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Fostering innovation through the creation of an interoperability capability: An analysis using the Business Narrative Modelling Language

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Fostering innovation through the creation of an interoperability capability: An analysis using the Business Narrative Modelling Language

Academic dissertation submitted with the purpose of obtaining a doctoral degree in Industrial Engineering and Management

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Manuel Luís Au-Yong Oliveira

Porto, April 2012

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To São and

João, Benedita, Joana, and Leonor

To my Parents

To my brother and sister

Acknowledgements

Finally, words of eternal Thanks and gratitude to my family who have lived this doctoral experience with me every day: São, companion of a lifetime, for her patience and love; and a special Thank-you also to our children João, Benedita, Joana and Leonor, for their unending support and interest in all of my projects and for providing true meaning to life.

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Resumo

O objetivo principal deste projeto de investigação foi o de aplicar a criatividade a métodos de pesquisa qualitativa, vistos como sendo inferiores (Mason, 2002) e faltando uma abordagem sistemática e estandardizada. Um objetivo foi o de encontrar uma solução que tornaria casos de investigação mais ágeis e mais comparáveis, uma solução de investigação nova a ser testada depois por nós ao aplicá-la a uma lacuna em particular na literatura da gestão, nomeadamente como a interoperabilidade se relaciona com a inovação. Ao realizar este objetivo tivemos cuidado para evitar ficarmos demasiado mecanicistas, mantendo-se alguma profundidade de análise no processo. A Linguagem de Modelação da Narrativa de Negócio (*Business Narrative Modelling Language* – BNML) é assim um produto desta pesquisa de doutoramento, uma linguagem baseada na narrativa e em representações visuais e que foi usada para analisar antecedentes de inovação. Representamos – baseado nas narrativas de atores organizacionais recolhidas em entrevistas semi-estruturadas (22 entrevistados num total de oito casos de estudo) e através de questões de inquérito qualitativas que tinham como objetivo aprofundar os temas abordados (dois inquéritos aprofundados foram realizados – um inquérito mais exploratório, que envolveu 54 alunos finalistas de uma licenciatura em Gestão; tendo sido realizado também um outro inquérito que envolveu 55 executivos de nove indústrias diferentes) – trocas de *deliverables* (coisas passíveis de serem entregues a atores) tangíveis e intangíveis ocorrendo ao longo de histórias (*storylines*) de interação social e ao longo de uma sequência de padrões. Também representamos ativos criados e usados nesta mesma sequência de padrões e ao longo dos nove blocos de construção do *Business Model Canvas*. Ontologias, tais como a *Enterprise Ontology* (Ontologia Empresarial) e a *Unicist Ontology of Innovation* (Ontologia Unicist de Inovação), assim como padrões de jogos pré-definidos, serviram como um elemento estandardizador na BNML, fornecendo uma base no sentido de haver mais comparabilidade entre casos. Como nota final, a BNML evoluiu para fornecer também uma *plot view* (vista de enredo ou de processo) de como a interoperabilidade é um antecedente da inovação, tendo usado no processo software Graphviz. Concluímos, depois de realizar a investigação, que a interoperabilidade é de facto um antecedente da inovação – uma relação tida na literatura como sendo difícil de provar – assim como a *servant leadership* (um estilo de liderança onde os líderes existem para liderar mas também para servir os seus seguidores) e as tecnologias de informação e comunicação (TIC). A *servant leadership* e as TIC são vistas como sendo facilitadoras da interoperabilidade que depois leva à inovação. Os nossos resultados de investigação, no entanto, mostram que em Portugal os estilos de liderança autocrático e paternalista predominam, com empresas *servant leadership* perfazendo uma pequena minoria. Empresas Portuguesas poderão estar assim a perder oportunidades de inovação e a deixar de aproveitar o potencial dos seus funcionários. A realidade emergiu na nossa investigação, uma vez que usamos a *Grounded Theory*. Concluímos ainda que usando mais tipos de interoperabilidade levará a mais inovação. Como consequência, as empresas fariam bem em alavancar todos os tipos de interoperabilidade à sua disposição. Evidência da investigação indica também que para as empresas Portuguesas se tornarem mais interoperáveis terá que haver um processo de mudança de cultura. Esta mudança cultural terá que acontecer ao nível individual, ao nível das equipas, ao nível do trabalho entre equipas, ao nível da organização total, assim como ao nível da nação.

Palavras-chave: BNML, inovação, interoperabilidade, pesquisa qualitativa, *servant leadership*, TIC

Abstract

The main objective of this research project was to apply creativity to qualitative research methods, seen as being inferior (Mason, 2002) and lacking a systematic and standardized approach. An objective was to find a solution which made research cases more agile and more comparable, and to then test our novel research solution by applying it to a particular gap in the management literature, namely how interoperability relates to innovation. In so doing care has been taken to avoid becoming too mechanistic and to maintain some depth of analysis in the process. The Business Narrative Modelling Language (BNML) is thus a product of this PhD research, based on the narrative and on visual representations, and has been used to analyze innovation antecedents. We have represented – based on organizational actors' narratives gathered in semi-structured interviews (22 interviewees in eight case studies in total) and via in-depth qualitative survey questions (two in-depth surveys, one more exploratory, having involved 54 students finalizing their BSc Management degree, the other survey having involved 55 executives from nine different industries) – tangible and intangible deliverable exchanges occurring over storylines of social interaction and along a pattern sequence. We have also represented assets built and used depicted in this same pattern sequence and along the Business Model Canvas's nine building blocks. Ontologies, such as the Enterprise Ontology and the Unicist Ontology of Innovation, as well as pre-defined game patterns, have served as a standardizing element in BNML, providing a basis for more comparability across cases. Finally, BNML has also evolved to provide a plot view (or process view) of how interoperability is an antecedent to innovation, having used Graphviz software in the process. We conclude following our research that interoperability is indeed an antecedent of innovation – a relationship seen in the literature as being difficult to prove – as are servant leadership (a leadership style where leaders exist to lead but also to serve followers) and information and communication technologies (ICT). Servant leadership and ICT are seen to be enablers of interoperability which then leads to innovation output. However, our research results also show that in Portugal autocratic and paternalistic leadership styles predominate, with servant leadership companies making up a small minority. Portuguese companies may thus be losing innovation opportunities and failing to tap into the potential of their employees. Reality has emerged in our research as we have used Grounded Theory and we further conclude that using more interoperability types will lead to more innovation output. Companies would thus do well to leverage all of the interoperability types at their disposal. Research evidence also indicates that in order for Portuguese companies to become more interoperable, culture change is deemed necessary, at the individual, team, inter-team, total organizational and national levels.

Key words: BNML, ICT, innovation, interoperability, qualitative research, servant leadership

This thesis is based on three published papers, two papers accepted for publication and an additional paper submitted to an international peer-review journal, as follows:

Paper I (published)

Oliveira, Manuel Au-Yong, Ferreira, João José Pinto (2011). Facilitating qualitative research in business studies - Using the business narrative to model value creation. *African Journal of Business Management*, vol. 5(1), 4 January, pp.68-75. (ISSN 1993-8233; ISI INDEXED JOURNAL; IMPACT FACTOR 1.105).

Paper II (published)

Oliveira, Manuel Au-Yong, Ferreira, João José Pinto (2011). Producing innovation: Comments on Lee and Yu (2010). *African Journal of Marketing Management*, vol. 3(3), March, pp.65-67.

Paper III (published)

Oliveira, Manuel Au-Yong, Ferreira, João José Pinto (2011). Book review – Business Model Generation: A handbook for visionaries, game changers and challengers. *African Journal of Business Management*, vol. 5(7), 4 April (ISSN 1993-8233; ISI INDEXED JOURNAL; IMPACT FACTOR 1.105).

Paper IV (accepted for publication)

Oliveira, Manuel Au-Yong, Ferreira, João José Pinto (forthcoming / accepted for publication). BNML representations: A storyline view and a plot view of how interoperability is an antecedent of innovation at IP BRICK. *African Journal of Business Management* (ISSN 1993-8233).

Paper V (accepted for publication)

Oliveira, Manuel Au-Yong, Ferreira, João José Pinto (forthcoming / accepted for publication). How interoperability fosters innovation: The case for servant leadership. *African Journal of Business Management* (ISSN 1993-8233).

Paper VI (submitted for review to an international peer-review journal)

Oliveira, Manuel Au-Yong, Ferreira, João José Pinto (submitted for review). Interoperability and innovation and the Business Narrative Modelling Language: Comments on Cabello-Medina et al. (2011).

General introduction

The research project

Organizations Worldwide are coming under increasing pressure to innovate and evolve (Moore, 2006) in survival-of-the-fittest and increasingly competitive free-market economies. The motivation for this PhD thesis came from the PhD candidate having gained valuable work experience in such markets internationally, initially linked to the selling of commodity-like products and then subsequently linked to the selling of radically innovative products (namely Waterco's award-winning MultiCyclone filter). Given that the latter was so much more meaningful and rewarding it served as a turning point in the research interests of the PhD candidate and was the foundation for this doctoral thesis about innovation antecedents. Having commenced doctoral studies at the Faculty of Economics of the University of Porto (FEP)[1], more focused at that stage on national culture – "the collective programming of the mind that distinguishes those who grew up in a specific country" (Hofstede, 1991, p.298) – and on organizational culture – "the collective programming of the mind that distinguishes the members of one organization from another" (Hofstede, 1991, p.298) – themes still present in this doctoral thesis (see for example papers IV and V) indeed the studying of culture opened the PhD candidate's mind to a number of important issues, such as leadership in general, which is closely linked to culture (Schein, 1992), and servant leadership in particular – after completing the taught part of the doctoral course in business science at FEP the PhD candidate then transferred to the Faculty of Engineering, also at the University of Porto (DEGI – FEUP), to write the required doctoral thesis in the field of innovation – under the supervision of Professor João José Pinto Ferreira. Innovation had proven to be a powerful tool for previous employer Waterco to create new customer loyalties in international markets, to a large extent irrespective of national culture, and so innovation was seen to be a unique way to drive global sales growth – much as Christensen and Raynor (2003) describe – so important to Portugal at a time when its domestic markets were shrinking in size due to its internal crisis. Thus a total of eight case studies were performed (BTM Travel, Diafresh, ExpressGlass, Infosistema, IP BRICK, Sage Portugal, Silampos, and Yazaki Saltano), each case involving differing innovation capabilities – innovation defined as being able to "simultaneously enhance society and increase profits" (Govindarajan and Trimble, 2005, p.xi) by: 1) Leading to productivity gains (improving existing work processes) (Govindarajan and Trimble, 2005); as well as: 2) Being linked to the commercialization of "new products and services that meet previously unfulfilled needs" (Govindarajan and Trimble, 2005, p.xi). In addition to the case studies, fifty-four students (in survey 1) and fifty-five executives (in survey 2 – involving nine different companies and industries) were surveyed with in-depth qualitative survey questions in order to gain additional insights into innovation antecedents. Very specifically, the literature was not clear on the relationship between interoperability and innovation, indeed the existence of a relationship was not seen to be easy to prove (Gasser and Palfrey, 2007). Interoperable can be defined as being "able to exchange and make use of information" (Oxford Dictionaries[2]) and interoperability was of interest to us in so far as it related to *people and organizations operating in conjunction and exchanging and using information to produce innovation*. Interoperability can also be defined as follows: "The ability of a system or an organization to work seamless[ly] with other systems or organization[s] without any special effort" (Mertins *et al.*, 2008, p.v). "One of the reasons why we tend to like interoperability is that we believe it leads to innovation" (Gasser and Palfrey, 2007, p.ii). However, "the relationship between interoperability

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[1] The PhD candidate would like to thank Professor Hortênsia Barandas for assistance given while studying at FEP (while taking the doctoral course in business science – marketing and strategy specialization).
[2] http://oxforddictionaries.com/definition/interoperable?q=interoperable, accessed on 08-04-2012.

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and innovation, while it likely exists in most cases, is extremely hard to prove" (Gasser and Palfrey, 2007, p.ii). This was thus an objective of this research project – to prove that there is a relationship between interoperability and innovation. We also set out to determine what type of relationship this was. To achieve this end we used the novel Business Narrative Modelling Language (BNML) which we developed (Oliveira and Ferreira, 2011a) mainly due to – as Gupta (2008, p.31) describes – "a desire to have more, a desire to have something better, a desire to have things which make life easier". BNML was seen to be an efficient as well as effective research tool to correctly determine the relationship between interoperability and innovation. Of note is that the BNML process also makes use of Graphviz software in order to generate meaningful graphs in accordance with the research evidence gathered.

In this doctoral research thesis we thus used a qualitative research strategy and the Business Narrative Modelling Language (BNML) to determine the relationship between interoperability and innovation. BNML was developed as a part of the doctoral research effort in order to make the qualitative research process more rapid and efficient, while allowing at the same time for a more standardized comparison of case studies. The need for BNML arose given evidence in the literature of a need for other more systematic and more objective research tools with which to perform qualitative research, without compromising the fluidity and flexibility which are characteristic of qualitative research projects (Mason, 2002). In addition to creating BNML, we then also validated this research tool in our investigation of the innovation process. Since Oliveira and Ferreira (2011a), our first peer-review journal publication on the language (paper I below), BNML has evolved to include a storyline view *and* a plot view – which we have applied to show how interoperability is an antecedent of innovation. While the storyline view (Oliveira and Ferreira, 2011a) involves actors, storylines, deliverable exchanges, a pattern sequence, assets created and used, as well as a number of ontologies, the second part of BNML – the plot view – involves a figure (and corresponding narrative) which is made up using Graphviz software, explaining the organizational narrative via plots. In the activities view of an organization plots can be seen to be the parallel of processes. Aveiro and Tribolet's (2006) work on ontologies inspired the plot view BNML representation. BNML is thus an integration of the two views described above – involving storylines and plots.

BNML is both a creative and rigorous research method which enables the rapid portrayal of research results and is a major output of this doctoral research effort. An objective of ours was, also, to make academic research more accessible to diverse audiences and we are satisfied that this was achieved mainly through the use of visual representations (accompanied by the narrative). Indeed the creation of BNML and its validation within the scope of this doctoral thesis will we hope bring academic research closer to practitioner needs as well as to other environments. Over 30,000 years ago visual narrative art was already present in cave paintings of animals and humans, communicating stories to illiterate audiences (Woodside, 2010).

Interoperability, defined as existing in five interaction types – communication, coordination, cooperation, collaboration and channel (involving the Internet) (Li et al., 2008) – and how we have proven that it is an antecedent of the innovation process, contributing to innovation output, is another main output of the PhD project.

In our qualitative survey of fifty-five executives – from nine leading Portuguese companies from nine different industries – the results clearly showed that leadership is seen to be a crucial factor contributing to the establishment of free-flowing communication channels in organizations – or an interoperability capability – which in turn will play a central role towards the production of innovative output. Servant leadership, however – where leaders exist to serve followers and to enable a creative working environment and where information and knowledge flow freely (Dierendonck and Patterson, 2010a) – is a distant reality from Portuguese companies. Indeed over

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one third of the executives surveyed indicated that autocratic leadership was the norm in their companies. This meant, in the words of one executive, that disagreeing with senior leadership is "suicide" – which plays against an interoperability asset being created. People will be afraid to voice their views if these are seen to be different from their leaders' views – thus inhibiting innovation. This we see as one area in particular which needs to change if Portuguese companies are to become more innovative. In order for a predominant leadership style in society to change, and be well accepted by organizations, culture change must first occur. Culture change can however be complex and involve organizational transformation (Coghlan and Rashford, 2006). Co-Recipient of the Nobel Prize in Economics in 1993, Douglass C. North, stated that in both Portugal and neighbouring Spain authoritarian systems have been the rule for centuries – indeed "neither self-government nor competitive markets existed" (North, 2005, p.112). This has been a major concern of the Troika Committee[3] charged with gearing Portugal out of its current economic crisis: "Troika wants more and better competition" (Machado, 2012, p.4). We do show below that this has been countered, however, in some companies in Portugal – companies where attitude and values count more during the hiring process than technical competencies and where, once hired, employees are very consciously developed in a meritocracy environment. Our case studies IP BRICK and Infosistema are companies where we saw a concern by leadership for serving others and which in turn led to a very explicit interoperability capability existing, leading then to innovation. Idea- and knowledge-sharing via unhindered communication channels can be promoted to contribute to innovation output.

Finally, BNML played an essential role in the demonstration of the above, as it is a language that builds on stories told by interviewees. Stories which included describing how the interoperability asset occurs in value networks before innovation. BNML made this evident by having a timeline which Allee's (2008) visual representations, for example, lack. Furthermore, when parameterizing the BNML data gathered in Excel sheets – data which included, in our research project, patterns, inputs/outputs, plots, as well as interoperability and innovation types – analysts who in future use BNML will, we hope, much as we did, rapidly realize which variables contribute most to organizational success. In this sense BNML will then serve as a roadmap guiding organizations along the path of change and development.

The research context - Portugal

This PhD project was undertaken at a crucial time for the Portuguese economy. Herein we emphasize the need for research in the area of interoperability so that Portuguese enterprises may become more competitive by way of increased innovation.

Some analysts argue that "few things matter more for the welfare of a country's citizens than the aggregate growth rate of the economy" (Porter et al., 2004, p.3) as economic growth in countries such as Portugal will improve the quality of life of citizens as (especially lower) incomes will tend to rise alongside an increase in gross domestic product (GDP) (Porter et al., 2004). Furthermore, more employment will ensue (Porter et al., 2004). A major problem at present in Portugal is unemployment which is at record levels – 15% at the end of February, 2012, according to Eurostat (2012).

"The [Global Competitiveness] *Report* contributes to the understanding of the key factors determining economic growth" (Schwab, 2010a, p.xi) and competitiveness can be defined as "the set of institutions, policies, and factors that determine the level of productivity of a country... a more competitive economy is one that is likely to grow

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[3] Made up by the European Commission, the European Central Bank and the International Monetary Fund (IMF).

faster in the medium to long run." (Schwab, 2010b, p.4). Portugal in 2005-2006 was placed in 22nd place by the Global Competitiveness Index (GCI) Ranking. Five years later Portugal is placed 46th (2010-2011 Rankings). This has to do with a decrease along twelve pillars, a set of measures which include technological readiness, business sophistication and innovation. Portugal needs to be a technological innovation leader as this will lead to increased competitiveness and growth. "In today's globalized world, technology has increasingly become an important element for firms to compete and prosper." (Schwab, 2010b, p.7). "In the long run, standards of living can be enhanced only by technological innovation" (Schwab, 2010b, p.8) and "Amid the present economic uncertainty, it will be important to resist pressures to cut back on R&D spending — both at the private and public levels — that will be so critical for sustainable growth going into the future." (Schwab, 2010b, p.8).

Countries / economies will have different needs according to their stage of development: "While all of the [twelve] pillars... matter to a certain extent for all economies, it is clear that they will affect them in different ways: the best way for Rwanda to improve its competitiveness is not the same as the best way for Germany to do so." (Schwab, 2010b, p.9). There are three stages of development and Portugal is in the last stage (Schwab, 2010b, p.11). In this last stage business sophistication and innovation are key for an *innovation-driven economy*. This is versus factor-driven or efficiency-driven economies, stages one and two of development respectively, where infrastructure and higher education and training, among others, will be key (of note is that Portugal scores quite high on infrastructure – 24th out of 139 countries) (Schwab, 2010b).

Portugal's internal crisis has been much publicized in the international media and despite efforts from the European Union and the International Monetary Fund (IMF), in 2011 and on into 2012, involving financial aid of around 80 thousand million Euros (Golden Broker, 2012; Kowsmann, 2012; Lynn, 2012) at beneficial interest rates, "the cost of insuring Portugal's debt against default was at record highs Tuesday [24-01-2012]" (Halas et al., 2012). This may mean that there is a need for a second bailout for Portugal in 2013 (Halas et al., 2012). In early 2012 Portugal's central bank "sharply lowered its economic outlook for 2012, citing a worse-than-expected drop in internal demand, and warned that instability in the euro zone and the global economy could hurt exports. In its winter report, the Bank of Portugal said it now expects the economy to contract 3.1% this year. Its fall [Autumn] forecast called for a 2.2% contraction. The government has put the number at 3%" (Kowsmann, 2012). Citigroup, however, is less optimistic "predicting the [Portuguese] economy will contract by 5.7% in 2012" (Lynn, 2012). We thus see Portugal as needing more studies that seek in some way to contribute to a way out of the internal crisis, in a country where "Portuguese citizens suffer through budget cuts and tax hikes" (Schuman, 2012, p.32), which are negatively affecting internal demand. "Austerity is going to make things worse in terms of economic growth which you can see in Greece, Latvia, Ireland, and Portugal" stated the winner of the 2001 Nobel Memorial Prize in Economics, Joseph Stiglitz (RFE/RL, 2012). "GDP [Gross Domestic Product] in Greece and Portugal has crashed under the weight of austerity" (The Economist, 2012). Solutions need to be found for Portuguese companies. For example, innovation is seen to be fundamental to increase international trade (Dantas, 2001), international trade which is, according to some analysts, in Portugal's case "the only positive contributor to its economy" (Kowsmann, 2012).

As an example of the very difficult situation some of the Portuguese companies included in the study, and operating in the internal domestic market, were going through, Diafresh, a fresh food distributor located in Porto (the second largest city in Portugal) whose main customers are restaurants in the Greater Porto area, filed for insolvency on the 10th of January 2012. This was done in order to recuperate the

company which "due to restaurant bankruptcies, restaurants closing down, re-structurings of certain customers, and the simple disappearance of other customers, has led to severe problems such as a recent 35.000 Euro debt which will never be paid to Diafresh, a lot of money for a small operation like ours... The market has dropped a lot since October 2011. Furthermore, banks are not financing companies as it involves too much risk, given the current economic climate, and this has led to customers financing their activities through their suppliers [such as Diafresh]... Diafresh suppliers are demanding payment after 30 days credit while Diafresh customers are only paying after 120 days credit, which makes the business unviable. Until mid-2011 we were doing very well though, and it all changed very quickly" (Diafresh Managing Director, João Miguel Cunha Pinto, interviewed on the 25-01-2012).

Innovation can serve as a protection mechanism against the competition (von Hippel et al., 1999). "Innovation is the lifeblood of all organizations" (Kelley and Littman, 2006, p.3) and even smaller players should concentrate their operations on the selling of innovative products and services (Simon, 1996). Selling commodity-like products and services puts companies in the situation where they can be easily replaced by other players in the industry which supply the same (or very similar) market offering. However, achieving the desired level of innovation is difficult and most "simply don't know how to achieve breakthroughs and there is usually no system in place to guide them" (von Hippel et al., 1999, p.31). An objective of our research was to provide some systematic guidelines to help companies innovate more. We see that increasing the number of interoperability types used by companies is essential in the process of increasing innovation output.

