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Reflecting on the production of intellectual capital visualisations

Production of IC
visualisations

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Abstract

Purpose – The first aim of this paper is to present the methods developed by one of the co-authors to render visible the complexity of intellectual capital (IC). These were developed to make relationships between IC elements and value creation accessible to managers seeking to act on IC. The second aim of the paper is to explore the ability of visualisation techniques to inscribe the complexity of IC. This is pursued through a process of reflecting on the experiences of “being involved” in the production of IC visuals.

Design/methodology/approach – The study details the methods utilised in a case study of a shared service centre of a financial services organisation and presents a reflective analysis using the Latourian notion of inscriptions.

Findings – In conducting its reflective analysis, the paper traces the various translations undergone by the inscriptions of IC, with the end result of these movements being a visual meta-narrative connecting the various IC elements to one another as well as dimensions of IC value creation.

Originality/value – The paper presents a novel examination of visualisations of IC as might be used within firms for the purposes of resource mobilisation and managerialist intervention.

Keywords Intellectual capital, Visual media, Financial services

Paper type Case study

Assessments of change, dynamics, and cause and effect are at the heart of thinking and explanation. To understand is to know *what cause provokes what effect, by what means, at what rate*. How then is such knowledge to be represented? (Tufte, 1997, p. 9, emphasis in original).

1. Introduction

The provocative opening to Tufte (1997), as quoted above, embodies the *raison d'être* for this paper. The domain we seek to investigate is that of intellectual capital (IC). Specifically, we present and reflect on methods that produce visualisations of IC. These methods emerged through a case study conducted by one of the co-authors aimed at investigating how IC was related to organisational value creation in a financial services

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firm[1]. In this, the underlying case study research project was connected to the “big questions that other researchers have asked: How does IC work in firms? What is IC composed of? How is IC related to value?” (Mouritsen, 2006, p. 823). In pursuing this research agenda, the IC literature has called for the greater acknowledgement of, and empirical investigation into, the complexity of IC in organisational settings (Cuganesan, 2005; Bueno *et al.*, 2006). The underlying research project was designed to answer this call.

More broadly, the complexity of organisational systems has been recognised (Anderson *et al.*, 1999; Lewin, 1999). Here, small changes to one or two parameters could have significant, emergent and unexpected effect(s) on the entire system (Anderson, 1999; Browning and Boudès, 2005). In these settings, accounting has struggled to adequately capture and represent causal relations, with the ubiquitous Balanced Scorecard receiving particular criticism (Norreklit, 2000). Representing complexity and causal relations remains a concern for accounting research (see, for example, Abernethy *et al.*, 2005).

The underlying research project that we reflect on in this paper is thus derived from accounting and IC-specific concerns with the representation of relations between different organisational elements. The representation methods developed in the case study emphasise how the complexity of IC can be revealed rather than reduced, and how IC is understood as a bundle of knowledge resources that produce network effects (Mouritsen and Larsen, 2006). The first aim of the paper is to present the methods developed by one of the co-authors to render visible the complexity of IC. These were developed to make relationships between IC elements and value creation accessible to managers seeking to intervene on IC. The second aim of the paper is to explore the ability of visualisation techniques to inscribe the complexity of IC. This is pursued through a process of reflecting on the experiences of “being involved” in the production of IC visuals.

Hence, our focus on visualising IC is not on IC imagery as contained in annual reports or IC statements, but on visual representations of IC that might be used within firms for the purposes of IC management. Section 2 of the paper discusses IC visualisation approaches that have been developed in the prior literature. This is followed in section 3 with an outline of the visualisation methods utilised in the case study project, which was located in the shared service centre of a financial services organisation (labelled “OzFS” to preserve anonymity). Section 4 discusses the methods developed using Latour’s (1987, 1999a, b) concept of inscriptions to guide our reflective analysis, while section 5 concludes the paper by presenting the main implications of the discussion for the visualisation of IC.

2. Literature review: IC representations through visualisation

It is widely acknowledged that the development of IC resources can create value for organisations (Stewart, 1997), and that IC can be usefully considered to comprise human, structural and relational capital (Cuganesan, 2005). Within the domain of IC, a central concern for IC practitioners, consultants and researchers is the rendering of the invisible as visible through the explication of IC. In particular, significant attention in research and practice continues to be devoted to the role of IC within organisations and its relationships with value, however the latter might be defined.

Over the last two decades, numerous frameworks and methods have been developed to render IC visible and accessible to those investigating it. Authors such as Sveiby (2007) identify more than 30 different alternatives, variously emphasising numbers expressed in monetary terms, numbers expressed in non-monetary terms, narrative and visualisation. As IC visualisation approaches are of most relevance to the objectives of the paper, these are reviewed in some detail below. The main frameworks that attempt to make visible the way that IC elements interact to create value are the IC-Navigator (Fernstrom *et al.*, 2004), strategy maps (Kaplan and Norton, 2004), value creation maps (Marr *et al.*, 2004), and causal performance maps (Abernethy *et al.*, 2005)[2].

Evolving out of their Balanced Scorecard work, Kaplan and Norton (2000, 2004) propose strategy maps as visual representations of a firm's hypotheses about how it creates value through the processes that it performs. Kaplan and Norton (2000, 2004) use the labels human capital, organisational capital and informational capital to refer to the intangible assets of the firm and claim that these:

[...] determine the performance of the critical internal processes. Once that link has been established [...] it [is] possible to align those [intangible] assets with the strategy and measure their contribution to it (Kaplan and Norton, 2004, p. 55).

Thus, in relation to IC, strategy maps represent propositions of those within the firm about how IC influences important business processes in causal fashion. Although Kaplan and Norton (2000, 2004) argue that the value of intangible assets can only be evaluated in light of their effects on critical business processes, this view has been criticised. It has been argued that the general causality logic of the Balanced Scorecard (and strategy maps by implication) is flawed (Norreklit, 2000). In addition, the focus on how intangible assets influence business processes is said to exclude a consideration of interdependencies between the intangible assets themselves (Marr and Schiuma, 2003).

