with that of the annual report. The consecutive similarities between the years (2007 to 2010) are notable in that they show an increased number of press releases communicating product and service launches, alliances, co-operation projects with customers and product awards and personal statements compared to previous years.

5.3 Significant keywords across the years

A further analysis of the semantic content in annual reports was made by identifying significant keywords of pairwise years. This was done by first making a frequency count of the words in the annual reports and then comparing these frequencies to words in the corpus used for generating the semantic representation (i.e. constituting a norm of word frequencies). We selected the 100 most overrepresented words in the annual reports, by making a chi-square test for each unique word, and where all the selected words were significantly overrepresented following Bonferroni corrections for multiple comparisons. These 100 keywords were selected as a set of words to compare text related to one year in relation to another year (see Table 2). This analysis was carried out using the chi-square test with the Bonferroni correction method just described. Hence, the analysis was limited to the 100 most overrepresented words, rather than all words in the reports. Table 2 (to be read horizontally) shows all significant words for 2001 compared to 2010, 2005 compared to 2001 and 2010, and finally 2010 compared to 2001 and 2005.

Comparing the significant keywords across the years provides a further indication of the semantic development. From significant keywords of ‘turnover’, ‘investments’, ‘segments’, ‘tonnes’, ‘production’ in 2001, to ‘customer’ entering in 2005, albeit still communicating cost-reduction measures and investments in production processes through ‘electricity’, ‘wood’, etc. The keywords for 2010, in relation to previous years, are primarily related to the company’s offering, the market and sustainability positioning, which can be seen as a result of the strategic change initiated in 2004 and in 2006.

Table 2. Significant keywords of pairwise year and their chi-square test scores with Bonferroni correction

| | AR 2001 | AR 2005 | AR 2010 |
|----------------|--|---|---|
| AR 2001 | | n/a | turnover 22.2 investments 19.9 segments 15.9 tonnes 15.2 production 13.4 currencies 11.8 stora 11.8 enso 10.5 kraft 9.1 |
| AR 2005 | costs 32.0 electricity 24.1 wood 23.0 sacks 12.9 boilers 10.2 customer 9.8 | | costs 43.7 boilers 20.0 electricity 19.1 turbines 15.5 investments 14.8 reductions 10.9 coated 10.9 |
| AR 2010 | packaging 54.3 solutions 13.2 sustainable 13.0 fossil 11.8 sustainability 11.8 renewable 10.8 | demand 17.9 packaging 13.1 sustainability 10.6 sek 9.8 | |

Summarizing the presentation of results and discussion thereof, the results provided some surprises in relation to the qualitative findings. One example is the difference between the years 2006 and 2007 (Figure 2). Where the qualitative study (based on document analysis and interviews) concluded that the revised strategy in 2006 was followed by similar expressions and development of product and service launches and new business initiatives in 2007, the LSA pointed to an equal emphasis on a continued focus on process efficiency and cost reductions hence showing less semantic similarity than was first concluded. Moreover, the overall trend of the semantic development – where the semantic distance becomes greater relative to the first year and progressively closer to the last year – is equally interesting from the perspective of strategic change indicating a gradual and continuous change, or logical incrementalism (Quinn, 1978). This development is further enhanced given the resulting significant keywords, based not only on frequency but also on the semantic representation of these words. At the same time, given the inherent meaning of these words (Table 2) equally raises the question of a more revolutionary change (Hamel, 1996) given the particular industrial setting and strategic change at hand.

Applying LSA to annual reports and press releases, which yielded somewhat different results that required different levels of analysis (i.e. words and document level), draws the attention to the different nature and purpose of corporate communication. Comparing the evolving semantic content between the two sources (Figures 2 and 4) begs the question whether these artefacts of corporate communication, and their semantic content, communicate change (i.e. are an effect of a strategic change) or if they influence change explicitly (aimed communication) or implicitly (through communication that might be required legally). Where the semantic content in annual reports in this particular case could be seen as an effect of strategic change, and a gradually developing one, the press releases may qualify as a representative of both. As noted in the literature, both are tools for corporate communication, written in adherence with legal and stock exchange requirements and/or with the aim to communicate a predetermined message to relevant stakeholders (Fiol, 1995; David, 2001). However, annual reports allow for more elaborate descriptions of important events, prioritised focus areas and more. Press releases are shorter in form, often event driven for reasons of legal or financial reporting requirements and/or with the objective to communicate a new product launch or collaboration.