The logic of the original research papers

Figure 1 summarizes the PhD research project, which involved a total of six original research papers. An introduction to each specific paper is given on the title page introducing each paper below (pages 7, 17, 23, 31, 73, and 123).

Literature review on research methodologies
Novel research methodology BNML proposed
Application of BNML to case study evidence
BNML uses visual representations and the narrative

Literature review: Book review
Book: *Business Model Generation*
(about a visual tool like BNML)
(Osterwalder and Pigneur, 2010)

Paper I → Paper II → Paper III

Literature review
Theme: innovation

Grounded Theory:
Ongoing literature review

Two surveys
Case study of Infosistema
Servant leadership and interoperability
as antecedents to innovation
Application of BNML

Paper VI ← Paper V ← Paper IV   IP BRICK
case study

Overview and summary of research
Eight case studies, two surveys
Application of BNML
Conclusion that using more interoperability types
leads to more innovation output

Identification of gap in the literature:
How does innovation relate to interoperability?
Application of BNML to case study evidence to prove
that interoperability is an antecedent to innovation

Figure 1. A summary of the PhD research project involving a total of six original papers

Following a need identified in the literature for alternative qualitative research approaches we wrote paper I, which describes our novel qualitative research method which we created and used in the PhD research project (in reality the Business Narrative Modelling Language, or BNML for short, has continued to evolve over the past year, however the foundation remains the same as can be found in paper I). Having described our novel research methodology we then identified another gap in the literature and applied BNML to the resolution of this research problem (papers IV, V and VI): "One of the reasons why we tend to like interoperability is that we believe it leads to innovation... [However] the relationship between interoperability and innovation, while it likely exists in most cases, is extremely hard to prove" (Gasser and Palfrey, 2007, p.ii). BNML was instrumental in proving that interoperability is an antecedent to innovation. Researcher bias was overcome by using triangulation, or multiple sources of evidence, as prescribed by Yin (2003) and Ghauri and Gronhaug (2005) and so important to case studies, more so than for surveys (Yin, 2003) – for example, field observations during company visits, the keeping of a diary, interviews with a number of organizational actors who all shared similar accounts, articles published in the media, and corporate videos and other literature made public – "all triangulating on the same set of research questions" (Yin, 2003, p.99). Before doing this we wrote papers II and III, part of the literature review. Paper II is a discussion about innovation. Paper III discusses another visual tool – the Business Model Canvas – which we favoured and which was subsequently incorporated into BNML. Finally, the literature review was also an ongoing effort throughout the research project and was performed as the data collection and analysis progressed. This is a method defended by Grounded Theorists (Corbin and Strauss, 2008) and is evident in papers IV, V and VI where the literature review is presented alongside empirical evidence gathered to provide an answer to the research question. So, in particular, papers IV and V are discussions of how innovation relates to interoperability. Paper VI continues this discussion while summarizing the global research approach and findings. After the inclusion of paper VI in this PhD thesis we felt that we had reached a point of saturation, much as Corbin and Strauss (2008, p.149) describe: "A researcher knows when sufficient sampling has occurred when the major categories show depth and variation in terms of their development".

Certain topics deemed of interest and relevant to the answering of the research question were also discussed in this PhD research initiative – topics such as leadership in general (paper IV and more in-depth in paper V), servant leadership in particular (paper V), ICT (papers IV, V and VI) and organizational culture (papers IV, V and VI). For example, leadership has a significant influence on the interoperability of organizations and servant leadership in particular, where leaders are inspired to serve (Dierendonck and Patterson, 2010b), promotes a favourable "fear-free" environment for communication to occur, thus being seen to promote innovation, as our research results show. Besides the Infosistema case study (paper V) we also prove this further with the aid of two in-depth qualitative surveys (again in paper V). Combining a number of research methods, such as BNML, case studies, surveys and Grounded Theory, as we have done in this PhD research project, is seen to lead to richer findings (Langley, 1999; Yin, 2003), indeed "multiple strategies are often advisable" (Langley, 1999, p.691). The use of multiple strategies led in fact to the discovery that our case studies did indeed utilize different interoperability types – the more types used, the more innovative they were (paper VI).

Annex A contains an article which we co-authored and was published in the *Journal of Business Ethics* (Gonçalves et al., 2012) and which uses our novel BNML in its analysis (a section done by the PhD candidate). Annex B has a list of references (with abstracts) of other publications related to this doctoral thesis and not published herein.

Facilitating qualitative research in business studies - Using the business narrative to model value creation

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Paper I (published)

Theme: PhD research methodology and some empirical work

Contribution of the paper to the research topic:

This article is a conceptual paper and is the result of previous research and publications (Oliveira and Ferreira, 2010a, b, c) concerning the innovative methodology BNML, refined herein. BNML was used in the PhD research to prove that a relationship between interoperability and innovation exists, the former leading to the latter. We first discuss the background of BNML – based on value network analysis, business narratives, game patterns and the enterprise ontology – and then move on to discussing some of the problems with qualitative research, shortcomings which BNML seeks to overcome. Our primary research question is presented: Can we contribute to qualitative research by supplying a modelling framework which greatly simplifies the qualitative analysis process, while providing at the same time for a more consistent approach and enabling comparison across cases? Empirical research we carried out is used to support various BNML representations in this article (figures 1, 2 and 3, which are a part of the BNML process), seen to be a rich communication experience. There is a "difference between the *theoretical knowledge* of the researchers [derived from thinking] and the *craft knowledge* of the practitioner [derived from their experience of doing]" (Scapens, 2008, p.918) and the two need to be brought together. "Ideas and knowledge... need to be communicated to practitioners in ways that draw out the practical implications of the research" (Scapens, 2008, p.918) and our Business Narrative Modelling Language (BNML) seeks to fulfill our desire to contribute to both theoretical and craft knowledge. Indeed BNML seeks to illustrate certain theoretical concepts in a way that practitioners will find appealing and intuitive. Significantly, BNML intends to make qualitative research more popular, improving the usability and standardization of this research method.

Full Length Research Paper

Facilitating qualitative research in business studies: Using the business narrative to model value creation

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This is a conceptual paper supported by empirical research giving details of a new Business Narrative Modelling Language (BNML). The need for BNML arose given a growing dissatisfaction with qualitative research approaches and also due to the need to bring entrepreneurs, especially those with little training in management theory, closer to the academic (as well as practitioner) discussion of innovation and strategy for value creation. We aim primarily for an improved communication process of events which can be described using the narrative, in the discussion of the value creation process. Our findings, illustrated through a case study, should be of interest to both researchers and practitioners alike.

Key words: Empirical research, qualitative research approaches, dissatisfaction, entrepreneurs, improved communication, Business Narrative Modelling Language (BNML).

INTRODUCTION

Good quality research must, according to Scapens (2008): be firmly grounded in theoretical understandings; seek to extend existing theoretical knowledge; and raise practical implications. This is precisely what we seek to do with this article as we have studied value network theory, the business narrative, game patterns and ontologies on which we base our contribution of a novel business narrative modelling language (BNML) which facilitates qualitative research (necessary to reveal a deep understanding of organizations) and additionally provides a means to easily communicate strategic change towards superior value creation.

According to Barton (2000), there is more than one path open to researchers in the social sciences, either a qualitative or a quantitative approach, so tensions will always exist. A barrier to the widespread use of qualitative research is that it is inherently subjective (Charnery,

2004). This has led to a war zone where quantitative researchers (Barton, 2000) maintain that they are able to produce much more objective results in a well-designed quantitative study (Koerber and McMichael, 2008). The main objective of the article is primarily to provide a novel modelling framework for business narratives to reduce the time necessary to perform qualitative research analyses, while increasing at the same time the consistency across qualitative case studies. This consistency is to be achieved by introducing reusable modelling constructs to be applied across different case studies, as long as they share the same domain ontology. By providing a modelling language that promotes consistency across cases, we aim at responding to a call made by researchers for the "need to develop frameworks for qualitative research that allows the kind of public scrutiny that is available to quantitative researchers" (Koerber and McMichael, 2008, p.470).

Research, as mentioned above, is primarily concerned with the creation of knowledge and in the business domain organizational knowledge may result in the gaining of a "competitive edge" (Alipour et al., 2010).

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Thus individuals and organizations alike would do well to improve on their "ability to create knowledge" (Alipour et al., 2010) by making it a main goal of theirs. Knowledge "must be carved out of the continuous web of ongoing reality" (Rose and Peterson, 1965) and for some regions, especially those battling with illiteracy, for example sub-Saharan Africa (Oloruntegbe et al., 2010), a novel application of scientific methodologies, namely those dealing with knowledge creation, may well be an "answer to human problems" (Oloruntegbe et al., 2010). Our conviction is that by using our business narrative modelling language, proposed herein, the aforementioned objectives may be more easily achieved.

In sum, this article is addressed to academics who undertake qualitative research and practitioners who have a need to rapidly analyse companies using a qualitative in-depth methodology. We wish to make qualitative research more attractive by making it easier to perform and more consistent and objective in its results, through using our business narrative modelling language.

THE BUSINESS NARRATIVE MODELLING LANGUAGE: BACKGROUND

Value networks

Verna Allee's research on value networks as fluid structures where organizations are seen to involve complex dynamic exchanges (Allee, 1997, 2000a, 2002a, 2008) constitutes a major part of BNML. One of Allee's main contributions has to do with how value is created (Allee, 2000a), namely via three currencies of value:(1) Goods, services and revenue (involving contracts, invoices and payment);(2) Knowledge (for example strategic information, technical know-how as well as collaborative design knowledge); and(3) Intangible benefits (including a sense of community and customer loyalty and other such value not normally appearing in financial measurements) (Allee, 2000a); where knowledge and intangible value exchange are seen to be of equal importance to revenue-generating exchanges, constituting the basis for organizational interaction and the foundation of successful business models (Allee, 2008; Alam et al., 2010a). These three currencies of value, which lead to value creation in the enterprise, are evident in our BNML, in the form of deliverables (tangible or intangible) which are exchanged and in the form of assets (such as Capital and information and communi-cation technologies - ICT), which are used or built up. What we add to Allee's modelling has to do with the dynamics of what goes on in organizations, which is now given additional emphasis, aided by a novel timeline and tracing of events which occur over time. Allee tells a story

about the organization, we in creating the BNML supply a detailed structure for the narrative inspired by patterns and with an ontology to supply added detail, as we shall see below.

Business narratives

The authoring of narratives (Czarniawska, 1999; Brown and Currie, 2003; Denning, 2004; Brown, 2006; Landrum, 2008; Chang and Aaker, 2009) is central to how individuals and groups "make sense of events in their working lives" and is a means "to define their work identities" (Brown and Currie, 2003, p.1). The narrative is increasingly seen as an appropriate path along which one may interpret and understand organizations (Czarniawska, 1999; Brown and Currie, 2003; Brown, 2006; Landrum, 2008) despite that in some quarters "narratives and storytelling have... been treated as unscientific and been given little attention" (Flory and Iglesias, 2010, p.113). It is our conviction that narratives are an important part of the work done by communication theorists (Brown and Currie, 2003), our objective herein, and so narratives and storytelling are to be a focus of BNML. The practical importance of "the effectiveness of the spoken word" (Nichols and Stevens, 1999, p.1) must be recognized for effective communication to take place. The increased interest in stories and the narrative is precisely that "stories can trigger change" (Brown et al., 2009) and are thus an indispensable tool at the disposal of leaders, researchers and management consultants. As we shall see below, the methodology which captures organizational narratives is qualitative in nature which thus justifies our subsequent interest in qualitative tools for constructing knowledge.

Game patterns and the enterprise ontology

The proposed BNML uses game patterns (Bjork et al., 2003; Bjork and Holopainen, 2005) which are re-inter-preted to produce business narratives. Thus the names for the narrative patterns were selected from the game pattern work developed by Bjork and Holopainen (2005). This option was taken because game patterns represent "meanings" shared by a wide audience that is familiar with both traditional and video games. The game pattern collection includes patterns for resource management; for information, communication and presentation; for actions and events; for goals; as well as patterns for social inter-action (Bjork and Holopainen, 2005). This means that patterns no longer have to be searched for as they already exist.

The instantiation of those game patterns (re-interpreted to produce narrative patterns) in the enterprise domain is

achieved through the usage of the enterprise ontology, proposed by Uschold et al. (1998). This ontology especially suits our need. It provides the means for the business narrative pattern parameterisation and leaves no room for misinterpretation. Combinations of Uschold et al.'s (1998) enterprise ontology terms are added to instantiate the pattern behaviour.

PROBLEMS WITH QUALITATIVE RESEARCH

Qualitative research - A lack of objectivity, rigour, trusworthiness and transparency

Mason (2002) comments that qualitative research is seen to be inferior to quantitative research. Yin (2003) also warns that a stereotype exists against case studies in particular namely that they lack objectivity and rigor. Carson et al. (2001) for example relate the trustworthyness of qualitative research to credibility, dependability and conformability and the trustworthiness of qualitative research is indeed a subject of analysis by the literature.

Ghauri and Gronhaug (2005) advocate the use of triangulation that is the use of multiple data sources whereby material from different interviewees, newspaper cuttings, documents and observations can all contribute to our judgment of whether the data we have is trustworthy. Carson et al. (2001) encouraged the keeping of memos of our actions and thoughts during our research study. While agreeing with the above we also believe that greater transparency is needed and is seen to be essential if qualitative research is to gain more advocates (Alam and Hoque, 2010).

Qualitative research - The case for ease (or difficulty) of use

Empirical inquiries that investigate contemporary phenomena within the real-life context in which they really occur are thus seen to be much more difficult than just doing statistics utilizing software from high up in an "ivory tower" (Scapens and Roberts, 1993). Usability can be defined as the "extent to which a product can be used by specified users to achieve specified goals with effecttiveness, efficiency and satisfaction in a specified context of use" (ISO 9241-171, p.7). A related term is that of accessibility, defined as the "usability of a product, service, environment or facility by people with the widest range of capabilities" (ISO 9241-171, p.2). In this context, we defined the premise whereby *qualitative research is not "user-friendly"* (in terms of its usability and accessibility) and that this is a reason behind it's lagging in popularity vis-à-vis quantitative methods. This view is shared by Guba and Lincoln (1994, p.106) who state that

mathematical (quantitative) propositions are "propositions that can be easily converted into precise mathematical formulas expressing functional relationships" and that these have been the main emphasis in science. Qualitative research is actually more difficult and especially more time-consuming than quantitative research which, after one learns the methodology, is actually comparatively easy, even though one may be led to think otherwise. Elharidy et al. (2008, p.144) gave an example of qualitative research and state that in particular "longitudinal studies are important for [qualitative research such as] grounded theory (Glaser and Strauss, 1967; Corbin and Strauss, 2008) so that the researcher can follow the unfolding events over a relatively long period of time and thereby gain an understanding of the phenomena being studied". Carson et al. (2001) similarly define qualitative research such as grounded theory as a complex and time-consuming technique. However, these authors concede that these disadvantages are outweighed by the closeness to reality, the depth of understanding, and the new insights which may result.

SELLING LEVEL OF QUALITATIVE RESEARCH

Siggelkow (2007) states that purely descriptive research is hard to sell. Case studies in particular, as they "do not have recourse to the canonical statement "results are significant at $p < 0.05$" that helps assuage readers' scepticism of empirical papers" means that "researchers using case research often feel they are fighting an uphill battle to persuade their readers" (Siggelkow, 2007, p.20) despite the view that "papers that build theory from cases are often regarded as the most interesting research... with impact disproportionate to their numbers" (Eisenhardt and Graebner, 2007, p.25).

Qualitative research – more art than science

Corbin and Strauss (2008, p.297) state that "quality in qualitative research is something that we recognize when we see it", suggesting that perhaps qualitative research is more of an art than a science.

SOLVING SHORTCOMINGS OF THE QUALITATIVE RESEARCH METHOD

Qualitative research - Moving ahead using BNML - A standardization process

Guba and Lincoln (1994, p.105) state that there is a "growing dissatisfaction with the patent overemphasis on growing dissatisfaction with the patent overemphasis on quantitative methods". We are in agreement with these
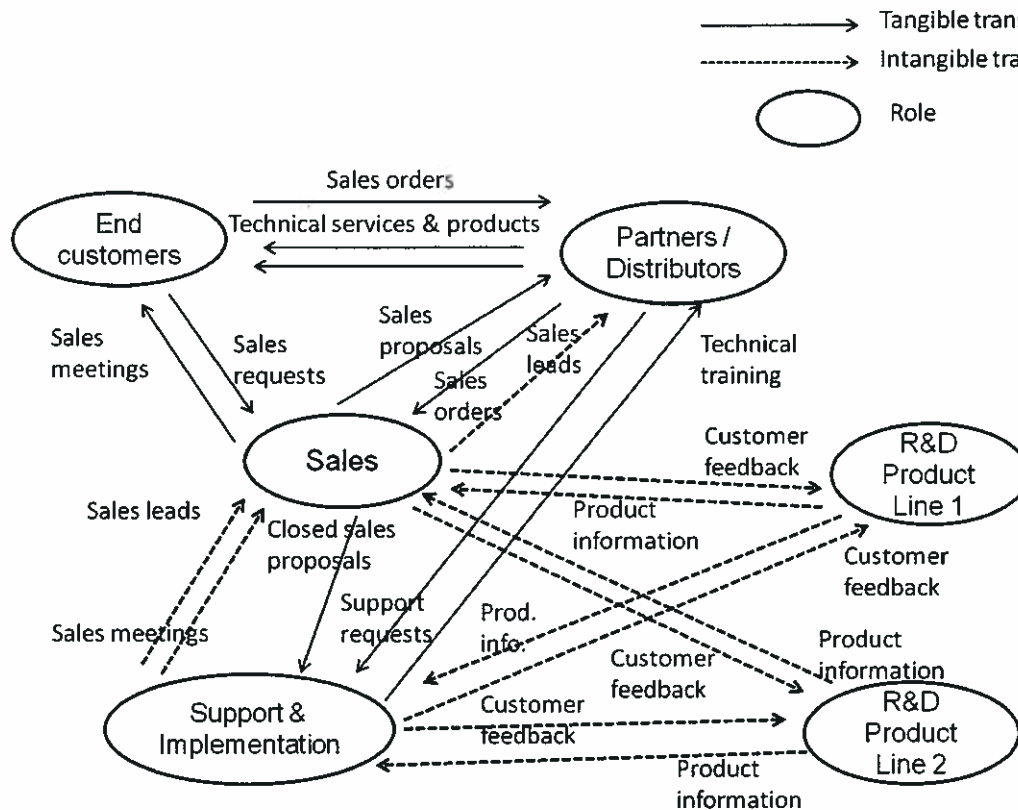
Figure 1. A value network for a software manufacturer. The BNML language has been used to support qualitative research at a software manufacturer. Founded in 2000, this firm has secured sustained growth despite the global crisis and increasing competition in the marketplace. Annual sales in 2010 are expected to be 5 million Euros, to be achieved with 48 full time employees, motivated by a profit-sharing scheme and a visionary leader who is active both in sales as well as in product development (innovation).

on quantitative methods". We are in agreement with these authors in so far as efforts are necessary "to build a case for a renewed interest in qualitative approaches" (Guba and Lincoln, 1994, p.105). It is this objectivity and rigour which we have spoken of and which is seen to be lacking which we seek to provide with our modelling tool. Our BNML also fosters transparency and we intend furthermore with our study to illustrate that part of the qualitative research process can indeed be systematized, without making the research "mechanistic", a risk which Elharidy et al. (2008) warn against.

We, in writing this paper aim to provide for an easier application of the qualitative research methodology by using our business narrative modelling language. We propose an approach that aims at making the qualitative research process (for example empirical case studies) easier by applying our business narrative modelling language (BNML) which makes use of existing narrative

patterns (Bjork and Holopainen, 2005) and explicit combinations of the enterprise ontology (Uschold et al., 1998) terms.

OUR PRIMARY RESEARCH QUESTION

Thus, the primary research question we have addressed is as follows: Can we contribute to qualitative research by supplying a modelling framework which greatly simplifies the qualitative analysis process, while providing at the same time for a more consistent approach and enabling comparison across cases?

THE BUILDING BLOCK OF THE BUSINESS NARRATIVE MODELLING LANGUAGE (BNML)

The BNML is supported by one basic building block,

derived from a standard narrative structure that comprises two main elements, namely a story and a plot (InPoint Language of Film, 2010). These elements are defined along certain dimensions, which can be communicated using questions. These dimensions are the story and the plot. For the story we describe: "Who?" relating to the character that provides or receives the deliverable and uses/builds enterprise assets; "What?" relates to a deliverable – tangible or intangible; and "Where?" to the location where the story unfolds. For the plot we describe "How?" the story unfolds, as a pattern sequence, and "When?" along a timeline. The "How?" is modelled as narrative patterns built as a combination of Uschold's (1998) enterprise ontology terms. The graphical representation of the business narrative develops therefore along two axes: (1) The storyline that unfolds along the timeline; here we can see the exchange of tangible and intangible deliverables, the plus sign indicating who is on the receiving end; (2) the narrative pattern sequence with the pattern name and the ontology terms – Some parameterization may be added in the figure to improve comprehension (Alam et al., 2010b).

Figure 1 shows the outcome of a value network analysis (Allee, 2000a, 2000b, 2002a, 2002b, 2008) we performed at a software manufacturer. The information can easily be portrayed with BNML (Figure 2) which adds a timeline and a sequencing of events not evident in Figure 1. Figure 3 illustrates further the social interactions that take place. The methodology for gathering the enterprise business narrative and to build the BNML diagram and supporting configuration unfolds as follows: (1) We start the process with a recorded interview, allowing for free speech by an enterprise member explaining his/her routine and perception of how things unfold within the enterprise; (2) A joint elaboration of the Value Network (Figure 1) follows, which is the first formalized approach to what happens in the enterprise; (3) The third step is, again, an interactive process between the consultant and the enterprise member that involves the identification of transaction blocks to be materialized as a combination of enterprise ontology items and asset usage (e.g.: ICT, intellectual property, etc.) and creation (e.g.; brand, customer loyalty); this is the point where the narrative pattern is selected to best fit the ontology terms and selected to best suit those transaction blocks; (4) The next step involves the definition of time horizons for specific patterns, enabling the adequate analysis of causality in the storyline (e.g.: sales happen, hopefully, every day); this could further lead to the construction of several related narrative diagrams (e.g. one or more per organizational unit in the enterprise); (5) Finally, the consultant reviews the recorded interview and brings in further detail in order to support a future in-depth analysis of the business narrative.