Value creation maps (Marr *et al.*, 2004) were proposed in response to the perceived failure of strategy maps to account for interdependencies between the resources within the firm. The authors prescribe the identification of "key value drivers" in a manner similar to a strategy mapping process, but emphasise the identification of direct dependencies (between organisational assets and strategy objectives) as well as indirect dependencies (between organisational assets). To generate value creation maps, the authors work with middle management levels through interviews and group feedback sessions to identify value drivers and organisational assets (comprising IC predominantly). Organisational participants are also required to make judgements as to the importance (moderate or strong) of the relationships between different organisational assets as well as with the identified value drivers. Thus, the main intent of the value creation map is to show inter-relationships between IC as well as how they impact value drivers. In the resulting visualisation, different sized arrows indicate whether identified relationships are of moderate or strong importance.

The IC-Navigator (Fernstrom *et al.*, 2004) is similar to value creation maps in that it too is based on an identification of the organisational resources of firm (including IC). In group workshops and interviews, organisational participants are asked by the authors to identify organisational resources and assign a value to each that represents their relative importance for value creation. In addition, organisational participants determine the relative importance of each individual resource identified relative to one

another. Finally, participants rate the relative importance of the interactions between resources. The end result is a visual representation (see Fernstrom *et al.*, 2004) where circle symbols are utilised to represent the organisational resources that were identified, with their size varying contingent on their relative importance to the strategic objectives of the firm and value creation (larger being more important). Arrows between different resources depict the identified relationships between resources, with the width of the arrow representing the importance of the transformations from one resource into others.

In contrast with the approaches described above, which rely on a single method of eliciting information about the inter-relationships within IC and between IC and value, Abernethy *et al.* (2005) employ multiple-methods in the building of causal performance maps. In a series of interviews, identified “experts” within the organisation studied describe desirable performance outcomes prior to being asked to provide a story about performance success. Other questions examine the factors that influence goal achievement, linkages between these factors and possible measures of these factors.

The authors use three different methods to construct visuals of how effectiveness and efficiency outcomes are influenced by processes and resource inputs. These comprise computer-assisted coding schemes, researcher-driven analysis of interview data and interactive mapping with the identified experts. The authors then integrate the maps generated through the three methods. The end result is a visual representation connecting elements of human and physical inputs, production processes and effectiveness and efficiency outcomes through recursive casual relationships.

In the adoption of a process-view, the causal performance map produced by Abernethy *et al.* (2005) is similar in part to a strategy map. This contrasts with the resource focus of value creation maps and the IC-Navigator. The causal performance map is also similar to strategy maps in that the visual representations that are produced identify important performance elements and their connections but do not attempt any differentiation or prioritisation of these. This is again unlike value creation maps and the IC-Navigator, which visually differentiate resources and relationships on the basis of their importance to the firm.

The underlying research project that we reflect on is built on these efforts in focusing on the visualisation of IC to represent the potentially complex nature of IC interactions and value creation. Given our focus on IC, we employ a resource focus similar to the IC-Navigator and value creation maps. Also, as the focus was on visualising IC for the purposes of managerial intervention, differentiating between IC resources and relationships in a manner similar to the IC-Navigator and value creation maps was considered desirable. the utilisation of narrative to access the complexity of IC, which was used by Abernethy *et al.* (2005) albeit in limited fashion, is also extended in the methods we adopt to produce IC visuals. These methods are outlined next.

3. The case study: developing visual representations of IC

The organisational setting for the underlying research project that we reflect on in this paper comprised the “Business and Technology” (B&T) division of OzFS, a large Australian financial services organisation. B&T performs the back office functions for OzFS’s products; they manage the overall information technology (IT) architecture, support and enhance software systems, and manage and implement major projects.

They also make available infrastructure support for cash management, fraud, physical security, business services and records management. In addition, B&T manages the OzFS property portfolio and its outsourcing contracts. B&T employs 16 per cent of OzFS's staff and, in keeping with the functions that it performs, is responsible for 45 per cent of its expense base (comprising predominantly personnel, technology, premises and supplier expenses). At the time of commencing the research, B&T executives were concerned with ascertaining how B&T added value to the broader organisation, particularly in relation to the management of IC. Hence, the aims of the case study were to investigate the inter-relationships between different IC elements as well as how IC was connected to value creation in the B&T division.

The process utilised to develop the visual representations of IC was an emergent one. First, we present why and how organisational narratives about IC were elicited. We then discuss how these narratives were translated into numbers and subsequently into visualisations of IC. In section 4, we interpret and reflect on each stage using the theoretical lens adopted for this process.

3.1 *Eliciting narrative*

The notion that narrative is an effective means of accessing and comprehending organisational complexity underpins the visualisation methods developed. The methods developed follow on from the work of Weick (Weick and Browning, 1986) and Snowden (Snowden, 2001; Kurtz and Snowden, 2003), who argue that complexity and ambiguity are best understood through the medium of language, metaphor and story. Narrative is thus a sense-making device or method that can be utilised to capture the complexity of IC elements and how these relate to each other and value creation. The grounding of the subsequent IC representations in organisational narrative was also considered to be consistent with practices in the IC domain, with both the Meritum Guidelines (Meritum Project, 2002) and the Danish Reporting Guidelines (Mouritsen *et al.*, 2003) advocating the use of narrative in IC reporting. In relation to managers of firms participating in the Danish Guidelines, Mouritsen and Flagstad (2005, p. 223) note that "to put humans into numbers was for many too much of a challenge; to put them in an endless array of new positive words was a more preferable translation". For these managers, narrative was the medium through which the relationships between IC and value could be better expressed.

Indeed, the use of narrative in organisations has been prescribed more broadly. The use of narrative and story-telling for explaining strategy, managing change and engaging employees are prescribed for leaders of contemporary businesses (see, for example, Brown *et al.*, 2005). In similar fashion, making intelligible the value of an organisation to external stakeholders is said to be enhanced where "the story of value creation and the use of benchmarks were used together to communicate fragmented and qualitative information about the role of intangibles in corporate value creation" (Holland, 2006, p. 78). The use of narrative to access relationships between IC and value is thus well-supported.