6 CONCLUSIONS, EXTENDED DISCUSSION AND SUGGESTIONS FOR FUTURE RESEARCH

Summarising the presentation and discussion of results, a number of issues are of particular interest in relation to the aims of the study. Firstly, by quantifying the semantic content of the annual reports and press releases we have examined and statistically evaluated the semantic development, with several significant results. Secondly, having used LSA for the first time in this particular setting and study of strategic change we have demonstrated that it can be a helpful method in further analysing and contrasting qualitative findings in case study research. It can also serve as a starting point for a longitudinal qualitative study of strategic change, providing indications of variations to consider on both an aggregated level and in relation to significant keywords and/or particular time periods.

We conclude that in this particular case the semantic content changed significantly over the time period covered, expressed through texts, and that an LSA as a quantitative method can be a complementary guide in a longitudinal qualitative study of strategic change. However, given the limited variation in semantic similarity scores over the years in annual reports (Figures 1 and 2), albeit statistically significant, indicate that strategic change may be limited expressed through the semantic content of corporate communication. Further and comparative research between actors and cases are important for future references.

Discussing the findings one step further, the theoretical implications of this study are related to the field of strategic management (i.e. strategic change) and case research. Firstly LSA opens up new ways of measuring strategic change. For example, testing and measuring an organisation's relative emphasis on market and non-market oriented cultural artefacts, such as customer-focused language and employee narratives as suggested by Homburg and Pflesser (2000) could yield novel answers to how strategic change is managed over time. This is of particular relevance given the traditional ways of measuring strategic change. While the rational and classical approaches to strategy and strategic change build on efficiency and achievement of objectives of (financial) profit maximisation, the processual or political approach (see e.g. Dufour & Steane, 2006; Whittington, 1997) acknowledge pluralistic outcomes (i.e. other than profit max). Through these perspectives, other ways of measuring strategic change towards for example increased market orientation and innovation can be argued for. Homburg and Pflesser (2000) argue the importance of cultural artefacts (e.g. customer focused language) as an important prerequisite for translating new norms for market orientation to actual market oriented behaviours. Hence, applying LSA in studies of strategic management and change provides new possibilities for identifying new findings and for operationalising and testing previous qualitative findings as well as provide opportunities for triangulation and validation in otherwise qualitative case study research. From the perspective of cognition and learning (Argyris, 1989; Brown et al., 1989), a measure of the semantic development over time may be an indicator of whether an organisation learns and adopts a new intended strategy and it's market oriented (or other) language, or just "learns about it".

For practice and management, the findings indicate that the use of LSA can serve as a complementary quantitative measure to for example financial results to measure the cognitive change (expressed through language), argued necessary in strategic change. The application of LSA could thus provide a benchmark to financial reports which does not capture and on-going cognitive change in an organisation. Furthermore, LSA could serve as a tool to measure the degree of coherence and/or non-coherence between individuals in management groups and other teams in relation to strategy implementation and innovation through operationalising the findings by Kellermans et al. (2011) and adding to the findings by Dong (2005) and Yang Helander (2007).

It should be noted that the study was limited to one case and the type and amount of data found in annual reports and press releases. This is why continued research using LSA in the areas of strategy and change is recommended. We welcome similar applications of LSA as the one performed here, as well as studies encompassing larger amounts of data. Even though our results were largely significant, statistical methods benefit from more data.

Hence, beyond corporate communication, other written material, interview transcripts and media clips may be used. The number of actors can naturally also be extended, opening for comparative case studies within and between industries as well as studies at group and individual levels. One example would be to apply LSA to management teams similar to studies performed by Dong (2005) and Yang and Helander (2007). A possible avenue could be to further develop the notions suggested by other authors, such as Kellermans et al. (2011), who argue that a high degree of strategic consensus in management groups improves strategy implementation in stable environments, with the likelihood of opposite effects in dynamic business environments. In applying LSA one could measure the semantic similarity between verbal expressions of individual actors (management team members) in relation to the strategic intent and with regard to the external environment.

Seeing that strategic change taps into the assumption and need for cognitive change, continued use of LSA would be most interesting to increase the understanding of how, if, why and when change occurs measured through semantic content of verbal and written, internal and public communication and documentation.

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