AN EVALUATION OF THE STUDY RESULTS

A rich communication experience

BNML and the advantage of using standard patterns

Figures 2 and 3 can be rapidly developed in the same afternoon as the main data collection activity by a research team. An advantage of using the BNML is its rapid application while ensuring the adequate detail for an in-depth analysis of the business narrative. The whole process introduces a very significant reduction in the time needed for building the business narrative, namely in the typical lengthy transcription time and pattern identification. The BNML diagrams developed in our case study, much to the surprise of the entrepreneur involved, were swiftly developed and subsequently refined with the entrepreneur (who actively and eagerly participated in the discussion). A graphical representation was of utmost importance for effective communication to occur. From the outset, BNML allowed the discussion of business strategy and enabled a very straightforward communication and clear understanding between the researchers and the company CEO (Alam et al., 2010c).

We have found (following several case studies which we have undertaken) that, as concerns the management of strategic change and especially in small enterprises, the most important of all is to be able to change the mind-set of the entrepreneur, as *change is of a personal nature* (Eriksen, 2008). To achieve this, at one entrepreneurial endeavour in particular, this involved moving from desperation to the possession of a positive vision for the future – BNML helped provide a new vision in a down-to-earth way. The potentially negative attitude towards the use of narratives, stories and pictorial representations needs to be put aside and it is necessary to devise new methods first to create knowledge and then to inspire change at all levels in organizations.

Conclusion

We thus see that there is a need to make qualitative research more popular, and in line with our exposition this will entail improving the usability and standardization of qualitative research methods, which we believe we achieve with our novel BNML. Greater credibility will result from more consistent approaches to interpreting and communicating qualitative information and research results.

Our novel BNML enables the modelling of the value
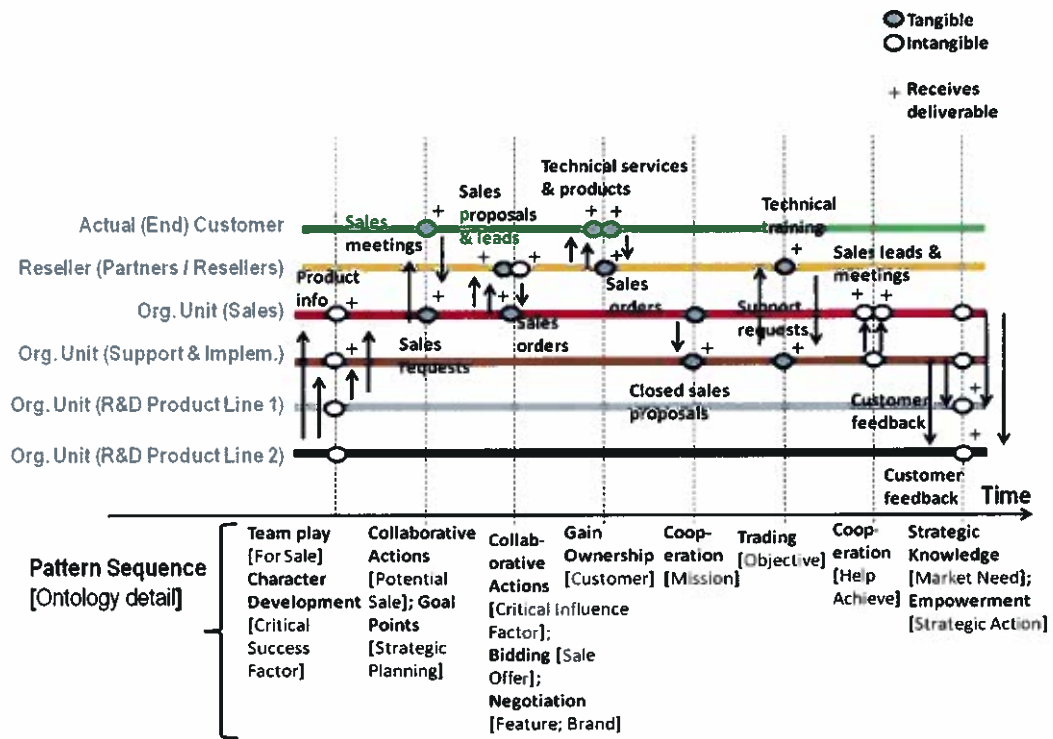
Figure 2. A representation of deliverables exchanged over time in a software manufacturer value network. We can see how six characters or actors: (1). Actual (End) Customer; (2). Reseller (Partners/Resellers); (3). Organizational Unit (Sales); (4). Organizational unit (Support and implementation); (5). Organizational unit (R&D product line 1); (6). Organizational Unit (R&D product line 2) named using terms taken from the enterprise ontology of Uschold et al. (1998) – interact over time (a timeline not present, for example, in Allee's (2000a, b; 2002a,b; 2008) representations). The top half of the figure represents the exchange of deliverables (tangible and intangible) between actors. In the bottom half of the figure we can see a Pattern Sequence (how the story is moved along – in this case initiated by Team Play and Character Development and then followed by Collaborative Actions and Goal Points, the figure shows) instantiated by Ontology terms (Uschold et al., 1998) for each interaction. An exemplification of the intangible deliverable exchanges (non-contractual - represented by the white oval shapes): The sales department; Support and Implementation are aided by the R&D departments which pass on product details to get them "up to speed" with products, thus enabling them to perform in the market. The sales department often passes on good sales leads of End Customers (another intangible deliverable) to Partners who respond by giving more business to the software manufacturer. As Support and Implementation spends a lot of time at customer sites they are able to give very good leads to the Sales Department and to also arrange sales meetings for them (both intangible deliverables). Finally, Sales and Support and Implementation both give customer feedback to the R&D departments – intangible value subsequently converted into innovation by R&D in the form of new product functionality.

creation business narrative, with an additional benefit of facilitating strategic change efforts as BNML will facilitate strategic change communication. BNML establishes a link between patterns of narrative structures and narrative plots and the value creation process (in the storyline), recognizable by all of the parties involved. As BNML supplies a framework at a level high enough to still permit a "personalization" of the analysis and which can be used across studies irrespective of the industry and focus, we introduce a novel modelling tool for refining storyline

interaction in the organizational environment. In effect we are reducing the complexity of qualitative research yet further as our modelling tool is also pictorial and so simple to grasp, even by a "subsistence, or necessity–based" (Baptista et al., 2008) entrepreneur, as we have found during our research efforts. The illustrations further high-lighted the usage and realization of both tangible and intangible assets, thus enabling the traceability between strategic objective, action and asset usage and realization in a language which we believe is "straightforward
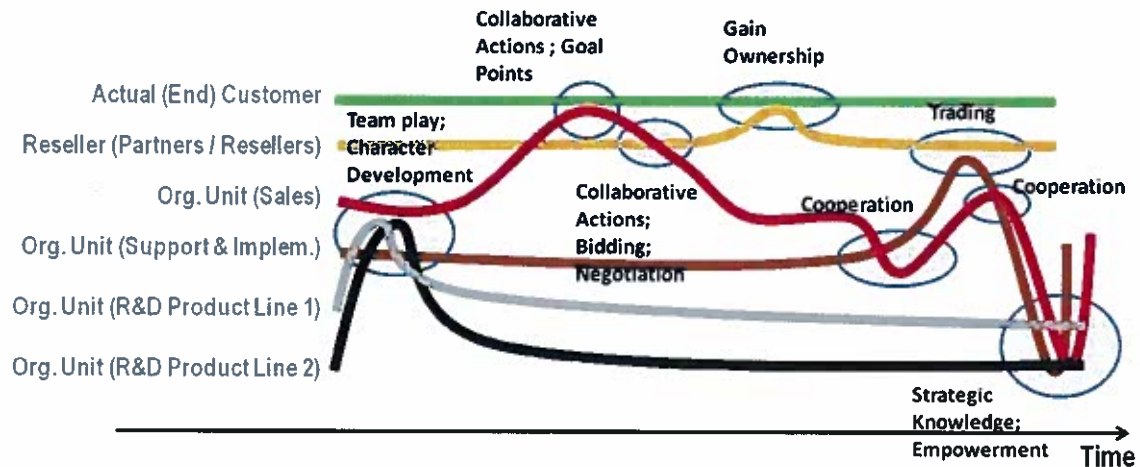
Figure 3. Storylines and pattern sequence over time in a software manufacturer value network. The wavy lines represent the six character storylines and how they progress in a dynamic fashion, coming together and then moving apart as the organizational narrative progresses, giving life in turn to the narratives of the respective characters. The clouds represent major social interaction (events named with game pattern terms taken from Figure 2) occurring between actors - this representation completes the previous representations of the value network.

and logical" (Kalula, 2010) as indeed should be used by research efforts involving the collection, analysis and interpretation of data (Kalula, 2010).

As Malone et al. (2003, pp.13-14) state, we must "be able to imagine alternative ways of accomplishing the same things". We thus hope that BNML will achieve a small step towards the increased usage of qualitative research in business studies (and its subsequent use, for example, in change initiatives).

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Producing innovation: Comments on Lee and Yu (2010)

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Paper II (published)

Theme: Theoretical background based also on some empirical work

Contribution of the paper to the research topic:

This article came after other enquiries into the innovation process – such as Oliveira et al. (2007, 2008, 2009). Oliveira et al. (2009), for example, is a publication in a non-scientific national magazine (*Executive Digest*, specialized in management) about the Lead User Method and aimed at professionals / "a wider audience", as Scapens (2008) suggests researchers should also strive for as "we need to extend our publications beyond papers in the research journals" (Scapens, 2008, p.917) as "it is quite obvious that practitioners do not read research papers" (Scapens, 2008, p.918). The article you are about to read is a part of the literature review of the PhD project, focusing in particular on innovation, and is a commentary of Lee and Yu (2010). Our commentary focuses on relationships, cooperation and trust. Cooperation, in particular, is a form of interoperability (Li et al., 2008), which, as we shall see throughout this PhD thesis, is central to the doctoral research topic. Cooperation is about "obtaining mutual benefits by sharing or partitioning work" (Li et al., 2008, p.20). Team work can be crucial to innovativeness and new product development, as we argue in our article. Certain cultural aspects are discussed, such as PDI (power distance) and the openness to be able to disagree with superiors without incurring negative consequences. A number of cultural traits may hinder or favour innovation performance and Lee and Yu (2010) discuss the ideal environment in which to produce innovation. Figure 1 in our article was produced with Graphviz software (a tool used for BNML representations) and communicates key words and patterns identified during our qualitative research at a software manufacturer. Even at this earlier stage of our research, forms of interoperability – such as cooperation and collaboration – are shown to lead to innovation – new concept development, new product development, and innovation commercialization (figure 1). Participative decision-making is favoured in lower power distance countries such as the USA and the Netherlands, where intimate relationships and cohesiveness are more likely to occur at the organizational level – which will lead in turn to increased innovation output. Our commentary defends how managers would do well to adopt such an approach, findings that our research also supports.

Commentary

Producing innovation: Comments on Lee and Yu (2010)

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There are many examples in the literature of articles which, due to their inherent message, have merited further attention from peers, in the form of article reviews or commentaries. One such example in "marketing" is Morgan and Hunt (1994), a highly cited paper. Morgan and Hunt's (1994) "The commitment-trust theory of relationship marketing" was actually ranked at number one by ISI Essential Science Indicators[SM] in the field of Economics and Business, having been cited approximately four hundred times in a decade (in-cites, 2003). Morgan and Hunt (1994) is similar to Lee and Yu (2010) in so far as both articles are about relationships and both articles are about cooperation and trust. The purpose of the article being reviewed (Lee and Yu, 2010), a survey by questionnaire with 182 valid responses, is to analyze "how different relationship styles of employees in the hi-tech industry influence innovation performance" (Lee and Yu, 2010: 1703) and indeed its conclusions are that "the relationship style of an organization has a significant positive effect on innovation performance" (Lee and Yu, 2010: 1707). But what is innovation performance and why is it so important to organizations? The economists' point of view is that innovation has to do with a new development and how it is (successfully) diffused (Knight, 1967). Certainly new products and services "can transform industries and companies" (Kotler and Keller, 2009: 605) and in so doing can change lives, both of those introducing the innovation (Schumpeter, 1950) as well as of those adopting the new approaches. Kotler and Keller (2009: 605) state simply that "new-product development shapes the company's future." Adis and Jublee (2010: 91) stated further that "new product success is a crucial business consideration for both small and large firms".

As concerns "marketing", innovativeness and team work are crucial as "marketers are playing a key role in the development of new products by identifying and evaluating new-product ideas and working with R&D and other areas in every stage of development" (Kotler and Keller, 2009: 606).

The article being reviewed (Lee and Yu, 2010) comes at a crucial time as we are experiencing a global financial crisis with "no industry untouched by its effects" (Sinha and Ahmad, 2009: 184) and which, accordingly, many companies are having difficulty in surpassing. Examples at the time of writing are companies in Greece, Portugal and Spain. In these countries in particular, experiencing difficulty, a positive rebound from the crisis is needed in order to avoid deep-felt long-term negative effects on the European Union and innovation ("the adoption of new approaches for an organization and suitable environment" (Lee and Yu, 2010: 1704) and "the manipulation of new knowledge to provide consumers with new products and services they need" (Afuah, 1998) as quoted by Lee and Yu, 2010: 1705)) is seen to be one avenue out of the crisis as innovation "may consequently create various economic performances" (Mansury and Love, 2008, as quoted by Lee and Yu, 2010: 1705). In countries such as Greece, Portugal and Spain power distance (or PDI, "the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally" (Hofstede, 2001: 98)) is high (House et al., 2004: 539) and so employees "are afraid to express disagreement with their managers and tend to prefer managers with autocratic decision-making styles" (Çakar, 2006: 11; Oliveira et al., 2008). This is far from the ideal environment in which to produce innovation, as suggested by Lee and Yu, and so managers in these cultures will do well to adapt their approach following Lee and Yu's findings. It is possible for companies to adapt their organizational practices, "the process by which certain means are achieved" (Adis and

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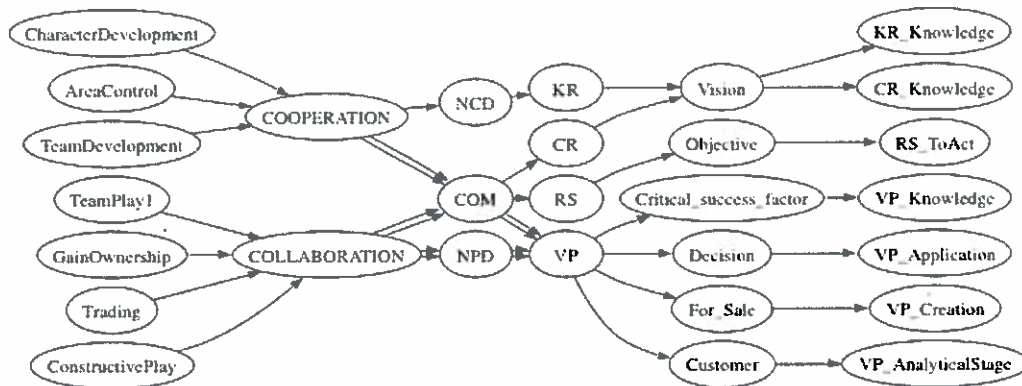
Figure 1. Key words and patterns identified during qualitative research at a software manufacturer.

Jublee, 2010: 91) to go against national cultures as "a nation is not an organization, and the two types of culture are of different kinds" (Hofstede, 2001: 393).

In contemporary organizations "social understandings" (Wilkins and Ouchi, 1983: 479) are not "immutable" (Wilkins and Ouchi, 1983: 479) and may be altered if Lee and Yu's suggestions are followed. Other countries in which PDI is high include Morocco and Nigeria (which had the two highest scores for this construct in House et al.'s (2004) study), as well as Zimbabwe, Zambia and Namibia – all "Category A" countries in terms of "power distance scores" (House et al., 2004: 539) and scoring low on the latest Global Competitiveness Index (World Economic Forum, 2010). Firms in these countries thus need to pay increased attention to organizational culture, to the fostering of intimate relationships, where disagreement can occur and differing opinions are valued, in order to increase innovation output. A preference for consultation (or participative decision-making) is found in low power distance cultures such as the USA and the Netherlands (each high scorers on the aforementioned Global Competitiveness Index, ranked 4th and 8th respectively) and indeed Lee and Yu prove that "the better an employee of a hi-tech company gets along with the organization, supervisor and colleague, the higher the organization's innovation performance due to its high cohesiveness" (Lee and Yu, 2010: 1707).

In sum, implications for management practice are that the individual-group emotional connection needs to be taken into account by a company and positively influenced to ensure good innovation performance in the organization. This can be achieved, according to Lee and Yu, through organizational culture. "Organizational culture is responsible for maintaining the social structure within the organization (and), it also generates the organization's identity and characterizes it from other organizations" (Kwantes et al., 2007: 98), including "the

accumulated shared learning of a given group, covering behavioural, emotional, and cognitive elements of the group members' total psychological functioning" (Schein, 1992: 10) and "company-member interaction modes" (Lee and Yu, 2010: 1707). The importance of Lee and Yu's findings and suggestions cannot be underestimated, suggestions along the lines that improving "the intimacy among organizational members can increase the level of innovation performance" (Lee and Yu, 2010: 1707), especially the relationships between an employee and the organization, an employee and his or her supervisor and an employee and his or her colleague. Management tools which can be used involve recruiting talents "with values close to the company" (Lee and Yu, 2010: 1707) but these authors also suggest having unhindered communication channels to build up mutual trust, bonuses linked to performance, and developing conflict-removing measures. Furthermore, the implementtation of a mentoring system should be adopted (such as that used by global management consultancy firm Accenture), as should a participative decision-making process and praise in public to increase employee fulfillment. Teamwork opportunities should also be encouraged.

Lee and Yu indicate other studies which support their findings on relationship style and innovation performance, studies such as those by Dickinson and McIntyre (1997) and Harvey and Speier (2000). We have found similar results through our qualitative research effort at a software manufacturer, in Portugal. Quantitative studies can be refined with qualitative research, which can supply more detail concerning the way things happen. After listening to our interview audio recordings, we applied Graphviz software to the key words and patterns we identified and Figure 1 is a result of this analysis. Figure 1 tells a story "of how the themes are related to one another" (Bernard, 2006: 451). As we can see,

cooperation and collaboration, which are types of relationships, are also major factors leading to the innovation phases NCD (new concept development), COM (innovation commercialization) and NPD (new product development). The process starts with patterns such as character development, team development and constructive play, and has results including knowledge of customer relationships (CR) and creation related to the value proposition (VP) of the firm.

SoftwareOne, a fictitious name given to our case study, which prefers to remain anonymous, is a very good case of collaboration and co-creation, which are "new platforms for marketing and innovation" (Bhalla, 2011). Verhoef and Leeflang (2009: 14) are concerned with "the decreasing influence of the marketing department within firms". According to Verhoef and Leeflang the innovativeness of the marketing department in particular represents a major driver of its influence and so this department's "pattern of beliefs, values and learned ways of coping with experience that have developed during the course of an organization's history" (Brown, 1995: 32) will be especially important for an organization to thrive. The best performers, according to Deshpande et al. (1993: 32) "have a market culture and are both highly customer oriented and innovative". Companies will do well to follow Lee and Yu's suggestions towards achieving increased innovation performance, especially first and foremost in the selection and recruitment of employees who share the desired values, as Lee and Yu suggest, but also by implementing other tools as their article's important message conveys.

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Book review – Business Model Generation: A handbook for visionaries, game changers and challengers

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Paper III (published)

Theme: Theoretical background based also on some empirical work

Contribution of the paper to the research topic:

This article is a part of the literature review for the doctoral thesis, reviewing a book - *Business Model Generation: A Handbook for visionaries, game changers and challengers*, by Osterwalder and Pigneur (2010) – which, much as we intend to do with our BNML, uses visual representations to portray how value is created in organizations. Following this book review we decided to incorporate the material covered – the very popular Business Model Canvas – in our BNML (the top "lane" of our BNML storyline views, evident in papers IV, V and VI of this doctoral thesis). The book is actually an example of how all five of the enterprise interoperability interaction types – communication, coordination, cooperation, collaboration, and channel (Li et al., 2008) can lead to innovative output as the book was co-created by 470 practitioners from 45 countries. Following an introduction to our article, where we discuss the objectives of the five main chapters in the book we then review Osterwalder and Pigneur's work leading up to this publication. We see a parallel between the business model of a company – seen to be "a conceptual view of a particular aspect of a specific company" (Osterwalder et al., 2005, pp.5-6) and the unstructured workflow participant narratives, pattern sequence and building and usage of assets shown in figure 1 of our article. With BNML we wish to portray "complex social phenomena" (Yin, 2003, p.2) from the inside out. In figure 2 of our article we constructed a Business Model Ontology Canvas representation applied to a software company we researched for our doctoral project. The connections between the nine building blocks in figure 2 are a form of business narrative, a narrative showing how enterprises make money. Much as Scapens (2008) we intend to make interpretive research in management "more relevant". For this to be accomplished we see additional tools – such as the business model canvas and BNML – as having an important role to play.

Book Review

Business Model Generation: A handbook for visionaries, game changers and challengers

Publisher: John Wiley and Sons, Inc., Hoboken, New Jersey (2010)
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INTRODUCTION

The book entitled "Business Model Generation: A Handbook for visionaries, game changers and challengers" though written by Osterwalder and Pigneur (2010) was also co-created by 470 practitioners from 45 countries. The book is thus a good example of how a global creative collaboration effort can contribute positively to the business and management literature and subsequently to the advancement of society (Alam and Hoque, 2010; Alam et al., 2010a, b).

Consisting of five main chapters (Canvas, Patterns, Design, Strategy and Process) and two additional chapters Outlook and Afterword, "Business Model Generation" should be read by those motivated to "defy outmoded business models and design tomorrow's enterprises" (front cover). The objectives of the five main chapters in the book are as follows:

To present the Business Model Canvas – a tool which can be used to describe, analyze and design business models.
To present leading business thinkers' concepts in the form of Business Model Patterns.
To present techniques to aid readers design business models.
To show how business modeling is central to the discussion of strategy
To present a generic process, taking advantage of the material described above and which is applicable to innovative process model design.

"Business Model Generation" presents itself as a useful review of the literature (Kalula, 2010) on business models and still (in Outlook) presents topics for future exploration. Lastly, Afterword shows how the book was a co-creation effort thus enabling future authors to follow their example in producing an innovative book relevant to academics and practitioners alike, around the globe.

Before proceeding to do an in-depth review of "Business Model Generation" we shall first have a look at other publications by the authors (Osterwalder, 2004; Osterwalder and Pigneur, 2002; Osterwalder et al., 2005; and Fritscher and Pigneur, 2010) which led up to this book.