To obtain organisational narratives about IC, methods were developed that were informed by the Cynefin framework which evolved from IBM's "Knowledge and Differentiation Programme" in Europe in 1997 (see Kurtz and Snowden, 2003; Snowden, 2006). The framework is supported by the application of narrative database software that was utilised in the translation of IC narrative into visualisations. Here the

software was utilised to attribute numbers to elements of IC found in the narrative. This was to develop visual patterns of interaction between the different elements of IC and access the organisational story (stories) about IC and value creation.

First, interviews were conducted with B&T management to identify the elements of IC that applied to organisational processes that operated at B&T. These interviews facilitated the identification (through analysis of the interview data by the researchers and confirmation by the managers through the provision of feedback) of a set of abstract indicators that represented individual IC elements considered to be present within B&T. These are presented in Table I.

Second, 41 employees from B&T were randomly sampled and required to provide at least one narrative to each of five questions about their experiences of work life at B&T. The questions comprised the following:

- (1) In relation to your work life at OzFS can you tell a story about something great that has happened to you or to a fellow employee?
- (2) In relation to your work life at OzFS can you tell a story about something bad that has happened to you or to a fellow employee?
- (3) In relation to performance measures used at OzFS can you tell a story about how a performance measure has helped you or a fellow employee?
- (4) In relation to performance measures used at OzFS can you tell a story about how a performance measure has hindered you or a fellow employee?
- (5) Can you tell us a story about how things really work at OzFS?

Each of the employees was then asked to self-index the narratives that they had just communicated utilising narrative database software. Specifically, employees were asked to relate their narrative to each of the abstract indicators identified earlier on a low-high continuum. For example, based on the indicator “an attractive place to work”, respondents connected whether “an attractive place to work” was applicable to the narrative in question and whether it was negatively (1) or positively (10) associated with the narrative, with the score stored in the database alongside the narrative. Respondents were able to relate any of the abstract indicators to any of their narratives. Further, respondents did not have to score an indicator where they saw no connections between an indicator and a narrative. For the research study, 208 narratives were gathered from the 41 employees sampled[3].

The analysis of the narratives and data was enabled by using another software module called SenseMaker™ Explorer. The Explorer software analyses what is called a

Relational capital	Structural capital	Human capital
Creates value for OzFS	People helping customers	An attractive place to work
Creates value for customer	Product-focused	The work is engaging
I can see the customer	Technology supports processes	Trained and competent staff
Positive customer experience	Technology supports customers	Long-term career
Requires a process worker	Performance is product-based	Looking to retire
Requires a knowledge worker	Easy to use technology	The new generation
Technology helping customers	Effective lines of communication	Set in their ways
Beating the competition	Innovative products	Learning from others

Table I.
Abstract indicators
categorised by the IC
tripartite framework

“sensemaking set” (SMS). A SMS contains a number of narratives and their associated abstract indicators. These SMSs are exported from the Indexer software and subsequently used by the Explorer for analysis. Explorer has a number of different visual analysis tools, the one applied in this research being the “Graph” tool, which gives a visual representation of complex inter-relationships. It allows the researcher to ask questions of the database by constructing a “query”. Using this interface questions can be constructed to determine the association between the narratives and the IC indicators and this is displayed in Figure 1 in the form of a scatter diagram. It visually represents the associations between intangible elements as contained in the narratives about the organisation.

Visualisations such as those in Figure 1 were considered useful in that they enable a comparison of all narratives that had been related by respondents to the IC indicators being queried and an assessment of their relationship to one another. In this case the software allowed the researcher to explore specific narratives that underpin individual points on the scatter graph or to draw up a list of all the narratives that were represented in the resultant scatter graph. This was considered useful on two fronts. First, practitioners and researchers (from an experimental perspective) could use this information to develop management interventions for IC. Those seeking to act on and through IC can explore the potential for multiple (and potentially opposing) effects of these actions. A viewer of the scatter diagram can visually identify inter-dependencies and associations between different IC elements based on how these have been constructed within the organisation. Through representations such as those illustrated in Figure 1, they can identify how positively impacting on one IC element might have negative and unintended impacts on other IC elements and can either mitigate or refrain from such actions. Similarly, they can identify where multiple positive impacts might be obtained and choose to prioritise efforts in these areas.

Second, the ability to analyse organisational narratives in this manner could aid the emergent process of coding, concept and relationship formulation and the iterative and continuous recourse from theory to data and back again that is typical of interpretive research. The ability to visually identify associations between different concepts through respondent-driven coding allows the researcher to develop connections between concepts and the formulation of frameworks and theories. Simultaneously, the researcher has the ability to identify and access narratives that either support or are inconsistent with the relationship being proposed. This in turn enables quick



Figure 1.
Scatter diagram output
from SenseMaker™
Explorer

immersion in the “raw” narrative data to reflect upon and assess the relationships and theories being developed. While these processes were not utilised in this paper (given its focus on a method to visualise IC rather than build IC “theory”), they are consistent with descriptions of interpretive research processes elsewhere (see Lowe, 2001; Irvine and Gaffikin, 2006).

However, a problem that arises is that there are many different relationships that can be explored, each characterised by varying strengths of relationship. During the research project, a need emerged for a means of comparing across relationships. In particular, the management of B&T sought to access an overview of all IC elements and their inter-relationships as well as to determine where and how to prioritise their attention. In this case we had analysed 25 separate IC indicators, which resulted in 300 different interactions. What evolved was a method of identifying and visually representing a pattern of relationships from within a multitude of complex inter-related narratives. The following section outlines the development of such a tool and discusses the implications of its use.

3.2 Measuring the inter-relationships of IC

A complementary tool to the Explorer software was developed based on a requirement to represent patterns from the complex inter-relationships contained in the narratives. Specifically, while the scatter graphs displayed dyadic relationships between IC indicators, we sought a representation that would enable an overview and comparison across all relationships given the needs of B&T management. Using the numerical data from the user rating of the narratives, a visual representation was developed in three stages. First, a statistical analysis using pair-wise correlations was performed to develop a measure of the underlying strengths of all the relationships between the elements of IC. Second, a visual display was produced that allowed for an encompassing view of the relationships between all of the elements of IC and what were identified as value-creation dimensions. Third, maps of specific value-creation dimensions were devised to help understand specific sets of IC interactions.

3.2.1 Statistical analysis of relationships between IC indicators. Building on SenseMaker™ Explorer’s ability to display a visual representation of the relationship between two IC indicators in the form of the scatter graphs, the same underlying data was then used to test the strength of the relationship using correlation analysis (Kenkel, 1989). One example of correlation analysis results (specifically between “The work is engaging” and “Long term career”) is presented in Equation (1):

Correlation : “The work is engaging” and “Long term career”

Pearson correlation of “The work is engaging” and “Long term career” = 0.701; (1)

p-value = 0.000.

The numbers produced through the correlation analysis acted as a representation of the strength of relationship between any two IC indicators across all narratives that were obtained. Importantly, this allowed a movement from examining the relationship between indicators in individual narratives (as in the scatter diagrams) towards examining the same relationship as enacted across all narratives. In turn, this enabled the production of further visual displays of IC indicators that enabled both overview and comparison.

3.2.2 Developing a visual display of IC indicators. The ability to calculate correlations that reveal the strength of the relationships between all of the IC indicators allowed the development of a visual display of the interactions between the indicators as displayed in Tables II-IV.

The horizontal and vertical axes in Tables II-IV represent the indicators and are grouped according to their classification within the three categories of IC. In each cell, the statistical data that have been calculated in respect of the strength of the relationship between these indicators is represented. Above the diagonal, symbols are used to represent the correlation coefficients in terms of whether they were “Strong” or “Medium” while the actual correlation coefficients are presented below the diagonal. It should be noted that the visual displays that were provided to B&T management only contained the “Strong” and “Medium” symbols rather than the actual correlation coefficients.

In Tables II-IV, “S” represents a correlation coefficient with an absolute value greater to or equal to 0.6, indicative of a strong relationship. “M” represents a correlation coefficient with an absolute value greater than or equal to 0.4 and less than 0.6, indicative of a medium strength relationship. Blank cells represent an absolute value less than 0.4, indicative of a weak relationship. All strong and medium strength associations were statistically significant, with obtained p -values being < 0.01 . In formulating these categories, we were informed by authors such as Cohen (1988) and De Vaus (2002). In summarising previous views, De Vaus (2002) describes correlation coefficients between 0.5 and 0.7 as being “substantial to very strong”, while those between 0.3 and 0.5 are “moderate to substantial”. All authors are careful to point out that the proposed categories are guidelines only rather than being strict definitions. We were more stringent in selecting 0.6 as the cut-off for “strong” and 0.4 as the cut-off for “medium”. This was to enable prioritisation of relationships as required by B&T management.

When provided with the information in Tables II-IV, B&T management focused on four particular IC elements, selecting these on the basis of how they related to the broader organisational goal of creating value. The specific IC elements that were focused on comprised: “Positive customer experience”, “Creates value for OzFS”, “Beating the competition” and “Creates value for customer”. These were seen by B&T management as being consistent with the OzFS espoused strategy of creating value for shareholders through creating value for customers and performing better than competitors[4]. Based on their identification as being related to notions of customer and shareholder value, these IC components were labelled “value dimensions”. The relationships between the various IC components and these “value dimensions” are represented in Table V using the same symbols as in Tables II-IV.

While not the focus of this paper, the underlying research project identified three main insights into the creation of value at OzFS as perceived by B&T employees (see the analysis in Table V). First, with the exception of the relationship between “beating the competition” and “creates value for the customer” (with a medium strength relationship) there were strong inter-relationships between the four dimensions. This indicated that employees connected customer and shareholder value together in narratives and reflections about their experiences at OzFS. As noted earlier, OzFS’s strategies and discourse about value connected these together in a causal fashion (customer value creating shareholder value). What is interesting is that at OzFS these

IC elements	Positive customer experience	Creates value for OzFS	I can see the customer	IC element				
				Sharing knowledge externally	Requires a knowledge worker	Beating the competition	Creates value for customer	Requires a process worker
<i>Relational capital</i>								
Positive customer experience		S	S	M	M	S	S	
Creates value for OzFS	0.757			M	S	S	S	
I can see the customer	0.637			M		M	M	
Sharing knowledge externally	0.566	0.551	0.587		M		M	
Requires a knowledge worker	0.412	0.454			M	M	M	
Beating the competition	0.610	0.733		0.456		M	S	
Creates value for customer	0.729	0.763	0.562	0.603	0.450	0.583	S	
Requires a process worker		0.409		0.415			M	
Technology helping customers	0.653	0.648	0.404	0.581	0.538	0.638		
<i>Structural capital</i>								
Product-focused	0.476	0.527		0.417	0.515	0.473	0.591	
Innovative products	0.454	0.565	0.529			0.500	0.499	
Performance is product-based			0.499	0.491		0.423	0.501	
							(continued)	

IC elements	IC element						
	Positive customer experience	Creates value for OzfS	I can see the customer	Sharing knowledge externally	Relational capital Requires a knowledge worker	Beating the competition	Creates value for customer
Easy to use technology People helping customers Effective lines of communication	0.542	0.491	0.421		0.418	0.489	0.566
	0.640	0.649	0.526	0.453	0.561	0.576	0.674
	0.695	0.645	0.441	0.410	0.415	0.570	0.597
Technology supports customers	0.617	0.582	0.424	0.413	0.496	0.563	0.656
Technology supports processes	0.549	0.525		0.431		0.562	0.523
<i>Human capital</i> The work is engaging	0.505	0.604		0.496		0.519	0.592
Trained and competent staff	0.512	0.580				0.504	0.505
Learning from others	0.564 0.623	0.579 0.574				0.594 0.521	0.507 0.558
Long-term career Set in their ways							
An attractive place to work	0.492	0.596		0.538		0.535	0.500
The new generation							
Looking to retire							

Production of IC visualisations

Table II.