A review of Osterwalder and Pigneur's work leading up to the book "Business Model Generation"

Osterwalder, the first author of the book "Business Model Generation" we are reviewing, attained the degree of Doctor of Management Information Processing at the Universite de Lausanne – Ecole des Hautes Etudes Commerciales, in 2004, under the supervision of Pigneur (co-author), a Professor in the Information Systems Department. As a research assistant, under Professor Pigneu, Osterwalder "taught and conducted research on business models" (Osterwalder, 2004, p.1) which is where he admittedly rediscovered his interest in developing countries, initially developed during his undergraduate degree in political science. The title of the PhD thesis is "The business model ontology: A proposition in a

design science approach". Osterwalder's higher education was all undertaken at the Universite de Lausanne, a notable institution located in the most competitive nation worldwide (World Economic Forum, 2010) – Switzerland – which continues its global leadership into 2010-2011 from the 2009-2010 rankings.

Revealing himself to be concerned with social issues, Osterwalder dedicated his doctoral thesis "To all those people out there fighting poverty in the world" and we see that this general objective is a main aim of the current volume being reviewed in so far as there is a concern for the "entrepreneurial spirit", for creating value and new businesses, in sum for improvement and transformation, a search for "innovative ways of doing business to replace old, outdated ones".

Entrepreneurship (namely upstarts that challenge the "old guard") and business model innovation (Lee and Yu, 2010) are seen to be major drivers of economic growth and well-being, as Osterwalder and Pigneur state in "Business Model Generation". In order to communicate their message "Business Model Generation" is not a "typical strategy or management book", indeed we believe that this should be the objective of current and future academic efforts as other efforts to eradicate poverty from the world have failed to date, and we need to rethink development and sustainability (Oloruntegbe, 2010). "Business Model Generation" conveys "the essentials of what you need to know, quickly, simply, and in a visual format" as other work has also sought to accomplish (Oliveira and Ferreira, 2010a, b, c, 2011; Alam et al., 2010b).

Previous publications by Osterwalder and Pigneur include an international conference participation with "An e-business model ontology for modeling e-business" (Osterwalder and Pigneur, 2002). In this publication these authors state that business models "can help companies understand, communicate and share, change, measure, simulate and learn more" about their businesses (Osterwalder and Pigneur, 2002, p.75). Four pillars support their theory and these are product innovation (including the company's value proposition to the target customer segment), customer relationship (involving the information strategy with target customers to develop their trust and loyalty), infrastructure management (involving resources in a partner network and the performance of infrastructure and logistics issues) and financials (encompassing the revenue model and the cost model and consequently profit and loss) (Osterwalder and Pigneur, 2002). Business models are seen to bridge the gap between strategy (the positioning, objectives and goals of the company) and business processes (involving the understanding and implementation of strategic information), indeed there often exists "quite a substantial gap between these two "worlds"" (Osterwalder and Pigneur, 2002, p.77). Business models are about communication (Osterwalder and Pigneur, 2002; Oliveira and Ferreira, 2010c) and by using ontologies (Uschold et al., 1998; Osterwalder, 2004; Oliveira and Ferreira, 2010a, b, c, 2011) one can "create a shared and common understanding of the domain and facilitate communication between people and heterogeneous and widely spread application systems" (Osterwalder and Pigneur, 2002, p.78).

Another publication and involving another co-author (Tucci) of Osterwalder and Pigneur's is "Clarifying business models: Origins, present and future of the concept" (Osterwalder et al., 2005). In this paper there is again the aim to clarify concepts involved in the business model domain and especially in regard to Information Systems (IS). A survey these authors undertook of an IS community shows "a divergence of understanding among people and particularly between business-oriented and technology oriented ones" (Osterwalder et al., 2005, p.3). Sixty-two respondents of the survey produced divergent definitions of "business model". A total of 54 definitions were produced, 44 of which could be grouped into major groups under "value/customer-oriented business model definition" (25 definitions or 55%) and "activity/role-oriented business model definition (EM – enterprise models)" (19 definitions or 45%). The former is the one favoured by Osterwalder et al. (2005) and seen to be more "outward looking". Business models are seen to be "the blueprint of how a company does business" (Osterwalder et al., 2005, p.4), carrying on from previous work by Osterwalder and Pigneur (2002) in so far as business models are "the translation of strategic issues, such as strategic positioning and strategic goals into a conceptual model that explicitly states how the business functions" (Osterwalder et al., 2005, p.4), the business model thus serving as a "building plan". The business model may also be seen to be "a conceptual view of a particular aspect of a specific company" (Osterwalder et al., 2005, pp.5-6) as Oliveira and Ferreira (2010c) suggested when they refer to pattern sequences and workflow participant narratives (Figure 1).

Osterwalder et al. (2005) very relevantly performed a tracing of the management term (string) "business model" in a large number of scholarly reviewed journals (Osterwalder et al. (2005, p.6) do state that "the search included several variations of the original term ["business model"] like "e-business model", "new business model" or "Internet business model""). This query revealed a significant increase in popularity of the term "business model" – up from seven appearances in the full text of journal articles in 1990, to 66 appearances in 1997, and to 667 appearances in 2003 (Business Source Premier database of scholarly business journals).

Osterwalder et al.'s (2005) research revealed also that "business model" appeared for the first time in an academic article by Bellman et al. (1957[1]). What these researchers also discovered was that the popularity of the term not only increased but that it also increased in accordance "with the advent of the Internet in the business world and the steep rise of the NASDAQ stock market for technology-heavy companies... Oddly, the number of times the term "business model" appeared in a business journal (peer-reviewed and non-peer reviewed) follows a pattern that resembles the shape of the NASDAQ market index... [suggesting] that the topic of business models probably has a relationship with technology" (Osterwalder et al., 2005, p.7).

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[1] In the second-to-last paragraph of the "Applications to the Business World – Simulation" section.
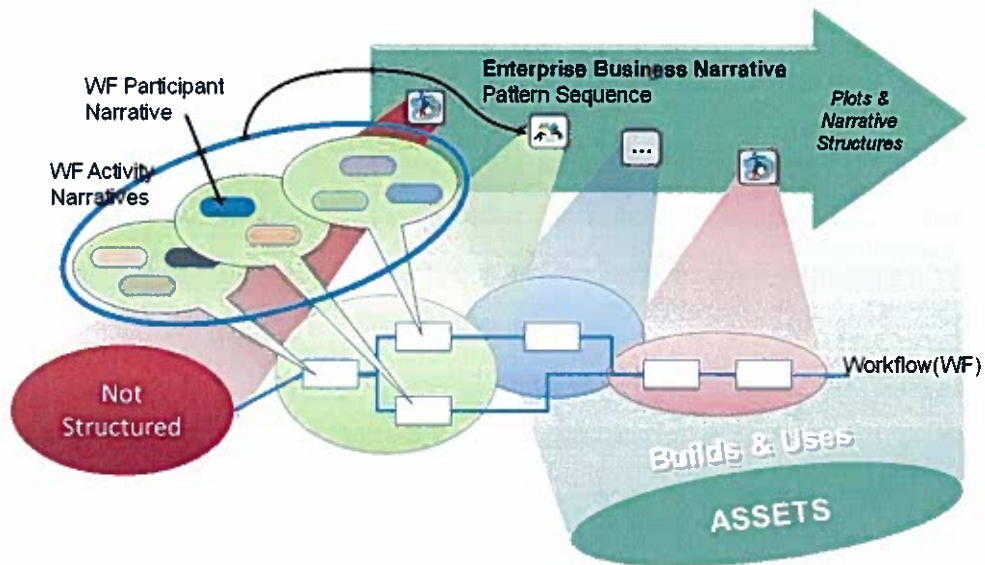
Figure 1. The Enterprise Business Narrative involving multiple Workflow (WF) Participant Narratives (Oliveira and Ferreira, 2010c).

Fritscher and Pigneur (2010) is an example of another very recent article in which we can find hints as to what is in Osterwalder and Pigneur's (2010) book "Business Model Generation". This recent article presents the Business Model Ontology Canvas (Figure 2) which builds notably upon the Business Model Ontology of Osterwalder and Pigneur (2002) mentioned earlier.
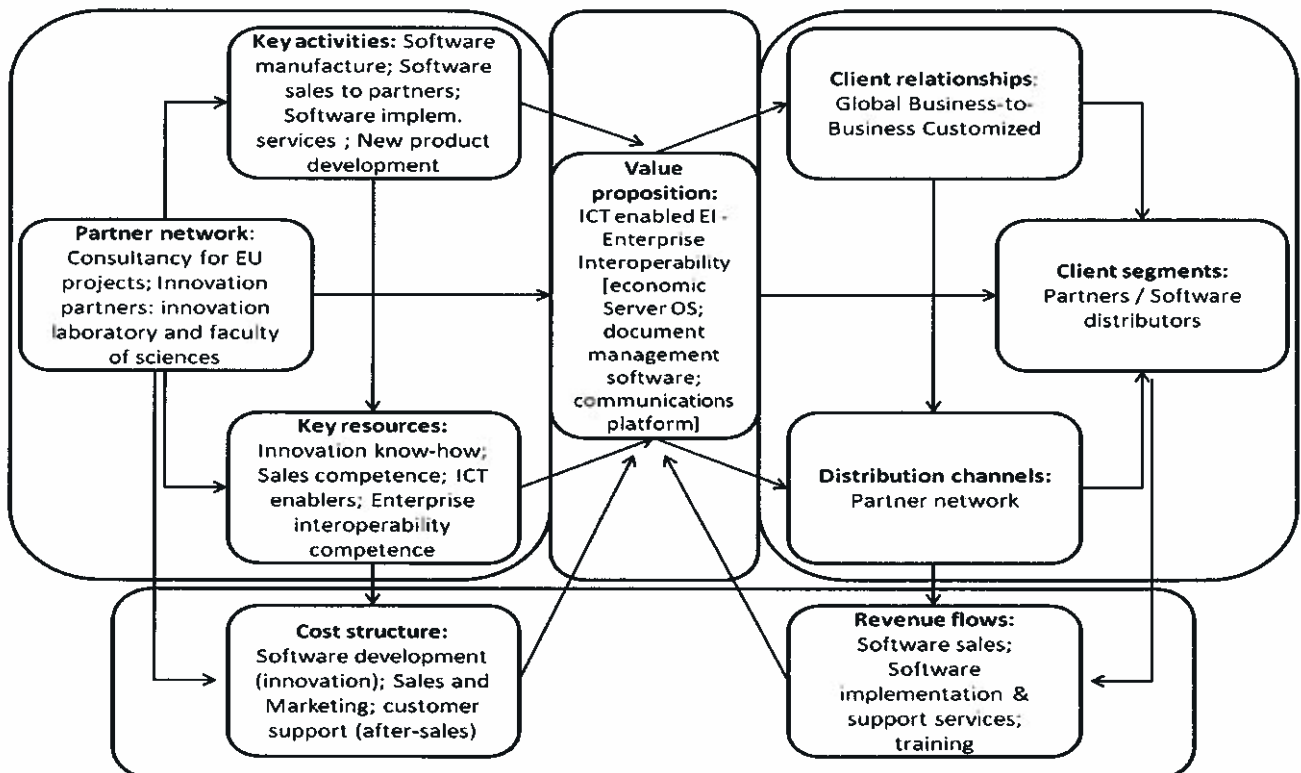
Figure 2. The Business Model Ontology Canvas (based on Fritscher and Pigneur, 2010).

Fritscher and Pigneur (2010, p.28) present a diagram and tool (made up of nine building blocks) (Figure 2) "derived from an in-depth literature review of a large number of previous conceptualizations of business models" with the objective to "help to support task modeling in engineering and process management". However, this tool is also fit to help at the strategic level (in the context of business) due to its flexibility, which makes possible "creative thinking and user-friendly interactions" (Fritscher and Pigneur, 2010, p.28). This canvas is dealt with in both narrative and visual detail in the book "Business Model Generation" (Osterwalder and Pigneur, 2010).

Figure 2 is the result of our research at a highly innovative software manufacturer located in Portugal. In order to explain the business, how it works, we resorted to the Business Model Canvas, as shown. The picture reflects, for example, that this company handles its customers as partners. This is made explicit in the model and illustrates the semantic richness of the business canvas business modelling approach. This highly effective visual representation is simpler than using pure narrative and more generalizable too (Langley, 1999).

A closer look at the book "Business Model Generation"

In the previous section we saw several scientific publications leading up to "Business Model Generation". This book adopts an approach very different to what we have seen earlier. First of all, the examples are presented pictorially. Secondly, exercises and workshop scenarios, which can be used immediately, complete the content. We thus witness, in the writing of this book, an approach not favoured by most scientific publications, scientific journals in particular. In so doing, however, the authors have managed to design a very practical book about business model innovation which is the type of book which can make a difference to practitioners (especially in developing countries) who are oftentimes estranged from academia, due to the complexity of some (if not most) of its content. The creative design, for example, is evident throughout, a task undertaken by Alan Smith (co-founder of the change agency The Movement). The authors are quick to mention however that a worldwide community of practitioners and researchers, from the business realm, also co-created this book (the online community is at www.BusinessModelGeneration.com/hub, "the place to be to exchange knowledge and experience on business model innovation" as they state in their online Welcome message[2]).

The concept of business model innovation has been around for centuries (the authors give the example of the founding of the Diners Club credit card in 1950, a business model innovation at the time; and speak also of Xerox, in 1959, when they started leasing photocopiers and introduced the per-copy payment system; but the mechanical printing device invention in the 1400s and the quest for different applications also qualifies as a business model innovation). What has changed is the scale and speed with which they now transform industry, an "extraordinary evolution" now addressed by Osterwalder and Pigneur. Apple (iPod/iTunes with online music), Skype (with very low-cost global calling rates) and the Grameen Bank (alleviating poverty) are all recent examples of innovative business models. What Osterwalder and Pigneur (2010) now offer is a way to systematize business model invention, design and implementation. The approach is one geared to practice, rather than preaching, and has depended upon the contributions of 470 community members, as mentioned earlier.

Chapter 1 describes the Business Model Canvas (Figure 2) – "a shared language for describing, visualizing, assessing, and changing business models". Each of the nine building blocks of the Business Model Canvas is described in pictorial and narrative detail, but so is what one should do with the canvas once it has been created (for example, translate business plans into the customer-centric business processes that early stage entrepreneurs will need).

Chapter 2 describes business model patterns (characteristics, arrangements and behaviours which re-occur), five in particular useful for business model design or invention. For example Pattern Nº1 – Unbundling – refers to the need to ideally unbundle (in order to avoid conflicts and/or trade-offs) the three fundamental types of business: customer relationship management businesses, product innovation businesses, and infrastructure management businesses. Interesting references connected to each pattern are given.

Chapter 3 provides a number of specific (six) design techniques to help design business models: Customer Insights, Ideation, Visual Thinking, Prototyping, Storytelling and Scenarios. Each is introduced using a story, for example about how adopting a customer perspective can be a guiding principle for an entire business model. The chapter includes technique demonstrations, exercises and suggestions as well as book references at the end.

Chapter 4 is about strategy and about how the lens of the Business Model Canvas may be used to re-interpret strategy. The path to be followed will involve constructive questions about existing business models and the environment will also be an object of analysis. SWOT (strength, weakness, opportunity and threat) analysis may be performed for each Business Model Canvas building block.

Chapter 5 focuses on process and a generic business model design process, which is adaptable to the uniqueness of each project, is proposed. This process involves five phases, each of which is described. Mobilize (to set the stage) is the first phase and Manage your business model (continuously) is the last phase. The Business Model Canvas is a tool used across each of the phases.

In conclusion, this practical book is the result of rigorous research undertaken over the last decade and can be used as a handbook to improve business models. A major advantage of the book is its graphics, which communicate its message clearly, hand-in-hand with its straightforward narrative. Despite this, however, academics can also enjoy the book as a wealth of references is provided, so that certain aspects may be studied more in-depth if required.

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[2] www.BusinessModelGeneration.com/hub accessed on the 20th December, 2010.

The book will be of great assistance to students, researchers, and practitioners looking for "powerful, simple, tested tools" leading to superior business model implementations. We expect that this innovative book will be of use to the Business Model Generation located in the four corners of the globe.

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BNML representations: A storyline view and a plot view of how interoperability is an antecedent of innovation at IP BRICK

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Paper IV (accepted for publication)

Theme: Further BNML development and in-depth empirical work

Contribution of the paper to the research topic:

This article is an in-depth qualitative case study of an innovative Portuguese company – IP BRICK. Following a literature review on innovation, interoperability and ICT, BNML is developed further and tested herein. In this article we use BNML to prove that the relationship between innovation and interoperability exists. The adding of a time dimension for example to Verna Allee's work on value networks contributed to the possibility of determining that interoperability leads to innovation. Using Graphviz software, to build graphs which also show connections over time, was an additional aid. During data gathering we visited IP BRICK a number of times, had kick-off and wrap-up meetings with the CEO, a former University of Porto professor, and we interviewed the five functional area directors separately (Sales, Finance, R&D product line 1, R&D product line 2, and Support and Implementation) and following an interview script. BNML is used as a pivot between the actual interviews and the research analysis (figure 2). Following a representation of IP BRICK's value network (figure 3), to which the interviewees contributed during the interviews (drawing their own individual versions, each of which having contributed to the final version, in figure 3), we created the IP BRICK BNML storyline view (figure 4) – which has four "lanes" of data. From the top of the IP BRICK BNML storyline view we can see how the business model canvas building blocks (lane 1) relate to IP BRICK deliverable exchanges between organizational actors (lane 2), how they relate also to the pattern sequence (lane 3) as well as to the assets created and used (lane 4). What these lanes of data show is the building of an interoperability capability at IP BRICK. Figure 4 in sum tells a story of how enterprise interoperability is an essential aspect contributing to innovation at IP BRICK. Table 3 shows interview evidence supporting the business patterns identified in figure 4. Figure 5 in turn is a functional ontology, or BNML plot view of the creation of an enterprise capability at IP BRICK – a new addition to the BNML methodology since Oliveira and Ferreira (2011a). Finally, towards the end of the article, figure 9 integrates the storyline and plot BNML views.

BNML representations: A storyline view and a plot view of how interoperability is an antecedent of innovation at IP BRICK

ABSTRACT

The relationship between interoperability and innovation is very hard to prove and more empirical studies are seen to be needed to this end. We performed an in-depth case study at an innovative Portuguese software firm which has achieved steady growth, international brand recognition and consistent annual profits, despite the much publicized economic crisis in Portugal. IP BRICK is interesting as it differs from the survivalist entrepreneurial endeavours which tend to be the norm in Portugal. We indeed conclude that having an interoperability capability is central and an antecedent to innovation. Furthermore, a dynamic organizational innovation culture is instrumental and ICT is seen to be an enabler in the process. Using digital knowledge management tools as a basis for innovation and having a company-wide profit-sharing scheme based on seniority, but also on merit, encourage a knowledge-sharing corporate culture. This is seen to be especially important in Portugal where there is no religious diversity, a characteristic of a dogmatic culture with a low creative orientation and an absence of a performance orientation. Our research has also used the Business Narrative Modelling Language (BNML) – a research tool which made the research effort more agile and dynamic when compared to more traditional research methods.

Key words: Interoperability, innovation, ICT, case study, BNML.

INTRODUCTION

The importance of innovation has been emphasized in the literature. Economic growth improves quality of life as incomes tend to rise with increases in gross domestic product (GDP) (Porter et al., 2004) and technological innovation in particular leads to increased growth (Schwab, 2010). Furthermore, knowledge management, which includes discovering knowledge, generating knowledge, and sharing knowledge (Jashapara, 2004) "is the most significant input to innovation, one of the preconditions for global organisations. This is one of the only ways that organisations can keep up to date with developments in technology, processes, customer demands, social changes and competitor changes" (du Plessis, 2008, p.65). Thus, a knowledge-sharing and dynamic organizational innovation culture must be promoted. The case study discussed herein benefits from – and seeks to contribute to – the organizational innovation culture and knowledge sharing literatures and is about a company which leverages knowledge (of employees, of customers) to create innovative products. Rather than having a "warehouse" of knowledge (involving simply storing knowledge for later use) at IP BRICK we shall see how they leverage "the 'learning' model where the creation and use of knowledge is seen as the outcome of an ongoing interaction between subject and world" (Kimble and Bourdon, 2008, p.462). We see this ongoing interaction as occurring due to the existence of an interoperability capability, defined as "the ability of a system or an organization to work seamless[ly] with other systems or organization[s] without any special effort" (Mertins et al., 2008, p.v), very evident in our case study findings. Cooperation and collaboration and information flows at IP BRICK lead to knowledge-creation and knowledge-sharing and ultimately to innovation. As early as 1990, Porter – The cluster school – drew from Marshallian externalities "to study how geographical proximities between firms and its suppliers, customers, and competitors can lead to more innovative products" (Tzeng, 2009, p.374). We are interested in this aforementioned proximity but also in how information and communication technology (ICT) can overcome physical distance to promote information and knowledge exchanges and thus lead to innovation. We are witnessing "a new wave of innovation processes fuelled by [the] "wisdom of the crowd" and powered by a new generation of enabling technologies" (Li, 2008, p.17); not only the nature of innovation is changing, the context of interoperability is changing also.

Portugal has dropped since 2005–2006 from 22nd place in the Global Competitiveness Index (GCI) Ranking to 46th only five years later. This has to do with decreases in a set of measures including technological readiness, business sophistication and innovation. As the company discussed herein has managed to counteract the tendency to decrease its competitiveness and has managed to grow and have profits even amidst a major crisis we believe that the lessons learned may be useful to other similar companies operating in Portugal as well as internationally.

Gasser and Palfrey (2007, p.ii) state that "One of the reasons why we tend to like interoperability is that we believe it leads to innovation". However, "the relationship between interoperability and innovation, while it likely exists in most cases, is extremely hard to prove" (Gasser and Palfrey, 2007, p.ii). So, enterprise interoperability is "the ability of an enterprise to interact with other organizations, to exchange information and to use the information that has been exchanged. It should be noted that interoperability is not only a property of ICT systems, but also concerns the business processes and the business context of an enterprise" (Li et al., 2006, p.4). Being able to seamlessly interoperate with others is a determinant of organizational competitiveness and while ICT is increasingly seen as being an essential tool leading to competitive advantage (Porter, 1980) "enterprise interoperability has become a strategic necessity in all industries" (Li et al., 2006, p.1).

Following a literature review, which involved both systematic searches of the Science Direct data base as well as non-systematic searches of various sources, in which we

identify a gap in the literature which we seek to fill – related to the relationship between interoperability, innovation and, also, ICT – we then move on to discussing the objectives and methodology for our research paper and then present the case study we have carried out to achieve our research objectives. We use the Business Narrative Modelling Language (BNML), a novel research method (Oliveira and Ferreira, 2011a), to expose the relationship between interoperability, innovation and ICT. BNML involves visual representations but also resorts to the narrative, thus combining two strategies for theorizing from process data, which is seen to be more advisable (Langley, 1999). Graphviz software also provided an additional basis which we used to achieve our research objectives: Interoperability is seen to be an antecedent of innovation, enabled by ICT.