Table III.
Map of inter-relationships
of IC

IC elements	IC element					
	Product- focused	Innovative products	Performance is product-based	Easy to use technology	People helping customers	Effective lines of communication
					Technology supports customers	Technology supports processes
<i>Relational capital</i>						
Positive customer experience	M	M		M	S	S
Creates value for OzFS	M	M		M	S	M
I can see the customer		M	M	M	M	M
Sharing knowledge externally	M		M		M	M
Requires a knowledge worker	M			M	M	M
Beating the competition	M	M	M	M	M	M
Creates value for customer	S	S	M	M	S	M
Requires a process worker		M	M		M	
Technology helping customers	M	M	M	S	M	S
<i>Structural capital</i>						
Product-focused		M	M	S	S	S
Innovative products	0.540		S	M	M	M
Performance is product-based	0.475	0.626		M	M	M
Easy to use technology	0.689	0.458	0.463		S	S

(continued)

IC elements	IC element					
	Product-focused	Innovative products	Performance is product-based	Easy to use technology	People helping customers	Effective lines of communication
					Technology supports customers	Technology supports processes
People helping customers	0.699	0.544	0.431	0.636	M	M
Effective lines of communication	0.579	0.500	0.412	0.626	0.591	S
Technology supports customers	0.758	0.497	0.503	0.817	0.578	0.694
Technology supports processes	0.707	0.495	0.507	0.712	0.523	0.677
<i>Human capital</i>						
The work is engaging						0.551
Trained and competent staff	0.577	0.486	0.431	0.657	0.609	0.497
Learning from others	0.547	0.508	0.550	0.712	0.451	0.600
Long-term career			0.409		0.418	0.638
Set in their ways						0.554
An attractive place to work				0.416	0.475	0.430
The new generation	0.489					0.409
Looking to retire						0.434

Table III.

Table IV.
Map of inter-relationships
of IC

IC elements	The work is engaging	Trained and competent staff	Learning from others	IC element Human capital Long-term career	Set in their ways	An attractive place to work	The new generation	Looking to retire
<i>Relational capital</i>								
Positive customer experience	M	M	M	S		M		
Creates value for OzFS I can see the customer	S	M	M	M		M		
Sharing knowledge externally	M					M		
Requires a knowledge worker								
Beating the competition	M	M	M	M		M		
Creates value for customer	M	M	M	M		M		
Requires a process worker		M			M		M	
Technology helping customers	M	M	M			M		
<i>Structural capital</i>								
Product-focused		M	M				M	
Innovative products		M	M					
Performance is product-based		M	M		M			
Easy to use technology		S	M				M	
People helping customers		S	M	M			M	

(continued)

IC elements	The work is engaging	Trained and competent staff	Learning from others	IC element			The new generation	Looking to retire
				Human capital	Set in their ways	An attractive place to work		
Effective lines of communication	M	M	S	S		M	M	
Technology supports customers	M	S	S	M		M	M	
Technology supports processes	M	S	S	M		M	M	
<i>Human capital</i>								
The work is engaging		M	M	S		S		
Trained and competent staff								
Learning from others	0.445		M	M			M	
Long-term career	0.567	0.588		M		M	M	
Set in their ways	0.701	0.450	0.542			S	M	
An attractive place to work								
The new generation	0.777		0.470	0.713				
Looking to retire		0.483	0.476	0.437				

Table IV.

Table V.
Value dimensions and
inter-actions with IC
components

IC elements	IC components	Positive customer experience	Value dimension		
			Creates value for OzFS	Beating the competition	Creates value for customer
Relational capital	Positive customer experience				
	Creates value for OzFS	S	S	S	S
	I can see the customer	S		S	S
	Sharing knowledge externally	M	M	M	M
	Requires a knowledge worker	M	M	M	M
	Beating the competition	S	S		
	Creates value for customer	S	M	M	
Structural capital	Requires a process worker				
	Technology helping customers				
	Product-focused	S	S	S	S
	Innovative products	M	M	M	S
	Performance is product-based	M	M	M	S
	Easy to use technology	M	M	M	M
	People helping customers	S	S	M	S
	Effective lines of communication	S	S	M	M
	Technology supports customers	S	M	M	S
	Technology supports processes	M	M	M	M
Human capital	The work is engaging	M	S	M	M
	Trained and competent staff	M	M	M	M
	Learning from others	M	M	M	M
	Long-term career	S	M	M	M
	Set in their ways				
	An attractive place to work	M	M	M	M
	The new generation				
	Looking to retire				

connections (note that the correlation analysis only suggests associations) were also made within organisational narratives, indicating a level of congruence between articulated strategy and employee experiences and perceptions at OzFS.

Second, the importance of both technology and people in customer relationships was highlighted by employees. Technology was strongly and positively associated with customer and shareholder value at OzFS, having strong relationships with all four value dimensions, while people had strong positive relationships with three of the four value dimensions (the exception being “beating the competition”). Both of these feature as important in positive employee narratives about OzFS, indicating a need to balance technology implementation and automation projects to ensure that in enhancing a “technology” effect, the “people” effect was not compromised.

In addition to suggestions about important IC elements are indications of less important IC elements. One of the issues that surfaced in discussions with B&T management was the management of the generational transition between employees that had been with OzFS for a significant period of time and new graduate entrants, with different human capital attributes and motivations to mobilise this. The related abstract indicators of “Set in their ways”, “Looking to retire” and “The new generation” were not associated to the value dimensions either in strong or medium fashion, indicating that these issues were seen as less relevant by the employees themselves.

3.2.3 Mapping the value-creation perspective. Maps of the value creation dimensions identified above were developed to represent visually the inter-relationships between IC indicators from a value-creation perspective. The maps for “Creates value for OzFS” and “Creates value for the customer” are displayed in Figures 2 and 3 respectively. These maps are partly inspired by the other types of maps identified earlier in the IC literature and, in particular, the IC-Navigator of Fernstrom *et al.* (2004) and the value creation maps of Marr *et al.* (2004).

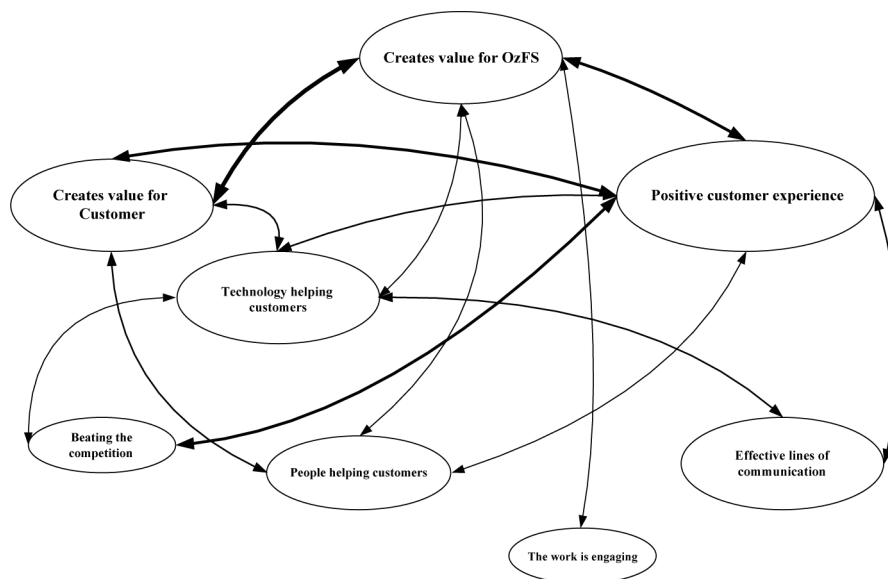


Figure 2.
Creates value for OzFS

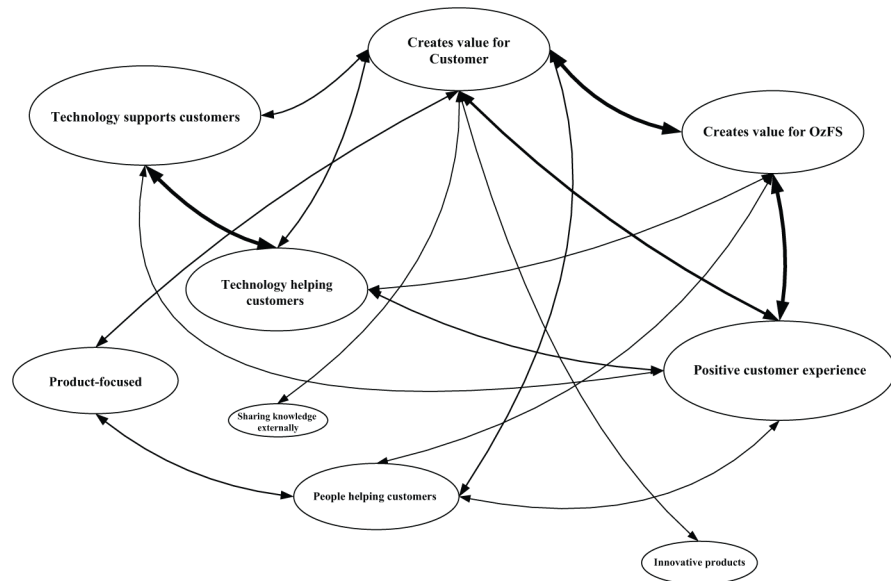


Figure 3.
Creates value for customer

To read the map the following explanation of its construction is required. First, each bubble represents an element of IC and its size is dependent on the number of strong relationships (> 0.6 as shown in Tables II-IV) that the indicator has with other indicators, signifying its importance to the overall representation of IC, with the focal indicator placed at the top of the model. Second, connections have been drawn between the indicators to signify the strength of the inter-relationship, the heavier the line the stronger the relationship. Third, the connections between the indicators have double-headed arrows signifying the associative nature of inter-relationships rather than any type of causality. Overall, while there are a multitude of connections between the IC elements within the visualisation, closer inspection and observation of these visualisations helped OzFS to make sense of the complex relationships between IC elements thus reducing the ambiguity surrounding value-creation.

The usefulness of the visualisations presented in the underlying research project is illustrated briefly using the map presented in Figure 2, which focuses on “Value for OzFS”. This visualisation indicates that, from the employee’s perspective, value is influenced by the ability to develop relational capital foremost and IC second. The fluidity of IC as represented by the double headed arrows suggests that should an element such as “Positive customer experience” begin to change (either positively or negatively), changes may also occur not only on “Value for OzFS” but on other value dimensions, such as “Creates value for customer”. The potential for multiple impacts of changes in an individual IC element across a number of dimensions other than “Value for OzFS” are thus illustrated utilising employee constructions of how IC works and is related to value. Maps such as Figures 2 and 3 were produced for each of the four value dimensions, as it was considered that the IC elements and relationships that were to be “prioritised” for further investigation were contingent on which value perspective was

taken. Overall, rather than a singular and uniform representation of IC, multiple representations of IC as a network of resources were produced in the B&T case study.

Having presented the methods that emerged to visualise the inter-relationships between IC and value, we reflect on the same using the Latourian notion of inscriptions (Latour, 1987, 1999a, b) to guide our analysis.

4. Reflections on the production of IC visualisations

Given the focus of the paper on representations of knowledge, as described in the opening quote to the paper, we draw on Latour's (1987, 1999a, b) concept of inscriptions and its link to knowledge production. In this, we follow a significant and established precedent, both in the broader accounting literature (for example, Cuganesan, 2008; Briers and Chua, 2001; Robson, 1992), as well as studies specific to IC (for example, McNamara *et al.*, 2004; Mouritsen *et al.*, 2001).