We also discuss our case study findings in view of the literature and finalize with suggestions for future research.

LITERATURE REVIEW

The literature review that follows commenced according to Corbin and Strauss's (2008, p.35) statement that "there is no need to review all of the literature in the field beforehand, as is frequently done by researchers using quantitative research approaches. It is impossible to know prior to the investigation what salient problems or what relevant concepts will be derived from this set of data. There is always something new to discover. If everything about a topic is known beforehand, there is no need for a qualitative study. Also, the researcher does not want to be so steeped in the literature that he or she is constrained and even stifled by it." Thus, the literature reviewed has been "a source for making comparisons... to stimulate questions during the analysis... to confirm findings" (Corbin and Strauss, 2008, p.37) as well as to illustrate where the literature "only partially explains a phenomenon" (Corbin and Strauss, 2008, p.37).

We performed systematic searches in a major data base – Science Direct – as well as other non-systematic searches – in order to reach "a firm foundation for advancing knowledge" (Webster and Watson, 2002). As described below, we shall see that, in particular, the relationship between interoperability and innovation has not been a focus of much research, prior to our study.

Innovation

A main focus of management research is into helping organizations successfully achieve sustained growth and innovation is one path indicated for this to occur (Christensen and Raynor, 2003). Indeed companies are increasingly under pressure to provide something new and valuable to consumer as well as to business markets (Johansson, 2007). One view in particular portrays companies operating in free-market economies as being similar to organic systems found in nature: a) natural selection will dictate that only the fittest will survive; b) subsequent generations will have to operate according to higher standards; c) enterprises must continually evolve to meet the unending challenge of providing new competitive advantages not yet neutralized by the competition (Moore, 2006) – the challenge is to "innovate or disappear" (Moreira, 2011).

Earlier work on competitive strategy emphasized how strategic advantage could be attained either by: a) industry-wide differentiation; b) overall cost leadership; or by c) achieving differentiation or lower costs while focusing on a particular segment only (Porter, 1980). More recent work has however pointed to the need for having simultaneously both differentiation and low cost products and services in order to create uncontested space in markets where the competition is not relevant (Kim and Mauborgne, 2005; van Assen et al., 2009). Differentiation or low costs can be achieved

via a number of innovations, up to fourteen in total, to which all companies are exposed: disruptive innovation, application innovation, product innovation, platform innovation, line-extension innovation, enhancement innovation, marketing innovation, experiential innovation, value-engineering innovation, integration innovation, process innovation, value-migration innovation, organic innovation, and acquisition innovation (Moore, 2006).

Despite the variety and importance of innovation to companies operating in today's marketplaces, most managers are dissatisfied with the way innovation is managed in their organizations (Tidd et al., 2005). In effect, great variations in innovation performance can be found even between companies operating in the same sector, variations which lead to different market shares, profitability levels, and growth and market caps (Tidd et al., 2005).

Innovation in organizations will depend on a number of factors. The organizational culture – "The accumulated shared learning of a given group, covering behavioural, emotional, and cognitive elements of the group members' total psychological functioning" (Schein, 1992, p.10) – is pointed out as one of those factors by a number of authors (Schein, 1992; von Hippel et al., 1999; Hargadon and Sutton, 2000; Govindarajan and Trimble, 2005; Kelley and Littman, 2006; Morgan and Liker, 2006; Johansson, 2007). In the review of contemporary innovation literature by Tzeng (2009) three main schools of innovation are put forth: economic perspective, social perspective, and cultural perspective (or culture school). The economic perspective views innovation as an institutionalized capability, linked to routines. The social perspective focuses on "authentic voices". The culture school, which interests us most, sees innovation as being a deep craft (Arthur, 2001, as quoted by Tzeng, 2009) of "affective identification" where shared beliefs and practices, taking the form of a collective memory, are the basis rather than technique or material motivation. A personal commitment of the revolutionary type (Berger and Luckman, 1967, as quoted by Tzeng, 2009), where faith is central (Hounshell, 1992, as quoted by Tzeng, 2009), is a necessary pre-requisite. Innovation is thus seen as a "calling" involving heart and soul (Weber, 1976, as quoted by Tzeng, 2009) and intrinsic rather than extrinsic motivation (Stern, 2004, as quoted by Tzeng, 2009). Being creative involves loving the process of innovation (Amabile, 1997) and having a successful innovative enterprise will depend on gathering such people together and organizing their efforts; while recognizing at the same time that innovation tends to be unplanned, accidental and unintentional (Rosenberg, 1990). This brings us to the next concept central to our study – interoperability – as, for example, interoperability problems arise "related to simultaneous business and product development" (Knothe and Jochem, 2009, p.15).

Interoperability and innovation

Interoperability is related to standards which "provide a way of sharing ideas" (Egyedi and Sherif, 2010, p.167). Interoperability is also concerned "with the ability of diverse systems and organizations to work together" (Peat, 2009). Interoperability can be defined as "the ability of a system or an organization to work seamless[ly] with other systems or organization[s] without any special effort" (Mertins et al., 2008, p.v) or still further as "the ability of people, organizations, and systems to efficiently and effectively exchange and use information" (Tsilas, 2007, p.55). We are interested in particular in interoperability as pertaining to *people and organizations able to operate in conjunction (together) to produce innovation*, whether it be product innovation (changes in products/services), process innovation (changes in the creation and delivery process), position innovation (product/service introduction/context changes) or paradigm innovation (changes in the mental models underpinning the organization) – which are "the '4Ps' of innovation" (Tidd et al., 2005, p.10). Gasser and Palfrey (2007, p.ii) state

that "One of the reasons why we tend to like interoperability is that we believe it leads to innovation". However, they continue, "the relationship between interoperability and innovation, while it likely exists in most cases, is extremely hard to prove" (Gasser and Palfrey, 2007, p.ii).

A systematic search in the Science Direct data base, on 17-02-2011, revealed the following search form (Saur-Amaral, 2010), in Table 1. We can see that the interest in interoperability is relatively recent, dating from 1998 and only 21 journal articles were found with "interoperability" in the title.

Table 1. Search form Nº1.

Content	Explanation
Objective of the search	Reveal whether research into the area of interoperability has been undertaken by a significant number of researchers and reveal, also, how recent the interest is in this topic
Data base	Science Direct, as this is a major academic data base
Date of search	17-02-2011
Inclusion criteria	Articles published in journals; in the period 1823-2010; in the social sciences area; containing "interoperability" in the title
Total number of articles found	21
First article dating from	1998

Another systematic search in the Science Direct data base, performed on 21-02-2011, revealed the following search form (Saur-Amaral, 2010), in Table 2. We can see that when narrowing the search down to "interoperability" and "innovation" in the title, abstract and keywords, in the area of Business, Management and Accounting, that only two articles were found; meaning that more research into this topic is needed.

Table 2. Search form Nº2.

Content	Explanation
Objective of the search	Reveal whether research into the area of interoperability and innovation has been undertaken by a significant number of researchers and reveal, also, how recent the interest is in this topic
Data base	Science Direct, as this is a major academic data base
Date of search	21-02-2011

Inclusion criteria	All sources; with "interoperability" and "innovation" in title, abstract and keywords; area of Business, Management and Accounting; all years
Total number of articles found	2
First article dating from	2006
References found	Hyvättinen, 2006; Chu et al., 2009

The two references resulting from the second systematic search of the Science Direct data base were Hyvättinen (2006) and Chu et al. (2009). Hyvättinen (2006) speaks of interoperability problems which "suggest a need for systematic efforts to ensure the actual interoperability of components in technology programmes based on an interface standard" (Hyvättinen, 2006, p.262). The focus of Hyvättinen (2006) is thus different than in our research, our research being more interested in the concept of agility, for example. Agility is connected to interoperability in so far as the "agile enterprise", as related to innovation, is able "to generate many solutions to a problem" (Izza et al., 2008, p.5). Chu et al.'s (2009) research focus, on the other hand, is not entirely different from ours as the focus is on effective content management to "achieve the goal and value of knowledge management" (Chu et al., 2009, p.2360). Knowledge is seen by Chu et al. (2009) as being "the most important asset of individuals as well as of organizations" (Chu et al., 2009, p.2360), determining enterprise competitiveness (Chu et al., 2009). Another more recent study by Bhalla (2011) similarly speaks of new platforms of collaboration and co-creation – in essence of knowledge sharing – which lead to innovation and, much like Chu et al. (2009), also interests us. We thus can see that research into the theme interoperability is recent and lacking, especially relating the term to innovation – with innovation as an output, resulting from the firm's interoperability capability. Li et al. (2006, p.4) also affirm that "interoperability is a relatively recent term"; and Hahn (2004, p.1) states that "research in interoperability is weakly structured. Some approaches exist but are partial and usually IT-oriented".

In effect, the term interoperability has been used in various fields. Forment et al. (2009) state that interoperability is a "must have feature" for Learning Management Systems (LMS) to enable "disruptive learning innovation practices" – ICT here empowers learning innovation. On the other hand, innovation and interoperability are key future E-Government themes, state Raus et al. (2010). Still further, Martin and Eisenhardt (2010) speak of interoperability between products, such as between Disney theme parks and films (which share characters) and between Apple's integrated products (computer, iTunes, iPod, iPhone [and iPad]). Iorio (2009) relates interoperability to an interoperable communications system between police, fire and emergency management in Tampa, Florida (thus being a "regional cooperative effort"). Egyedi and Sherif (2010) discuss next-generation Ethernet Networks and emphasize the need to develop state-of-the-art standards while combining standardization with innovation – interoperability is called into question when (inevitably) standards change, leading in turn to increased transaction costs. Silverstein and Schomberg (2007) highlight interoperability in the design of a new metering-system architecture for the electric industry (public utilities). Dini et al. (2008) relate interoperability to digital ecosystems. Small and medium sized enterprises (SMEs), on the other hand, also need to create value and this is often achieved in their case by specializing in niche activities but they also will "have to combine forces to compete jointly in the market... [and] seamlessly interoperate with others" (Li et al., 2006, p.1) Indeed Enterprise Interoperability is ever more a strategic necessity in all industries (Li et al., 2006).

Interoperability appears as a need, indeed "enterprise interoperability is an area where research can lead to outstanding results in terms of innovation, leading to economic growth and employment." (Li et al., 2006, p.3); enterprise interoperability types including: communication, coordination, cooperation, collaboration, and channel (Li et al., 2008). The need to effectively exchange and use information (to interoperate) increases as one moves from coordination to cooperation to collaboration, suggests Pollard (2005). This is because the desired outcome goes simply from efficiency in meeting objectives (coordination) to efficiency in meeting objectives but at the same time saving time and cost (cooperation); and yet still further to efficiency in meeting objectives while saving time and cost but where innovative breakthrough results also want to be accomplished (collaboration). Especially in the latter case effective use of ICT can lower the need for the physical co-location of the actors involved, providing a channel for communication. A team collaborating is an interdependent group thus interoperability is key.

Interoperability has been linked to Allee's value [innovation] networks which imply the need for interoperability. "Enterprises need to concentrate on value innovation and producing more of not the same (with higher margins). To this end enterprises operate increasingly in dynamic value networks (Allee, 2002)" (Li et al., 2008, p.2). Therefore, interoperability needs to be geared towards making use of and indeed increasing "creativity, collaboration and change in more dynamic networks to release its full potential as an instrument for value creation" (Li et al., 2008, p.2). Li et al. (2008) state further that in the search for increased profitability, interoperability should be "a means for developing blue ocean strategies [Kim and Mauborgne (2005)], by creating value innovation for customers" which in turn means "simultaneously pursu[ing] differentiation and low cost... value innovation, i.e. introducing radical innovations in the products, services, processes, etc., that are genuinely valued by customers" (Li et al., 2008, p.19). Creating new market territory where the existing competition isn't relevant will result (Kim and Mauborgne, 2005). However, the process involved and by which this is achieved, leveraging interoperability, is not described, a gap in the literature which we intend to overcome with our detailed case study.

A Framework for Enterprise Interoperability (FEI) is provided by ISO (2009). This framework is for describing and representing concerns (there are 4 concerns - business, process, services, and data), barriers (there are 3 barriers - conceptual, technological, and organizational) and approaches to enabling enterprise interoperability (ISO, 2009). The method prescribed by ISO (2009) makes the quantification of existing capabilities possible (AS-IS situation), while at the same time identifying those missing capabilities which need to be improved upon in order to achieve higher interoperability levels (TO-BE situation).

A relationship between interoperability, innovation and ICT

We intend to expose, in our paper, how ICT enables interoperability which leads to innovation. Some links exist in the literature between interoperability, innovation and ICT – ICT having been "entwined with major changes in society since the invention of electrical telegraphy in the 1830s" (Mansell et al., 2007, p.1). ICT is seen as being "the innovation engine that will continue to drive growth and value for the next ten years" (Reding, 2008, p.1). An objective of our research is to prove that a relationship between enterprise interoperability (EI), innovation and ICT exists. We believe that the relationship is a direct one, as Figure 1 below illustrates.
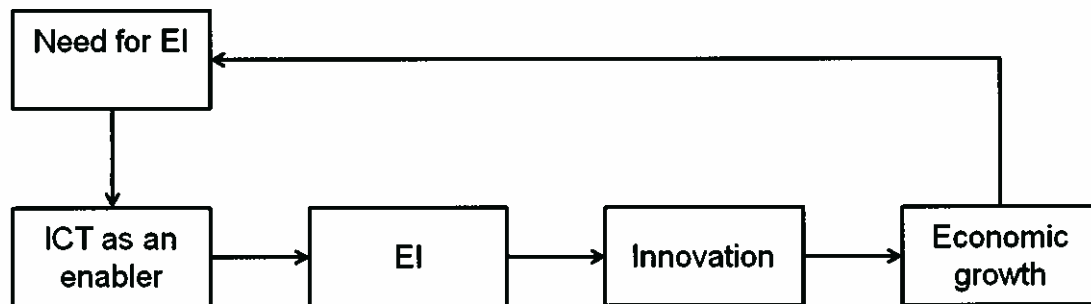
Figure 1. The relationship between interoperability, innovation and ICT (a suggestion by the authors based on the literature).

Several references in the literature provide support for the relationship suggested in figure 1:

1) Technologies are potentially seen as enablers rather than as determinants of particular outcomes (Mansell et al., 2007);
2) ICT can be seen to be the innovation engine" (Reding, 2008);
3) Enterprise interoperability is expected to have an ever increasing contribution to the impact of ICT on economic growth. (Li et al., 2008);
4) Enterprise interoperability will likely create value for the economy as well as society at large (Li et al., 2008).
5) According to Serrano and Fischer (2007) interoperability is related to a new paradigm – that of ubiquity and its contribution to collaborative innovation – interoperability will evolve in future as a new form of intelligence and the influence of technology is undeniable.
6) Similarly, Hahn (2004) states that interoperability is essential for innovation to occur as it allows for seamless cooperation as well as optimized processes; in turn this will be dependent on new technologies, both within, as well as between, enterprises.
7) Furthermore, networked enterprises are a growing phenomenon (Iansiti and Levien, 2004) and are ever more supported by ICT (Li et al., 2006), ICT being a critical infrastructure underpinning both the economy and society (Li, 2008).

We are interested in facilitating co-creation. Indeed, how interoperability, connected to a new concept of Enterprise Systems (Li, 2008) drives open innovation of enterprises (Chesbrough, 2007) is a very current topic considered to be a key factor by the European Commission (Li, 2008).

Finally, the importance of innovation (von Hippel et al., 1999; Lilien et al., 2002; Cash et al., 2008; Kotler and Keller, 2009) and the necessary collaboration (Dyer and Nobeoka, 2000; Kogut, 2000; MacCormack and Herman, 2004; Camarinha-Matos and Afsarmanesh, 2005a, b; 2007, 2008; Camarinha-Matos, 2008a, b; Pisano and Verganti, 2008) in order to achieve this end cannot be underestimated. A growing body of literature is proof of this and we see it as leading up to the need for interoperability. Furthermore, the role of ICT (digital connectivity) is seen as being fundamental, indeed strategic in the way it makes possible improved information processing routines, the basis for increased innovation (Pavlou, 2004; Rabelo, 2008; Rabelo et al., 2008; Cash et al., 2008; Bonabeau, 2009). ICT is an innovation engine (Reding, 2008) and "EI [enterprise interoperability] may have an increasing contribution to the ICT impact" (Li et al., 2008). Interoperability is believed to be an antecedent of organizational innovativeness, innovativeness defined here as the ability of organizations to generate new product (or service) sales.

A contribution to the literature

There are a number of diverse studies mainly linking interoperability, innovation and technology. However, more empirical studies are seen to be needed. Hahn (2004), Li et al. (2006) (European Commission), Li et al., 2008 (European Commission), and Egyedi and Sherif (2010) are examples of studies linking interoperability, innovation and technology but which did not do any apparent empirical work. Qualitative data gathering (using interviews), our method in this study, has been used before in interoperability research such as by Martin and Eisenhardt (2010) and by Raus et al. (2010). Martin and Eisenhardt's (2010) research differs from ours as they investigated cross-business-unit collaboration and large firm value creation. Our study focuses on interoperability within an SME (small and medium enterprise) as well as between the firm and partners (customers) and which leads to innovation. Raus et al. (2010), in turn, evaluate Information Technology innovations in a business-to-government context quite distinct from our context. They performed a single case study about establishing an interoperable platform to connect a multitude of suppliers. We thus see our study as contributing to the existent literature on interoperability and innovation, and in particular as it focuses on a Portuguese company. Portuguese companies have not been a consistent focus in international publications. Some publications have discussed Portuguese entrepreneurial endeavours namely Baptista et al. (2008, p.56) who state that in Portugal there is a "relatively high prevalence of subsistence, or necessity-based, entrepreneurial activity... associated with high mortality and low growth rates for new firms, thus leading to relatively small effects of new business formation on employment growth." IP BRICK is an example of a Portuguese start-up which has countered the tendency mentioned by Baptista et al. (2008) and thus merits attention.

OBJECTIVES

The novel modelling framework BNML (Oliveira and Ferreira, 2010a, b, c, 2011a, forthcoming) uses storylines, the narrative, game patterns, and ontologies to reduce the time necessary to perform qualitative research analyses, while increasing at the same time the consistency across qualitative case studies.

A map can be defined as "a visual representation that... names the most important entities that exist within that domain, and simultaneously places them within two or more relationships... and encourages mentally moving among entities... [becoming] a helpful record of emerging knowledge" (Huff and Jenkins, 2002). While BNML, following exploratory research, apparently achieves this – see, for example, the projects which we have been involved in – Almeida (2010) who used BNML in her Master's dissertation to model the business narrative of a strategic consultancy process; and Krause (2011) who, in his Master's dissertation, applied BNML to classify conceptual patterns – further in-depth research is necessary to confirm the validity and ease of use of BNML.

Thus, the following research question which we aim to address is as follows: *Does BNML contribute to qualitative research by supplying a modelling framework which greatly simplifies the qualitative analysis process, while providing at the same time for a more consistent approach and enabling comparison across cases?*

It is also our objective with this study to apply BNML to a specific research problem and as "innovation nowadays is at the top of the strategic agenda of corporations" (Tzeng, 2009) we set out to analyse how different organizations go about achieving their goal of bringing innovative products (and / or services) to the marketplace, while leveraging interoperability between systems, enabled by ICT. Our research objective then is also to test the Business Narrative Modelling Language (BNML) (Oliveira and Ferreira,

2011a), which we have developed, and in particular to use it *to determine the relationship between interoperability, innovation and ICT.*

METHODOLOGY

It is generally accepted that there are two divergent paths in knowledge development (Scapens, 2007): one involves the formulation of a tentative theory followed by controlled situational events and empirical deductions (using statistical methods and quantification/ measurement procedures to reflect their perspective of knowledge), and the other, less popular, involves natural but uncontrollable observations while working towards a set of inductive principles (following the identification of a gap in the literature researchers admit to putting the literature aside to then inductively derive theory from the phenomenon - theory will *emerge*, as Elharidy et al. (2008) propose; Weerawardena and Mort (2006) go as far as stating that "seven emergent themes of the in-depth case study interviews" are presented).

Ghauri and Gronhaug (2005) agree and state that researchers have to opt between the use of a qualitative or a quantitative method though the difference involves not the quality of the end result but the procedure. Admittedly there is some discussion in the literature as to which method is more "scientific". Quantitative methods, being more structured, are seen to be better by the majority of researchers in business studies. However, Ghauri and Gronhaug (2005) hold that using quantitative methods or techniques is not "better", rather each research project will have suitable methods and techniques depending on the research problem.

According to Corbin and Strauss (2008) "quality in qualitative research is something that we recognize when we see it", suggesting that perhaps qualitative research is more of an art than a science. Certainly qualitative research should be carried out by skilled researchers whose methodology is transparent.

Qualitative research explores and rationalizes while at the same time using intuitive abstraction often based upon the shrewd sense and past experience of the researcher – the emphasis is on interpretation and understanding, in natural settings and with an "insider view", rather than on testing and verifying (and thus, using an "outsider view" which is result oriented) (Ghauri and Gronhaug, 2005).

When we want to understand a little-known phenomena, such as interoperability and its relation to innovation, qualitative research, which can provide intricate details for example concerning human behaviour, is preferable (Ghauri and Gronhaug, 2005) and indeed quite suitable for the study of individuals and organizations (Remenyi et al., 1998). It is becoming increasingly accepted among management scholars that people and their behaviour are best researched using phenomenology or the non-positivistic approach (Remenyi et al., 1998).

We in performing this research aim to provide for an easier application of the qualitative research methodology by using our Business Narrative Modelling Language (BNML). Qualitative research is seen to be inferior to quantitative research (Mason, 2002) and Yin (2003) warns that this is due to a stereotype existing against case studies in particular as they are seen to lack an objective and rigourous stance. This objectivity and rigour is added by our modelling tool BNML, which is based on a pre-existing Enterprise Ontology (Uschold et al., 1998) and pre-defined Business Patterns (Bjork and Holopainen, 2005).

Thus we aim to offer structure and objectivity to a task which other means (such as software packages) have also sought to provide in the past. The researcher will still perform (now less) exhaustive coding whereby instances will be assigned to a category. However, what will differ is the development of the coding frame which will already exist in the form of game patterns (Bjork and Holopainen, 2005) and the

Enterprise Ontology (Uschold et al., 1998). Furthermore, we develop Allee's (2000a, 2000b, 2002, 2008) value network analysis further by adding a time frame to the organizational narrative whle maintaining asset denominations already present in the literature – such as a sense of community, technical know-how and customer relationships (Allee, 2008).

Doumeingts and Chen (2003) have stated that "enterprise modelling and ontologies should enforce the conceptual basis of interoperability research" (as quoted in Hahn, 2004). This is an objective of our research, to use enterprise modelling and ontologies [present in our novel modelling language – BNML] to build on the current concept of interoperability. Ontologies, "a model of the World using meaning-based concept representations" (Oliveira and Ferreira, 2010a), are used "mainly to cover the semantic aspects of interoperability" (Hahn, 2004).

Our objective is to perform inductive theory building using a case study. The persuasive power a single case may have has been mentioned in the literature (Siggelkow, 2007) and classic scholars and authors of highly regarded papers have used the case study method (Eisenhardt and Graebner, 2007). We believe that we have found the "talking pig" that Siggelkow (2007) speaks of (that is, our case IP BRICK, a unique technology company immune to the successive crises in the Portuguese economy) and which may originate (we hope) some excitement. We have gained access to and will be reporting on real-life experiences, benefitting both academia and practice, and Dubé and Paré (2003) do state that this will add respect and interest to our study. Furthermore, "in-depth case investigations open the way to new ideas and new lines of reasoning" (Dubé and Paré, 2003).

Qualitative research, namely involving interviews during primary data collection, has been used in major research efforts connected to interoperability and innovation (Martin and Eisenhardt, 2010; Raus et al., 2010).

We conducted five in-depth, semi-structured interviews using an interview script, and also had two important meetings with the CEO of IP BRICK to position and clarify the research objectives. Unstructured interviews play an important role as a research tool (Bryman, 1989), where the aim is "to elicit respondents' ways of thinking about the issues" while "minimizing the degree to which they are constrained" (Bryman, 1989). We did elicit ways of thinking of respondents, who were allowed to stray from our main subject to talk about areas which they deemed interesting and relevant – but in all of the interviews each of the questions in the interview script were satisfactorily answered. Other research tools included several company visits to observe IP BRICK functioning, an analysis of company documents and company-related media releases, the exchange of e-mails with interviewees to clarify interview issues, all of these having contributed to an effort of triangulation in order to elicit accurate and meaningful data.

USEFULNESS AND VALIDITY OF THE PROPOSED STUDY

Portugal is our home country and so this research is aimed at contributing in a small way to increasing essential knowledge which may lead to improved quality of life here. Portugal, whilst included in an exclusive group of 28 advanced economies Worldwide, is a peripheral European economy which is having difficulty in converging with the European Union EU-27 GDP per capita average, currently standing at roughly two-thirds of this figure (Mateus, 2006). Portugal is described as a less-favoured economy in the European context by Moreira et al. (2007) and also by Moreira et al. (2008). In relation to industrialised countries in general Portugal has not only a technological but also a human capital deficit, with some of the poorest education indicators in Europe and in the developed World (Teixeira and Tavares-Lehmann, 2007). Portuguese culture is not considered to be innovation facilitating (Javidan, 2004), particularly true in

the case of open innovation (Lopes and Teixeira, 2009). What can we do to move forward, away from these poor indicators?

We intend to capture, using a qualitative methodology, the stories that participants author in their work environment to provide an identity and sense to their working lives. In the midst of a turbulent environment, where interoperability, innovation, collaboration and ICT are central, qualitative methodologies are seen to be more appropriate in the case of managerial and organizational issues, "hence, an increasing interest in the application of qualitative research methods" (Myers, 1997). Such studies, which may bring to the fore rich detailed descriptions for example of how collective mind is achieved, are lacking in the literature (Hage, 1999; Pavlou, 2004; Camarinha-Matos, 2008b).

We intend to model the narratives, which are "an appropriate interpretive lens for understanding organizations" (Brown and Currie, 2003; Brown, 2006) using patterns provided by Bjork and Holopainen (2005), thus providing another important and novel perspective on Allee's (2000a, b, 2008) work on value networks and the creation of value.

The case studied – IP BRICK – adds to the interest of the project in so far as it has been carefully chosen to represent relevant issues in various highly competitive and turbulent environments today.

EMPIRICAL STUDY

This article presents the results of a case study. This research strategy is seen to be appropriate for our inquiry into the relationship between interoperability, innovation and ICT as our research question focuses on a contemporary event (Yin, 2003). The data was collected during company visits, meetings, interviews, telephone and e-mail exchanges, as well as resorting to corporate website and document analyses and articles in the popular press about the companies. Digital corporate product and brand advertising videos present on www.youtube.com were also a source of information. "The use of mixed or multiple methods in case study research usually contributes to increasing accuracy and complexity/coverage in a study" (Woodside, 2010).

During the processes of data gathering, representation and analysis the research team also resorted to a novel qualitative research methodology developed by the research team and called the Business Narrative Modelling Language (BNML) (Oliveira and Ferreira, 2010a, b, c, 2011a, forthcoming). This methodology involves an interactive interview process where the interviewee is not simply a passive informant but also aids in the construction of a value network representation of organizational social interactions. This is the first of several visual representations, others involving storylines, specific depictions of deliverable exchanges, and assets being created and used. Graphviz software also enables the construction of figures to further represent what goes on in the organizations.

Langley (1999) supplies an in-depth review of strategies for theorizing from process data advocating that one should not be limited to the use of only one strategy, that "multiple strategies are often advisable" (Langley, 1999) as each have strengths and weaknesses "in terms of their capacity to generate theory that is accurate, parsimonious, general and useful" (Langley, 1999). The concern is with what to do with the data once it has been collected. Langley (1999) provides an approximate ordering of sensemaking strategies along three dimensions: accuracy, simplicity and generality. The narrative is seen to be the most accurate but least simple and generalizable strategy, the opposite occurring with visual mapping (less accurate but more simple and generalizable), which thus complement each other. We seek a balance between the narrative and visual representations with our Business Narrative Modelling

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Language (BNML) (Oliveira and Ferreira, 2010a, b, c, 2011a, forthcoming). We also embed several ontologies (Uschold et al., 1998; Fritscher and Pigneur, 2010; the Unicist ontologies of human learning and innovation) in our BNML analysis, which thus become a part of it, in order to provide for more standardization across cases. The whole process is illustrated below, in figure 2, picturing the BNML as a pivot between the actual interview and the research analysis.

Case study – IP BRICK

IP BRICK is a privately-owned software house located in Portugal and founded just over a decade ago. It has fifty full-time employees, twenty-two of whom divided into two R and D departments to produce original innovative products. IP BRICK has annual sales of 4 million Euros (2010), having increased its sales volume by 20% in relation to 2009. Though manufacturing two main product lines for national and international sales and distribution (named herein Product Line 1 – which refers to a highly innovative but at the same time low-priced operating system for servers – IPBrick – based on open source software - Linux; and Product Line 2 – referring to other management software for workflow and document management and UCOIP communications (unified communications over IP, a step beyond VOIP – voice over IP – which appeared in the 1990s), the company also commercializes a line of products manufactured by another organization (anti-virus software under the brand name Kaspersky) however in this case in Portugal alone. Sales volume is made up of approximately 50% of sales of the in-house manufactured products and 50% of sales of the 3rd party software. IP BRICK has five main functional areas which are: Sales, Research and Development Product Line 1, Research and Development (R and D) Product Line 2, Support and Implementation, and Finance. Of note is that the average age in the company is low, being 28 years (including the CEO and directors). Employees with no prior working experience are preferred as these individuals tend to not have "bad habits" which might hinder their absorbing IP BRICK's corporate culture (based on knowledge sharing and innovation contributions by all members of the organization). Despite Portugal having gone through a major crisis over the last few years, a fact which has been focused upon by the international media quite consistently, IP BRICK has always returned a profit at year-end and sales have been growing steadily since the year 2000. IP BRICK is considered by competitors in the software industry, and also according to articles in the press, to be highly innovative, despite never having had financial capital injected into the company. The IP BRICK brand is well-known internationally. This is seen to be also due to an annual spending of 15 - 16% of sales on R and D (innovation) activities which contributes to the production of innovative products. Product prices and customer proposals range from 500€ to 60.000€. Sales margins are lower for the products not manufactured by IP BRICK (10-15% in this case). In sum, IP BRICK's revenue stream comes from software sales, software implementation and support services, and from giving training to partners / software distributors concerning IP BRICK's products.
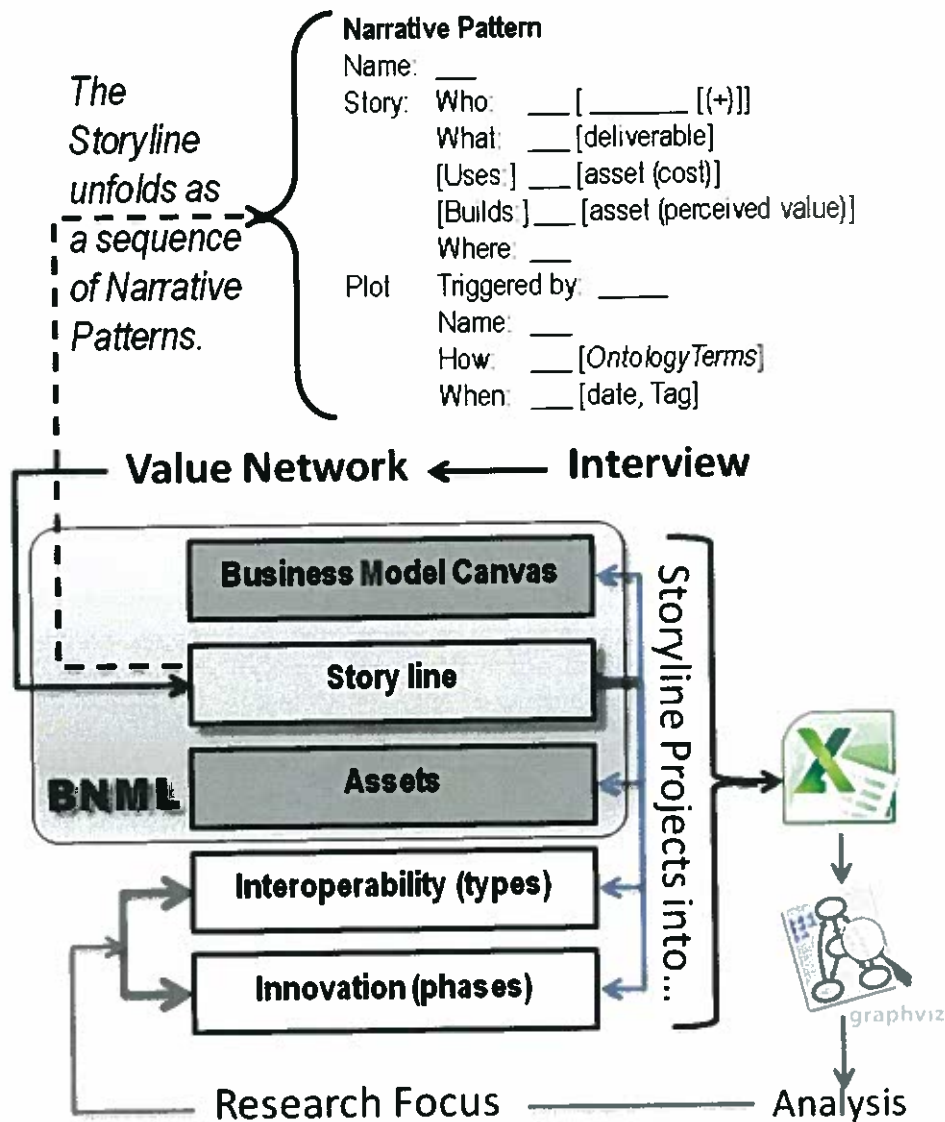
Figure 2. BNML as a pivot between the actual interview and the research analysis.

DATA GATHERING

Following a kick-off meeting with the CEO (PhD) and a tour of the IP BRICK facilities, the five functional area directors (each holding a Bachelor degree) were interviewed separately. The interviews were all tape-recorded and had durations of between 60 and 120 minutes. The researcher followed a script for the interviews and the interview duration also depended upon the issues raised by the interviewee. Interviewees were given the freedom to speak of whatever issues they deemed relevant to the research topic of knowledge creation and innovation. Furthermore, for example, if certain technical aspects of the products manufactured by IP BRICK required further explaining, then the interview would have been prolonged a bit longer. Similarly, if sales and marketing activities required further explanations then this would also have led to more time being spent in the interview. Another aspect which made the interviews rather unique is that the interviewees were asked to help map out the interactions between the internal and external organizational actors of IP BRICK, as

concerns their functional department. This involved writing down the names of the actors (roles) on a blank piece of paper and then drawing arrowed lines between these actors, naming the deliverables, both tangible and intangible, exchanged between them. Right after the interviews, the researcher would finish this value network mapping (Allee, 2000a, b, 2002, 2008) in his office. After the interviews some follow-up occurred, namely phone calls to the interviewees and e-mail exchanges to clarify certain interview issues. The result of this data gathering process is shown in figure 3. This representation is the first step of our Business Narrative Modelling Language (BNML) – a methodology for performing qualitative research (Alam and Hoque, 2010).

In figure 3 the ovals represent roles or actors in the value network (including the CEO, the five functional departments, as well as other external entities such as international partners / distributors, banks and consultancy firms). The dashed lines show that an intangible deliverable has been exchanged (such as a sales lead or technical ideas) whereas the solid lines show that a tangible deliverable has been exchanged (items such as sales orders, invoices or capital). A balance should exist in the value network between these two types of deliverables, as can be seen to be the case with IP BRICK – A reasonable number of each type of deliverable, tangible and intangible, is present in figure 3. Note how the CEO has a mentoring relationship with both R and D departments and with Support and Implementation, whereas the CEO supervises Sales and Finance, with whom closer, more formal relationships thus exist. R and D, seen to be the most important function in the firm by the firm directors, receives important customer feedback from Sales and from Support and Implementation. This feedback (knowledge) will feed the continuous improvement process.
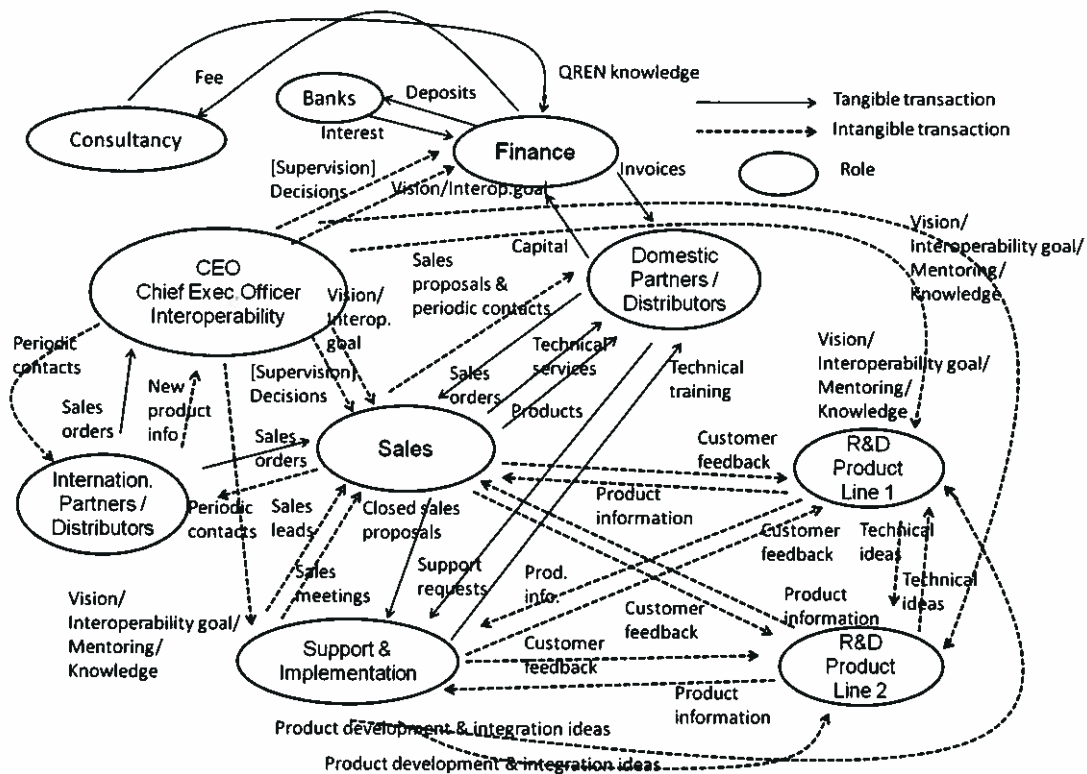
Figure 3. Value network for IP BRICK.

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DATA ANALYSIS AND PRESENTATION

Figure 4 shows our BNML (storyline view) where we can see the different actors (roles) in the value network connected to the creation of an enterprise interoperability capability, an essential aspect contributing to innovation at IP BRICK.

As one can see, not only in figure 4 but also in figure 3, many interactions occur and the CEO, though playing a vital role concerning character development, area control and team development (business patterns evident in figure 4), IP BRICK's success is due mainly to a concerted group effort. We can also see that interoperability is a goal but also a capability which emerges due to it being company policy (i.e. required by senior management - the CEO) to share knowledge.

In figure 4 a series of deliverables are exchanged over time, deliverable exchanges which carry over directly from figure 3. Allee's value network thus serves as a basis for this BNML representation, which now has a timeline, an aspect not present in Allee's representations.
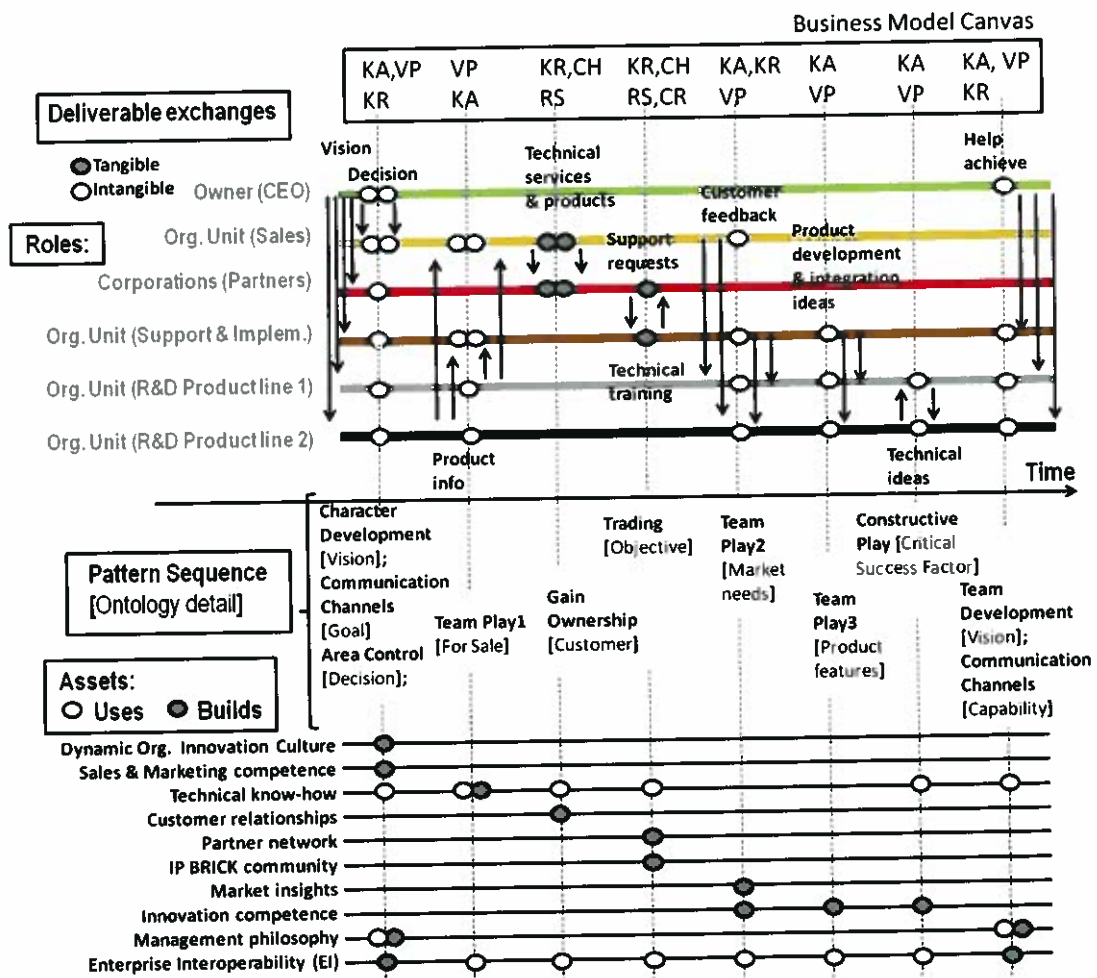
Figure 4. Tangible and intangible deliverable exchanges at IP Brick along a pattern sequence - Building an enterprise interoperability capability at IP Brick.

The pattern sequence shows a narrative occurring, from character development, communication channels and area control right through to team development. We thus, see a story unfolding, IP BRICK's story leading to the creation of value. Uschold et al.'s

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(1998) ontology adds standardized (and repeatable) detail to the patterns, patterns which are taken from Bjork and Holopainen's (2005) exhaustive listing of patterns, thus saving us the task of coming up with suitable pattern names as they already exist in the literature. This simplifies the qualitative research process. Deliverable exchanges include a vision and decisions passed on to Sales:

> "The objective of the company is to have a network of partners, a network to distribute our products, not only nationally but internationally also"

(Support and Implementation Director, referring to the decision to develop strong network ties, within as well as across borders).

Knowledge sharing occurs easily not only between departments at IP BRICK but also between IP BRICK and its customers. This interoperability capability is a goal set out from the outset by the CEO and has become an integral part of the dynamic organizational innovation culture (the organizational memory).

Product information (deliverable) is also passed on to Sales and to Support and Implementation by the R and D departments, to prepare them for their contact with clients (partners):

> "I would say that the heart of the company is R and D – the part of the company which involves development and innovation... due to their innovation and to the products which they develop"

(again the Support and Implementation Director, referring to how an internal or closed innovation effort drives the company forward, new product information then having to be shared by R and D especially with those who will come into contact with customers – Sales and Support and Implementation).

In turn, after contact with customers, Sales and Support and Implementation then pass on valuable customer feedback to R and D, feeding the innovation cycle:

> "We all together try and achieve sales records... Often we sell without doing hardly anything at all because the product is well-known, because what we do is innovative, because people attribute value to us. We do not sell because there was a salesperson who did everything to close a deal... A lot happens due to the product we have. There are no commissions for salespersons because if I sell the merit of the sale belongs to the salesperson, but also to the person who developed the product because he or she had ideas and developed the product; and the merit is also due to Support and Implementation, who did a good service and implementation job... The merit is everyone's. It is of the whole company acting together... That is why we have a profit-sharing scheme."

(Sales Director commenting on the presence of a form of collective mind at IP BRICK, which fuels the exchange and sharing of information and knowledge).

There is a further exchange of product development and integration ideas, as well as of technical ideas, which will lead to new product features and this is part of the patterns team play and constructive play (a critical success factor), patterns which are visible in Figure 4:

> "We are all guinea pigs for our own products, which we use internally too."