According to Latour (1987), knowledge involves the acquisition of familiarity with an event and the subsequent application of this familiarity to other related situations. One means of gaining knowledge over remote elements is through the collection of "information traces" about them. For Latour (1987), the fabrication of "inscriptions" is required. Inscriptions enable the bringing back of events and places and this "bringing back" enables familiarity and knowledge. The consequences of these inscriptions are momentous for Latour, and are likened to a "Copernican revolution", whereby many things are made to revolve around a scientist via the collection of their traces rather than the scientist revolving around these various things (Latour, 1987).

Viewed in these terms, the collection of 208 narratives of OzFS employees is akin to the collection of information traces about how B&T employees make sense of IC. Inscribed in electronic form, these information traces were able to be captured, stored and mobilised later for the purposes of the underlying research project. At this juncture, an important movement in the inscription process should be noted; specifically, that inscriptions construct the very traces that they represent (Latour, 1999b). Thus, we shift from notions of representational correspondence with how IC works within the firm to a notion of representations that produce or construct how IC works within the firm. IC is no longer the intangible elements of organisations as conceived of by its employees and other interested actors, but captured in narrative and metaphor co-produced by those providing the narrative and those producing the visualisations. It is this "fixing" of IC, what it comprises and how it relates to other IC elements and value in the firm that allows for its mobilisation either in research processes or for the interventions of IC management (Mouritsen and Larsen, 2006).

However, to facilitate intervention, further translations are required. Specifically, in order to mobilise and calculate IC further, abstractions of IC beyond the organisational narrative are required. This problem of inscribing is described by Latour (1987) as the challenge of not only gathering inscriptions but also getting rid of them. While inscriptions may enable a Copernican revolution, the elements brought back can overwhelm by their sheer number or scale. The solution to this threat of overwhelming inscriptions is what Latour describes as "cascading inscriptions", where additional work is performed to combine masses of inscriptions into higher and more aggregated degrees of inscription. Quantification, totals and averages, classification frameworks, tables, cartography and equations are just some of the mechanisms that Latour (1987)

identifies as available for the aggregation of inscriptions. In this manner, “when you hold the final elements you also, in some way, hold the others” (Latour, 1987, p. 235).

Thus the ability to cascade inscriptions is critical. The use of the elements of IC and the scoring of narrative in terms of their relevance to these elements is that which, in our methods, enables the combinability of first-order inscriptions, being the organisational narratives elicited, and their cascading into higher-order inscriptions to occur. The use of IC elements provides a label that enables grouping of narratives while the use of the scores has multiple effects. First, it orders the various narratives within a group by producing a numeric relationship between each narrative associated with a particular IC element. Second, it enables translations of narrative about IC into visual productions of IC through the use of the scatter graphs presented in the previous section. Thus the IC elements and scores simultaneously bring narratives about IC together whilst differentiating them through grouping and scoring respectively. Importantly, the expression in numeric form allows for further calculations to occur through the use of statistical analysis. Indeed, this is a yet higher-order inscription in the cascading of inscriptions as we are now able to compare the relationship between different IC elements at a meta-narrative level rather than across individual narratives using the scatter-graphs.

However, the cascading and translations come at a possible cost. The movement from organisational narratives about IC to numeric expression and visual productions of IC results in a reduction of heterogeneity, with gradual losses of locality and particularity as successive stages of inscription occur (Latour, 1999b). In the methods discussed, the translations of inscriptions that occurred were not irreversible. If at any point, the conditions of possibility that made these translations are required to be made visible, then the scientist can cascade down into the underlying narratives that make up a scatter graph that generates a particular correlation or regression co-efficient. Thus, through the use of technology, those who hold the highest order inscriptions (Figures 2 and 3), be these scientists in practice (managers seeking to intervene in IC) or in academia (researchers seeking to investigate IC) can translate these to their numeric or narrative forms and reverse the cascading process.

Despite the possibilities of “cascading down” inscriptions, it is the highest order inscriptions (Figures 2 and 3) that are the most powerful, for they are have the most to say about (produce about) IC and how it works within a firm. One reading of Figures 2 and 3 suggests that these present a meta-narrative of how employees relate IC elements to each other and to value creation within the firm, as well as the relative strengths of these perceived relationships. Thus Figure 3 produces a map of IC that:

- links the multiple elements that influence OzFS’s ability to “create value for customers”;
- prioritises these such that the role of technology, the customer experience and the value subsequently generated for OzFS are inserted into the foreground while others are rendered less visible; and
- speaks for the 208 narratives elicited from B&T employees.

Simultaneously, absent from these inscriptions are the underlying narratives that were considered important for the capturing of heterogeneous complexity or the individual indicator-based scores or the different correlations associated with each relationship. It is here that we encounter the paradox of visualising IC for the purposes of managerial

interventions, for IC visualisations say the most about IC and how it works within firms by saying the least. They say a lot in producing an overview of all IC elements and their relationships and ordering these on the basis of strength of relationship to each other and value. B&T management sought these properties so they could identify where and how to mobilise resources in managing and intervening IC. They also say little being removed (translated) away from the narratives that actually talked about how IC worked and was related to value.

Overall, we have drawn on the Latourian notion of inscriptions and its role in producing knowledge (Latour, 1987, 1999a, b) to reflect upon the methods developed to visualise how IC works and relates to value in a case study of a financial services organisation. We have described the movements that occurred in the production of the visual as the researchers involved sought to account for IC. We present our concluding observations and comments in the next section.

5. Conclusion

In the second wave of knowledge management, there is a shift from the level of the individual to the level of knowledge resources, and there is an ambition to find ways to make the management of knowledge possible via intellectual capital information. This requires a translation of “three-dimensional” objects into “two-dimensional” inscriptions in intellectual capital information. (Mouritsen and Larsen, 2006, p. 376).

In searching for new ways to intervene in IC and mobilise IC resources, as suggested by Mouritsen and Larsen (2006) above, the theme of this paper is relevant – how is IC and knowledge about IC to be inscribed and represented? Traditional accounting statements are deficient in how they represent the intangible resources of the firm and their capacity to create value (Fincham and Roslender, 2003). While scorecard methods and narrative-based approaches have developed as a means of inscribing IC, approaches that attempt to present visualisations of IC have proliferated.