(Finance Director referring to how internal feedback from using IP BRICK's products is also a source of innovation).

Figure 4 also shows assets used and built along the pattern sequence. The CEO contributes, during the patterns character development and area control, to the development of a dynamic organizational innovation culture as well as to the development of the essential IP BRICK sales and marketing competence:

"The decision to invest in young people has been an essential aspect to the value-adding activities of the company because these are people who have no old knowledge and who find a company [IP BRICK] for the first time and enjoy being here, they seize the opportunities [given to them]. The younger they are the more I enjoy working with them. They are people who are very available, who enjoy learning, they don't have bad habits which you acquire at some companies. And then they really 'feel' the company, as it was their first opportunity, and they like the products, they like being a part of this... The company is very young, people are really proud of being here and they really want to be here and contribute as much as they can to help the company"

(Sales Director referring to the dynamic organizational innovation corporate culture at IP BRICK).

Technical know-how (concerning both tangible products and services offered) is used (asset usage is made evident by the white ovals at the bottom of figure 4) in the whole process of the development of a dynamic organizational innovation culture. Technical know-how is also used during the pattern team play 1, when knowledge-sharing occurs between R and D Product Line 1 and R and D Product Line 2 and Sales and Support and Implementation. This normally occurs during face-to-face interactions but there are several software applications which also make this exchange of information possible. Gaining ownership of customers (another pattern) involves using technical know-how and building customer relationships. Actual trading (another pattern) involves using technical know-how (sales competence and product knowledge) to build a partner network and an IP BRICK community. The patterns team development and communication channels end the pattern sequence in figure 4 and result in the building of a management philosophy, which is the visionary CEO's view for the company's future:

"We have here [at IP BRICK] an innovation culture, for creating new things, always. Our two main products have always to accompany the needs of our partners, of our customers. We have to see what they want. Because they at times say "This is good but it lacks this" and we reply "No problem, we'll develop it." We really have that type of culture, continuous innovation. In our industry it is impossible for our product to stop evolving."

(Finance Director).

Finally, the Business Model Canvas (Fritscher and Pigneur, 2010; Osterwalder and Pigneur, 2010; Oliveira and Ferreira, 2011b) is also evident in figure 4 – each pattern corresponding to Business Canvas building blocks. Of note is that the Value Proposition (VP) and the Key Activities (KA) which it involves are present in most patterns, which is indicative of the company's focus on creating value. A concern is also evident for developing Key Resources (KR) (such as enterprise interoperability) linked to the Value Proposition of the company by the CEO. Finally, the Distribution Channel (CH) is seen to be via sales by the Sales department to Partners as well as through the provision of other services (such as training) provided to these same Partners by Support and Implementation – and which all generate Revenue Streams (RS). Trading builds a Partner Network and an IP BRICK Community, based on Customer Relationships (CR) – which are also part of the Business Model Canvas.

Table 3 shows other interview evidence leading up to the ten business patterns identified and visible in figure 4. The business patterns have also been categorized in table 3 according to the phase to which they correspond in the knowledge management cycle (Jashapara, 2004). Individual as well as organizational learning will occur (especially in social interactions where the CEO is involved), due also to the high levels of motivation in the firm (made evident in the interview interactions – in particular the profit-sharing scheme is an external motivating force "viewed as a means to

influence the organizational culture" (Bushardt et al., 2007) but high levels of internal motivation also exist, the desire to make a difference in an innovation-producing company). Information acquired at university (a somewhat passive process which involved IP BRICK's young graduates normally quite recently, who were "told" (Jashapara, 2004) what is best at university) is transformed at this stage into knowledge applicable in the workplace due to the hands-on approach at IP BRICK (young employees are given considerable responsibility at IP BRICK). Knowledge sharing (for example by the R and D departments) is part of the dynamic organizational innovation culture (a major asset which is built and is evident in figure 4); knowledge which will be leveraged (by Sales and by Support and Implementation) to produce revenue streams for IP BRICK. The cycle continues as the R and D departments evaluate strategic knowledge to ensure a continuous flow of innovative products in demand by the market:

> "*All of our products evolve like that, always with customers already interested in them. We never do anything very spectacular and which no one will buy. We develop according to what we observe.*"

(Sales Director commenting on IP BRICK's absorptive capacity)

Table 3. Other interview evidence leading up to the ten business patterns related to the knowledge management cycle (Jashapara, 2004) at IP BRICK.

Business Pattern	Phase in the knowledge management cycle	Interview evidence
Character Development	Discovering knowledge (involves individual learning)	"*Internationally, despite there being other people involved internally, the main sales role and sales contacts are performed by our CEO. Our CEO helps Sales including the Sales Director, giving a push when necessary, especially in bigger deals.*" (Finance Director)
Communication Channels	Generating knowledge (involves information distribution and interpretation)	"*There are several ways to promote product innovation, including the observations which reach us from our partners, when they are installing our products; they mention problems, ask questions which we pass on to R and D as possible ideas for programming and to allow for new product functionality*" (Support and Implementation Director)
Area Control	Generating knowledge (involves organizational learning)	"*Our CEO coordinates everything, having a more direct intervention in Sales and Finance. He is the heart of our five departments... In our functional matrix our CEO replaces the Sales Director when she isn't in.*" (Finance Director)
Team Play1	Sharing knowledge (part of the organizational culture)	"*The two main products which we develop involve a lot of information and functionality which needs to be managed and passed on.*" (R and D1 Director)

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Gain ownership	Leveraging knowledge (which contributes directly to the revenue stream)	*"We often sell without doing almost anything because the product is well-known, because this is innovative."* (Sales Director)
Trading	Leveraging knowledge (which contributes directly to the revenue stream)	*"Support and Implementation spend a lot of time with our partners. Our products have lots of different solutions. And there are a lot of services associated to our products. We need to train our partners so that they can sell technical training to end customers."* (Sales Director)
Team Play2	Sharing knowledge (part of the organizational culture)	*"There are various ideas that appear that promote product innovation including observations that come from our partners during installations. Problems, questions, difficulties encountered are passed on by Support and Implementation to R and D for programming and to develop new functionality."* (Support and Implementation Director)
Team Play3	Evaluating knowledge (strategic perspective)	*"Sometimes customers aren't even aware of their needs and IP BRICK anticipates them."* (R and D2 Director)
Constructive Play	Evaluating knowledge (strategic perspective)	*"The two R and D Directors exchange technical information."* (R&D2 Director)
Team Development	Generating knowledge (involves organizational learning)	*"Our CEO is a source of innovation, our products were practically born from his ideas."* (Support and Implementation Director)

Figure 5 is a diagram (made using Graphviz software) where the plots explain the organizational narrative at IP BRICK. There is a parallel between the plots in figure 5 and the process view (activities view) of an organization. Figure 5 is a second component of BNML – the plot view – adding to the storyline view (in figure 4). BNML is an integration of the two views. Figure 5 was inspired by Aveiro and Tribolet (2006) – who set out to "propose an ontology for the organizational function concept, anchored on the fundamental concept of activity" (Aveiro and Tribolet, 2006) – activities which aim at accomplishing a specific task "given an initial state... [and] a recognizable end-state" (Aveiro and Tribolet, 2006). Figure 5 is, thus, a functional ontology of the creation of an enterprise capability (at IP BRICK). It is the result of previous parameterization in an Excel sheet according to the BNML mapping (Figure 4). Patterns are triggered by actors (CEO, Human Resources, Unit Directors, Partners, and Departments such as Sales, R and D1, R and D2, Support and Implementation) represented by the red arrowed boxes on the left of figure 5. Certain inputs (In-ManagementPhilosophy, In-TechnicalKnowHow, In-InteroperabilityCompetence) along with the Actor interventions feed into the various plots (how and when the Vision, Goal, Vision_and_CommunicationCapability, Decision, MarketNeeds, CustomerRelationships, SalesObjectives, CriticalSuccessFactor, SalesPrep, and ProductFeatures are achieved) represented by the red arrowed boxes in the center of

figure 5. Plots show how IP BRICK solves the major issues it is confronted with in order to deliver competitive and innovative products and services to market. For this to occur, the plots will have certain outputs (such as a dynamic organizational innovation culture, an interoperability competence, a management philosophy, a sales and marketing competence, market insights, customer relationships, a partner network, an IP BRICK Community, an innovation competence, and technical know-how). The inputs and outputs mentioned above are simply the assets present in figure 4. The inputs are assets used (represented by the white oval shapes at the bottom of figure 4), the outputs are the assets built (represented by the grey oval shapes at the bottom of figure 4). These outputs are in turn controlled by key state variables (Var-Vision, Var_CharacterDevelopment, Var_ManagementPhilosophy, Var_MarketInsights, Var_CommunicationChannels, Var_Knowledge, Var_SalesVolume, Var_TechnicalKnowHow, Var_InnovationCompetence, Var_Interoperability) which indicate (to senior management) whether there has been a departure from the norm. If there has been a departure from the norm resilience dynamics (Aveiro and Tribolet, 2006) come into play – the organization is self-maintained to survive via (new) microgenesis processes or, in other words, the implementation of micro changes to secure adaptation to the environment (Aveiro and Tribolet, 2006). As an example of a reading of figure 5, the CEO, unit directors, and partners (actors triggering the event) use the management philosophy (input) to achieve the goal (plot) of having an interoperability competence (output). The goal plot uses the state variables Var_ManagementPhilosophy and Var_CommunicationChannels to detect departures from the norm. These state variables can be measured using a variety of management tools. Another example of how figure 5 can be read involves the output dynamic organizational innovation culture. This output is triggered by Human Resources and the CEO. Technical know-how is used as an input to the Vision plot. The state variables Var_Vision and Var_CharacterDevelopment provide feedback on the evolution of this activity. Finally, we thus have seen how the functional ontology in figure 5 involves five steps – indicated at the bottom of the figure – actors and inputs trigger plots which lead to outputs which are in turn monitored by state variables.

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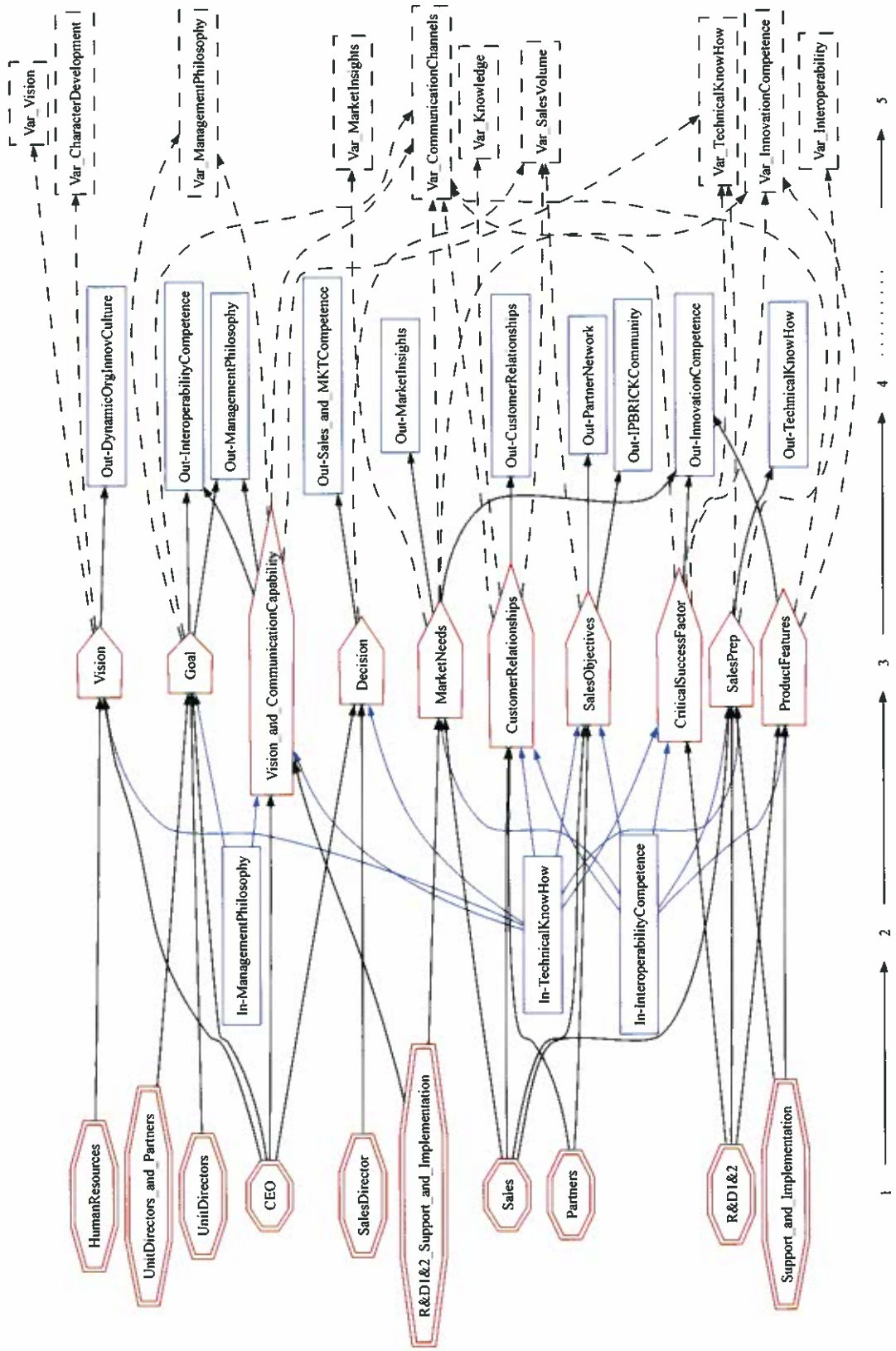
Figure 5. A functional ontology (BNML plot view) of the creation of an enterprise capability at IP BRICK.

Figure 6 is another detailed view of IP BRICK provided by Graphviz software and derived from an Excel IP BRICK parameterization sheet – a parameterization involving business patterns (Bjork and Holopainen, 2005), EI types (Li et al., 2008), the Business Model Canvas (Fritscher and Pigneur, 2010; Osterwalder and Pigneur, 2010; Oliveira and Ferreira, 2011b), Uschold et al.'s (1998) Enterprise Ontology, Unicist Ontologies and the phases of innovation, all woven together in the BNML representation. Figure 6 is, in effect, a collection of key terms or strings which explain how innovation occurs at IP BRICK.
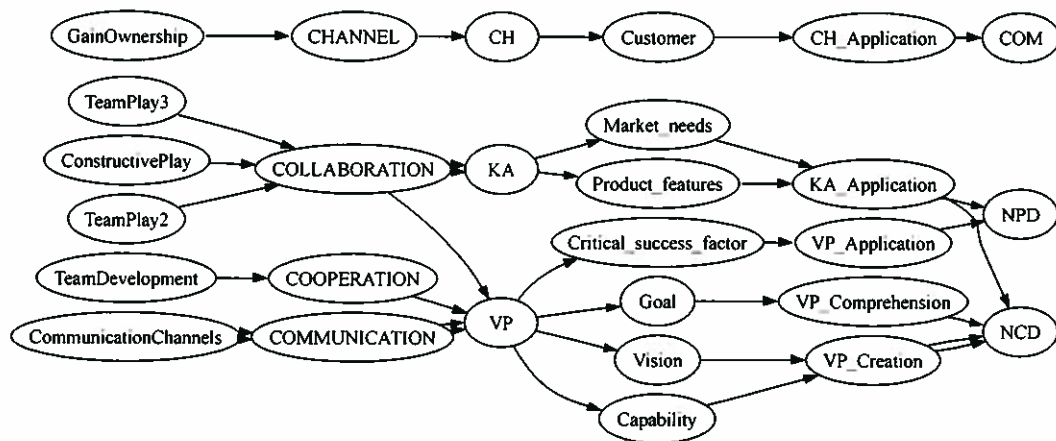
Figure 6. A BNML pattern sequence showing Enterprise Interoperability types as antecedents of the three innovation phases.

Uschold et al.'s (1998) Enterprise Ontology appears with terms such as Customer, Market needs, Product features, Critical success factor, Goal, Vision and Capability (figure 6). We also use Unicist ontologies and the Unicist ontology of human learning (with terms such as knowledge, to act, application, and analytical stage) is seen to be appropriate given that, at IP BRICK:

> "Training and development while on the job is continuous, for example for trainees who really learn while they are here... about our products, about our development support tools which they will need to use, about how to improve their computer programming... and we also have other official training sessions for groups of employees, here at IP BRICK - training in languages, leadership, [organizational] behavior, sales... The CEO establishes the rules which we need to follow and in terms of leadership we also see how our CEO acts and try to act in the same way with our teams, we all learn a lot from him... Another example of our development is how Sun Tzu's book The Art of War was given to all of the directors by the CEO. The book has many interesting ideas and topics which we can apply here in our day-to-day functioning."

(R and D1 Director)

On the left hand side of figure 6 the six patterns Gain Ownership, Team Play 3, Constructive Play, Team Play 2, Team Development and Communication Channels

feed into four enterprise interoperability types – channel, collaboration, cooperation and communication. Thus we can see that interoperability is an antecedent leading to the three phases of innovation COM (innovation commercialization), NPD (new product development), and NCD (new concept development) present on the right side of Figure 6 – thus, answering our research question. So, for example, COMM (innovation commercialization phase) is fed by the Gain Ownership pattern which involves CHANNEL interoperability - information-and-communication-technology-enabled, or ICT-enabled:

> "Our key activities are extremely influenced by ICT which we not only sell but also use to manage knowledge internally... Even our quality management system, which is normally associated at other companies to a lot of paper, a lot of files, here we don't have any paper at all. All of our processes are implemented in our software applications. More than 95% of the time we are able to do without paper."

(R and D2 Director)

The Customer is a key word here (Uschold et al., 1998, ontology term) for whom the communication channels developed are applied (CH_Application). Another view of figure 6 involves Team Development, which in turn involves COOPERATION (interoperability) linked to the value proposition (VP) and leading ultimately to NCD (new concept development).

The reality in figure 6 is a direct result of the IP BRICK interviews / case study.

In sum, EI involves interactions including communication, coordination, cooperation, and collaboration within, as well as between, firms operating in the marketplace (Li et al., 2008). Figure 6 unveils how this interoperability competence leads to innovation. Miller (2000) stated that "To be interoperable, one should actively be engaged in the ongoing process of ensuring that the systems, procedures and culture of an organization are managed in such a way so as to maximize opportunities for exchange and re-use of information, whether internally or externally." This aspect in particular – interoperability - is very visible at IP BRICK and was mentioned often during the interviews of the company directors, for example by the Finance Director as follows:

> "We are working, including the CEO, to make all of the departments interact, to make them work in synchrony. We aim for this coordination because the customers are the same for all of us and we need them to be satisfied at all levels."

Figure 7 below represents, indeed emphasizes, how the actors' storylines interact along the business narrative, giving life to a pattern sequence, this being another visual BNML representation. The grey clouds represent times when the actors (roles) come together, socializing for value creation purposes. Despite the fact that figures 4 through 7 represent the same narrative the latter is very useful for the visualization of what actually happens as it puts in evidence the actual interactions. Thus, the CEO (green line) interacts with all of the other actors present in figure 7. The pattern team play 1, for example, involves interactions at two moments, between the R and D departments and Support and Implementation and between the R and D departments and Sales. Then ownership is gained, of customers (partners), by Sales, as a result of the preceding team play during which knowledge sharing occurred. Trading (an objective) then follows, another social interaction between partners and support and implementation. Team play 2 and team play 3, as well as constructive play, are part of a pattern sequence that builds an innovation competence at IP BRICK (an asset visible in figure 4) as follows:
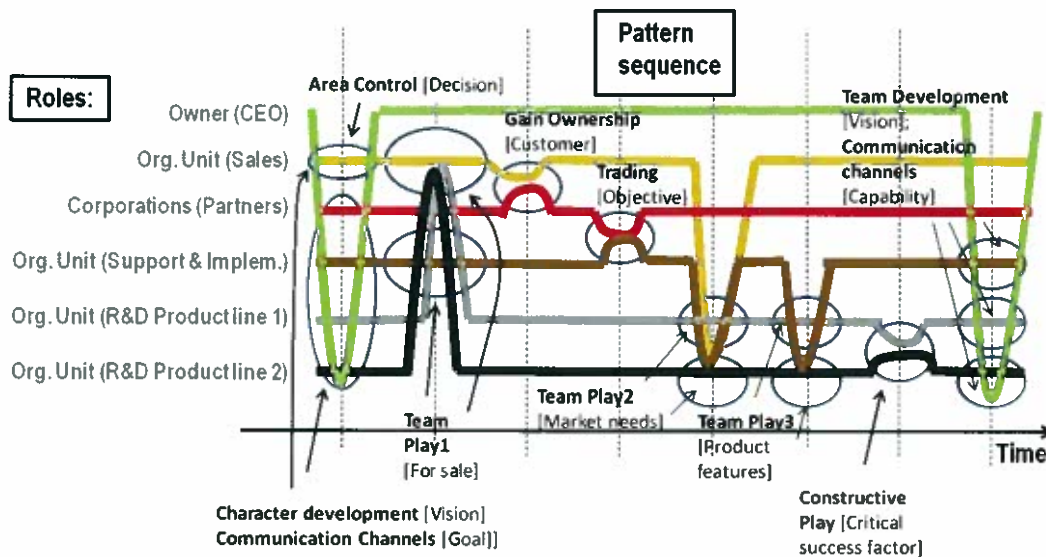
Figure 7. BNML representation showing social interaction between roles along a pattern sequence.