The visualisation approach presented in this paper builds on and extends prior IC visualisation efforts in a number of ways. First, the use of organisational narratives and the association of IC elements through these by participants is different to the approaches of the IC-Navigator (Fernstrom *et al.*, 2004), value creation maps (Marr *et al.*, 2004), strategy maps (Kaplan and Norton, 2000, 2004), and is more extensive than the semi-structured interview approach used to generate causal performance maps (Abernethy *et al.*, 2005).

Second, through the use of the narrative database software, those producing inscriptions can cascade both up the various levels of inscription provided and down to the traces of individual narratives. This allows researchers and practitioners to identify narratives consistent with higher-order representations (such as in Figures 2 and 3) as well as those that appear to be exceptions (through, for example, the scatter diagrams in Figure 1). The other visualisation approaches do not appear to have the same ability to counter the irreversibility of cascading inscription due to their focus on moving from interview and workshop information to visualisation production. All rely on expert knowledge in producing the visualisations (with the exception of the computer-coding method utilised by Abernethy *et al.* (2005)) and hence the cascading process is in the minds of the expert rather than the hands of the researcher/practitioner investigating IC.

Finally, in differentiating between IC elements and their relationships the visualisations presented (Figures 2 and 3) are different to those of strategy maps and causal performance maps. Here, the end inscriptions are more in keeping with those produced by the IC-Navigator and value creation map processes with differences in IC elements and their relationships symbolised using objects of different sizes and shading. Here, however, we focus on inscribing the associative nature of the relationship between the IC indicators rather than any type of causality.

Within this paper, we have reflected on the methods used to produce a particular form of IC inscription; specifically, visual representations of IC based on organisational narratives. While these methods are specific to a single case study, we consider them to be related to the range of IC visualisation methods that have been developed in the prior literature as well as visualisation more broadly. Hence, we contend that our reflections have implications beyond the methods presented here to the broader accounting for IC literature.

Through reflecting on the methods developed, we highlight the translation of organisational narrative into numeric and visual form. The movement from narrative to visual is significant. First, narratives are grouped and relations produced between narratives. Second, this process in turn enables comparison within groups either numerically (comparing scores) or visually (scatter-graphs of scores). Third, through further calculations, comparisons across groups of narratives are enabled. At the end, the researcher or practitioner examines a meta-narrative connecting the various IC elements to each other as well as dimensions of IC value creation.

It is important to note that the translations and movements come at a possible cost, specifically, a movement away from the local and the particular through the homogenisation of narrative into numeric form and the visual production of meta-narratives of how IC works in a firm. It is here that we encountered the paradox of IC visualisation approaches (employed both by ourselves and others). Whilst we might seek to inscribe the complexity of IC and multiple causal relations through visual representation, this same complexity needs to be somehow reduced and abstracted away if the inscriptions produced are to be mobilised further. Indeed, the result of the movements employed to produce IC visualisations, be these grounded initially in numeric information traces (such as the IC-Navigator or value creation maps), narrative (such as the methods presented in this paper) or multiple triangulated inscriptions (such as the causal performance maps), is that the resultant visualisations say a lot about how IC works within firms only by simultaneously saying very little.

This finding is important given the popularity of visualisation approaches over numbers and narrative, which has been explained in terms of both its effects on the communication, processing and absorption of information (Hoffjan and Schmitting, 2003), as well as the advent and adoption of new and advanced visualisation technologies (Whyte *et al.*, 2008). Based on our experiences, we question the extent to which a visual inscription of IC-value relationships can provide the sought after transparency about organisations and their ability to create value. Specifically, we point to the cascading process and movements away from how IC might be enacted to how it is represented visually as problematic.

Thus, it may be that a meta-narrative of how IC connects to value within an organisation is required in both visual and narrative form. The former is to aid the communication of an overview of the elements comprised within the IC network and

their relational properties (such as importance and strength of connections), while the latter enables the complex story of value creation to be told without reduction. Within these representations of IC inter-relationships and value might be numbers. We say this because numbers by themselves have been shown to be insufficient for expressing and communicating relations between IC and value (Mouritsen *et al.*, 2001; Mouritsen and Flagstad, 2005) despite being the subject of renewed interest[5]. In this, we are consistent with existing research that supports the public disclosure of qualitative information comprising “value creation processes, the broad categories of intangibles, the use of the value-creation story and benchmark indicators matched to their position in the story” (Holland, 2006, p. 163). We add that, even within firms, such efforts are required to make accessible the complexities of IC and value creation.

In closing, we call for further research into the role and effects of IC visualisations (such as those discussed here) within those organisations seeking to participate in the so-called “2nd wave of knowledge management” as well as by those seeking to evaluate organisational value creation activities. How the relational attributes of numerical, narrative and visual representations influence their use and the mobilisation of resources by managers within firms, by capital markets participants and by stakeholders in general represent areas that future research needs to address.

Notes

1. The term “related” is used deliberately here as we examine constituent views of IC and value creation located in a specific organisational context.
2. Strategy maps (Kaplan and Norton, 2004) and causal performance maps (Abernethy *et al.*, 2005) were not developed to focus on IC specifically. Rather, their focus is on broader dimensions of organisation performance that includes, but is not restricted to, IC.
3. The extra three stories came from more enthusiastic employees who had on occasion an extra story to tell.
4. Further detail cannot be provided due to commercial sensitivity and the need to preserve the anonymity of the participating organisation. However, the espoused strategies were broadly consistent with the service-profit chain that has been described in the literature (Heskett *et al.*, 1997).
5. A recent report by the Securities and Exchange Commission Advisory Committee (Securities and Exchange Commission, 2008, p. 15) recommended that the Securities and Exchange Commission “encourage private sector initiatives targeted at best practice development of company use of key performance indicators (KPIs) in their business reports [...] The SEC also should encourage companies to provide, explain, and consistently disclose period-to-period company-specific KPIs.”.

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