> *"My work involves innovation management, an orientation, a definition of the product development paths to follow, given to the R and D2 team, made up by seven people. I will also interact with all of the departments in the company, implementing specific developments or alterations which my colleagues ask for (for example, the Support and Implementation Director, who comes into contact with the customer, implementing our products there and bringing back important information and suggestions which enable us to do our development work properly, here in R and D). I also might need to intervene in the management of a number of ongoing projects we have... Our goal is to satisfy real customer needs, entirely new and unpredictable situations which appear and are brought to us by Sales, for example, who have that routine of coming by R and D. In view of information presented to us and taking into account what we already have or might come to develop for that situation, we make specific development proposals..."*

(R and D2 Director)

The three business patterns – team play2, team play3 and constructive play – were described as follows:

> *"Being in charge of R and D involves interacting with all of the departments... salespersons contribute with incremental innovation ideas... R and D1 Director and R and D2 Director communicate constantly – we are always exchanging ideas as our management software product lines, which I am in charge of, are completely based and have their roots in our main product line (operating system). There is a constant need to talk and discuss and exchange ideas so as to correctly orient development, so that both product lines function correctly... We even also speak constantly to the financial department as they are our [internal] customer, we have specific financial area products for the automation of administrative processes as well as customer information management products, which they use and test for us... So we have an ongoing dialogue with the Financial Director too, to satisfy her needs, to optimize*

*products and functionality she requires, to share project completion dates... And
of course we also speak to the CEO."*

(R and D2 Director)

The final patterns (team development and communication channels) show, again, how
the CEO develops the team further, helping them achieve their goals in a mentoring
relationship and promoting communication channels:

> *"Support and Implementation might contact us directly if they are having a lot of
> problems with something in particular... a configuration at a customer, for
> example... They will register the problem on TRAC but there is nothing like
> personal contact, informing and exerting more pressure on our department
> personally if urgent changes, like a program update, are seen to be needed.
> Information technologies, ICT, are useful tools, but there is nothing like a
> personal approach to issues; we have a lot of things which are registered but
> the importance of an item might not be evident; if we don't give a quick
> response to an issue Support and Implementation might then contact us to see
> how things are evolving: "Are we going to have a quick update or not?" There is
> that need and sometimes that happens."*

The R and D1 Director stated further that:

> *"Our CEO contributes a lot with innovative ideas... A lot of our innovation also
> comes from feedback from customers/partners/distributors. Interactions
> especially with the international market are very good for idea generation. Not
> that we are behind here [in Portugal]... but the dialogue with
> customers/partners/distributors around our products is very important, it reveals
> needs which arise, gaps in our products, automation suggestions (for example
> only two clicks to fully configure a product)... We also brainstorm and have
> weekly meetings internally... IPBrick [product line 1 – operating system] doesn't
> stop, it has never stagnated, every day it has new functionality, every day.
> Problems are solved, something is always being done. Always. Every day."*

(R and D1 Director)

IP BRICK – REVIEWING THE METHODOLOGY APPLIED - THE EMERGENCE OF AN INTEROPERABILITY CAPABILITY USING BNML

In sum after the field work and with the material still fresh in their minds the research
team created the BNML representations of the data, as mentioned above. The
recordings of the interviews were listened to and the relevant material transcribed to
support the patterns identified (in sequence). An Excel table was built and filled with
our BNML data for parameterization purposes (the parameterization process – Excel
sheet detailing – was repeated until a satisfactory, in-depth level of detail was reached
which permitted us to formulate conclusions to our research effort) and from there
graphs were developed with Graphviz – graph visualization software (found at
http://www.graphviz.org/). We are satisfied that the figures (4 through 7) and the
relevant adjoining narratives provide a means to communicate how interoperability,
enabled by ICT, leads to innovation at IP BRICK. Gasser and Palfrey (2007, p.ii) did
state that "one of the reasons why we tend to like interoperability is that we believe it
leads to innovation". Though "the relationship between interoperability and innovation,
while it likely exists in most cases, is extremely hard to prove" (Gasser and Palfrey,
2007) we believe that with our research we have laid down the foundation for this
relationship to be further demonstrated with more in-depth case studies.

The end results of our study were presented first to the CEO and then to the rest of the IP BRICK team. This allowed for a validation of our results but also made possible a further in-depth discussion of our findings.

A DISCUSSION OF THE CASE IN VIEW OF THE LITERATURE

Alam (2011) suggests that the discussion of research findings should take into account earlier research, on the one hand for validation purposes, on the other "to provide a standpoint for the current research". We seek to achieve the above in this section.

Information and communication technologies (ICT) play a big part in IP BRICK's day-to-day activities, for example for internal process management and for sales purposes, and are in effect a significant part of the organizational culture. In particular, Internet-based tools are a source of business value at IP BRICK, confirming research by Soto-Acosta et al. (2010). The computer systems industry "embraces innovation at a breath-taking rate" (Patterson and Hennessy, 1994) and IP BRICK is no exception. In view of competing products sales is a major challenge (Miettinen et al., 2010) and customer collaboration and co-creation (Bhalla, 2011) is essential to innovation output at IP BRICK – Web 2.0 technologies helping to connect and to ensure real-time communication and contributions; countering a tendency within SMEs to have "limited technology systems to store knowledge and information in a useful way" (du Plessis, 2008). Information technology is far from being a centralized function at IP BRICK, decentralized operations occurring in particular due to the leveraging of the Internet – connectivity between users and integration is a major concern (Laurindo, 2002). Indeed, interoperability, defined above as "the ability of a system or an organization to work seamless[ly] with other systems or organization[s] without any special effort" (Mertins et al., 2008) is also very evident in our case study findings. We thus see interoperability as being central to future discussions on knowledge management and in particular to its presence as an antecedent of innovation.

IP BRICK's products developed in-house are used by IP BRICK, on the one hand for testing purposes (much as in a laboratory environment) on the other because they permit saving the hiring of further human resources, thus keeping costs down. For example:

1. Pricing information, receipts, invoices, credit notes, are all accessible to customers online every day without further human intervention being necessary (via iPortalDoc Light - an online application which has free-of-charge access for customers); and products can be purchased online too. This reveals great ease of communication and an interoperability capability.

2. IPTicket is for registering customer service hours (to be used by the Finance department), but also for reporting software problems, queries, and suggestions directly to IP BRICK's appropriate division (for example, Help-desk or Support and Implementation). Customers as well as employees can access this application which serves as a continuous innovation platform with valuable feedback and insights. Interoperability is also revealed through the use of this application.

From a business standpoint, standalone software product sales have also given way to the "provision of various types of services" (Valtakoski and Ronkko, 2010) and IP BRICK does make product training one of its major goals and sources of revenue streams.

IP BRICK is very forward-looking and paper is kept to a minimum – for every fifty or so documents in a physical paper format (including mainly items received in the post), there will be well over a thousand digital documents exchanged within the company (including e-mail exchanges). Younger employees adhere faster to the "no-paper, all-

digital" policy which IP BRICK's organizational culture also seeks to promote in its customers. IP BRICK practices and, equally importantly, sells what it "preaches". Thus, IP BRICK's organizational culture is instrumental to its survival and growth (Pecujlija et al., 2010) and is a source of competitive advantage not easily imitable by competitors.

What is evident at IP BRICK is a concerted effort to share information and knowledge – revealing, once again, an interoperability capability, between its various departments – in a very positive way, as Lee (2010) stated is so important. In order to create innovative products which the market wants to acquire, consequently creating competitive advantage, knowledge must be managed well (Chen and Chen, 2010). Everyone benefits from this collaboration as IP BRICK has a profit-sharing scheme – up to 25% of the annual profit is distributed amongst employees. The profit-sharing scheme is based on seniority but also based on a voting system – employees vote at year-end to determine who has contributed most to the company during the past year and financial compensation will be attributed accordingly. This is not normal (that is, not a regular practice in most companies) especially in Portugal and during a period of crisis. The Co-recipient of the Nobel Prize for Economics in 1993 – Douglass C. North – stated that a problem with Portuguese management is that it is authoritarian and does not promote self-government or competition, or the development of human resources (North, 2005), very different to what we see as occurring at IP BRICK. Organizations, irrespective of geographical location and culture, would benefit from implementing such a system as we see at IP BRICK, as a performance orientation is also creative and "helps economic accomplishments" (Triandis, 2004, p.xvi).

Organizational learning is closely linked to performance at IP BRICK, confirming research by Bustinza et al. (2010), and is a fundamental contributor to "the ability to innovate [which] has always been an important contributor to organizational success" (Fichman, 2001). Learning is seen to occur faster, especially as concerns the assimilation of the corporate culture, when the human resources are younger and free of "bad habits" (Usunier and Lee, 2005) and this is the case also with IP BRICK. For example, the Sales Director is 26 years old, has been with the company for four years, and is the eldest in her department. Of particular interest is being able to develop "motivation, concept learning and the development of skills and appropriate scientific attitudes" (Alam et al., 2010). Having said that, the cost of training individuals to become highly skilled and able to consistently contribute to IP BRICK's dynamic organizational innovation culture (a major asset which concerns senior management at IP BRICK and visible in figure 4) is quite high and so effort must be expended to avoid a "brain and body drain" (Alam and Hoque, 2010) from the firm. A Christmas party where presents are distributed, corporate team-building weekends, an annual award-giving ceremony for IP BRICK's employees, an annual IP BRICK anniversary party, having a team of employees enter sports events (such as long distance running) representing the company, promoting social events at the company such as encouraging employees to bring a birthday cake and drinks when it is their birthday, for all to participate in the birthday celebration, and having a TV onsite and ordering in pizza for everyone when Portugal is playing in an important international event such as the World Soccer Cup, are some examples of how IP BRICK achieves this. "The higher the socialization of a member in an organization is, the higher his/her job satisfaction is" (Lee and Yu, 2010; Oliveira and Ferreira, 2011c) and employee retention should follow.

Having a highly qualified CEO, who has acute social and leadership skills, in order to develop the intimacy necessary among employees which will positively impact on innovation performance, is essential (Lee and Yu, 2010). Such a CEO is a source for developing human resources, for developing trusting relationships, and for passing on and creating an all-important vision, management philosophy and corporate culture. Upper-Echelon Theory states that there will be a flow of values and beliefs from the

leader to the organizational culture (Hambrick and Mason, 1984, as quoted by Winston, 2010) and we believe that this is a sustaining element at IP BRICK to counteract Portugal's absence of religious diversity, a characteristic of a dogmatic culture where a low creative orientation and an absence of a performance orientation will tend to be found (Triandis, 2004).

A CEO who also travels extensively abroad to make contact with the main, as well as new, international customer base, but who readily delegates responsibility including for international sales contacts to his sales department, is similarly very important. The CEO, very aware of advanced customer needs and of what is already available in the software market is, thus, also a source of product and process innovation, oftentimes even radical innovation, especially, as we mentioned above, due to spending time with people who "have never shared the same ship, but also have never shared the same ocean" (Malhotra et al., 2001). IP BRICK's success is also due to having the courage to internationalize. The main effort involving the search for new business, internationally, is assigned to the CEO, who then passes on sales contacts to his sales team; despite many [software] firms choosing to "internationalize only a little and gradually" (Ronkko and Peltonen, 2010). Currently, at IP BRICK, international business accounts for more than half of annual sales (Pereira, 2011).

CONCLUDING REMARKS ABOUT BNML: INTEROPERABILITY AS AN ANTECEDENT TO INNOVATION

BNML was a very important research tool used in our research. It has two views both evident in figure 4 (storyline view) and figure 5 (plot view). By systematically making evident who the organizational actors are, who they interact with, what deliverables they exchange in the process, the assets built and used over a pattern sequence, and along the Business Model Canvas building blocks (figure 4), we address a number of issues which normally occupy a much more significant amount of time in qualitative research efforts. Furthermore, the Plot View (inspired in Aveiro and Tribolet's (2006) functional ontology - figure 5) can lead to the analysis (using Graphviz software) in figure 8 – where we can see that the interoperability competence (input) leads to (is an antecedent of) the building of an innovation competence. In effect, in figure 8, we have a BNML representation where we can see actors (e.g. Sales), inputs (e.g. Interoperability Competence), outputs (e.g. Innovation Competence), plots (e.g. Sales Objectives), patterns (e.g. Trading), state variables (e.g. Var_SalesVolume) and assets (e.g. Interoperability Competence) all in the same representation – here, in sum, showing how the asset interoperability competence is used to build an asset entitled innovation competence. Of note is how the key state variables (such as Var_InnovationCompetence and Var_Interoperability) indicate to the CEO whether micro changes (mocrogenesis processes) need to be implemented to secure the organization-environment fit (Aveiro and Tribolet, 2006).

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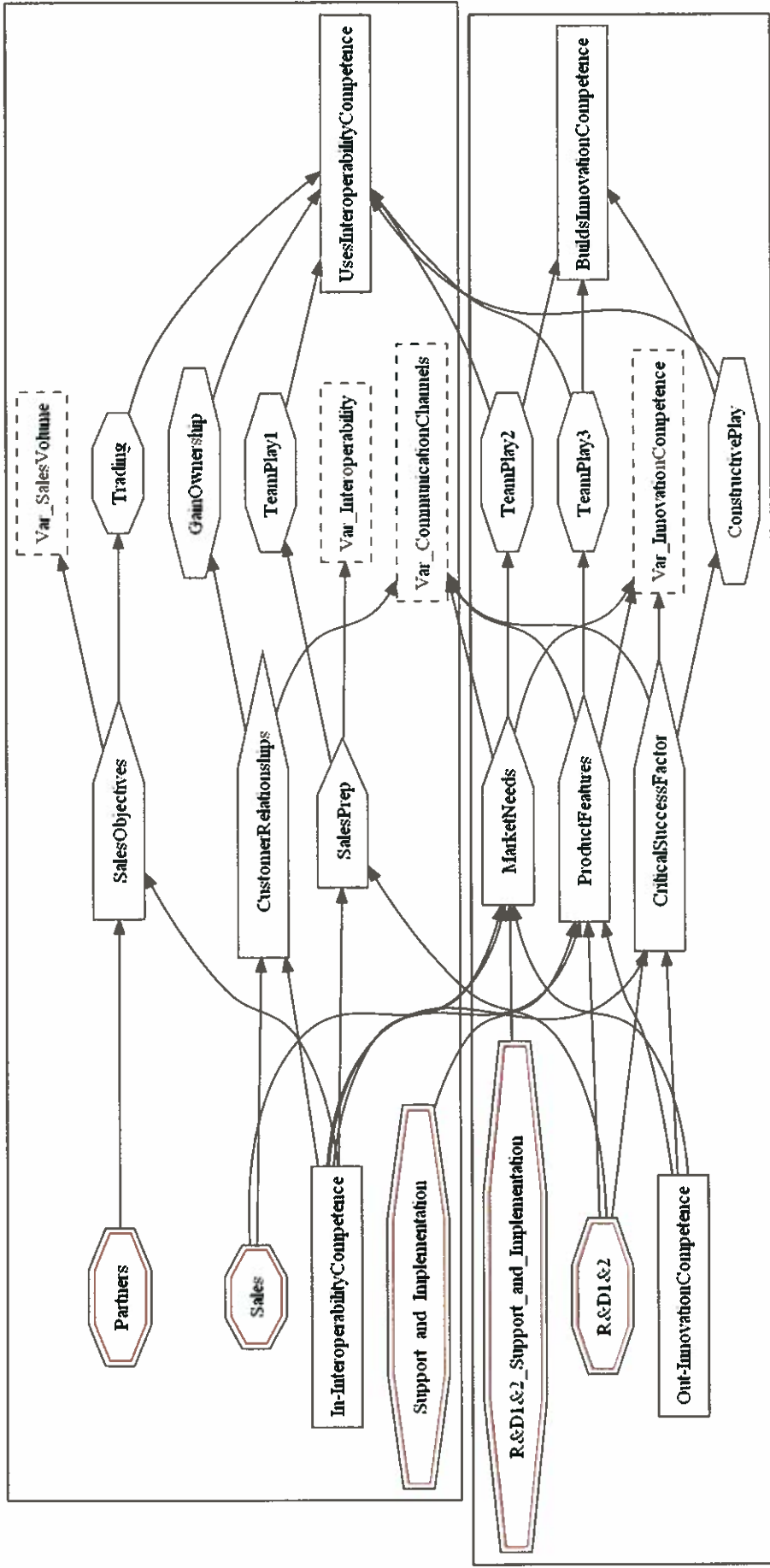
Figure 8. BNML – Plot view of how interoperability leads to innovation.

Furthermore, in figure 8 the patterns trading, gain ownership, team play 1, team play 2, and team play 3 are each dependent on technology, using the interoperability competence which then leads to innovation.

Figure 9 shows the integration of the plot view and the storyline view. Both views are needed for organizational coherence and both comprise our BNML. For example, in figure 9 we can see how the CEO is concerned with the Character Development of his staff via a microgenesis process.

SUGGESTIONS FOR FUTURE RESEARCH

We have, thus, continued research into small software firms as addressed by Miettinen et al. (2010) and which face particular growth challenges. According to Miettinen et al. (2010) human resource management (HRM) is the greatest challenge for these small firms acting in the software service industry and this is a major concern of IP BRICK's CEO and directors, as we have seen above; in the hiring process, in the development and retention mechanisms of the best employees, as well as concerning the indoctrination of new organizational members into the organizational culture – where interoperability plays a major role. Other in-depth analyses of such HR processes are seen to be necessary. Furthermore, we used the BNML and in so doing significantly decreased the time and effort necessary to make sense of the qualitative data gathered. We thus suggest that other authors use BNML in their research efforts.
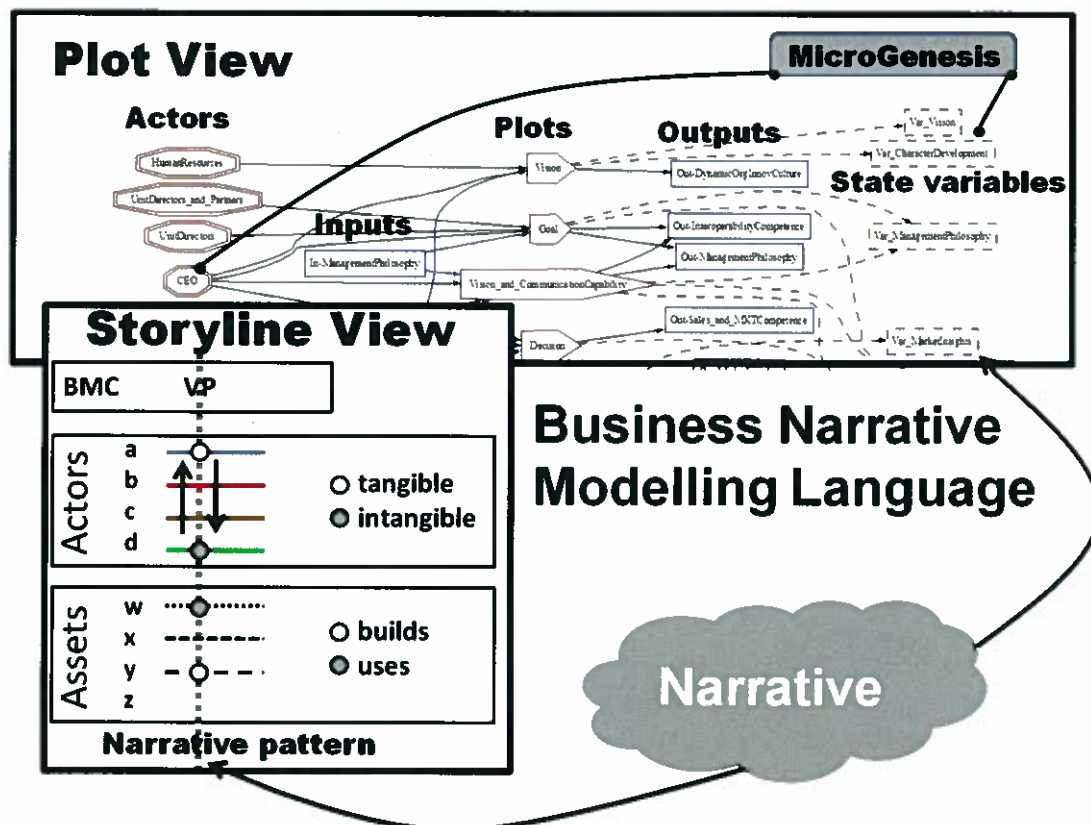
Figure 9. Integrating storyline and plot BNML views.

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How interoperability fosters innovation: The case for servant leadership

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Paper V (accepted for publication)

Theme: Theoretical and empirical work

Contribution of the paper to the research topic:

Though it is believed that interoperability leads to innovation the relationship is seen to be extremely hard to prove. The objective of this paper was to prove that interoperability is an antecedent of innovation, as some literature suggests and as we proved, above, in our previous research paper (paper IV). To this end we again used BNML, thus testing further our research method. As our literature review was an ongoing effort, following on from our empirical work, each actually feeding into each other throughout the doctoral research project, as the grounded theory approach suggests should happen, we were also led to an enquiry into the role played by servant leadership. "Analysts often discover... other materials that seem pertinent to the area under investigation" (Corbin and Strauss, 2008, p.35) and such was the case with servant leadership. Servant leaders do not use their power to manage and lead enterprises but rather persuade staff "with the power of service... whereby followers are given extraordinary freedom to excel" (Dierendonck and Patterson, 2010b, p.8). We saw the above as being a very good leadership style in which to foster innovation in organizations. So, following a literature review (in which organizational and national culture were both subjects of analysis – as the PhD candidate was very interested in these themes when he commenced his doctoral studies at the Faculty of Economics of the University of Porto – before transferring to the Faculty of Engineering), we performed three separate research studies, all undertaken in Portugal. This article thus publishes the results of two in-depth qualitative surveys, as well as the results of a case study about another innovative Portuguese firm called Infosistema. The result is this article about how interoperability fosters innovation, and which also presents the case for servant leadership. BNML very satisfactorily supported the research effort, revealing itself as an important research tool. We demonstrated that servant leadership and enterprise interoperability are both antecedents of innovation. Enterprise interoperability is an organizational asset, initially built and then used by an organization. We conclude, following our study, that the leadership style adopted by an organization influences organizational communication channels (interoperability) and subsequently impacts, also, innovation output and revenue streams.

How interoperability fosters innovation: The case for servant leadership

Abstract

What is the relationship between interoperability and innovation? While a relationship likely exists, according to the literature, it is seen to be very hard to prove. Furthermore, what role does [Servant] Leadership play? In order to address these questions this research paper is based upon three research efforts, undertaken in Portugal – 1) An exploratory in-depth survey concerning Servant Leadership, administered to students finalizing their BSc Management Degree (54 valid responses); 2) An in-depth survey on Servant Leadership, interoperability and innovation administered to executives in various industries (55 valid responses from nine different industries); 3) A case study of Infosistema, an innovative Portuguese firm which exemplifies the Servant Leadership philosophy. Our results show that Servant Leadership leads to interoperability and both are seen to be antecedents of innovation. However, the Servant Leadership philosophy is a distant reality from most organizations in Portugal and this may mean less free-flowing communication and thus less organizational innovation as a consequence. Some culture change may first be necessary so that Servant Leadership may become more widespread. We also use the Business Narrative Modelling Language (BNML) at various points in the discussion, thus combining the narrative and visual content to communicate key management concepts.

1. Introduction

"One of the reasons why we tend to like interoperability is that we believe it leads to innovation" (Gasser and Palfrey, 2007, p.ii). However, "the relationship between interoperability and innovation, while it likely exists in most cases, is extremely hard to prove" (Gasser and Palfrey, 2007, p.ii). Furthermore, what is the role played by [servant] leadership? To answer these research questions, and provide proof of the relationship between interoperability and innovation, we performed three separate research studies, all undertaken in Western Europe (Portugal). The first research study was an exploratory survey of students' attitudes towards leadership, with 54 valid in-depth qualitative responses. The second research study was an in-depth survey of executives' beliefs and attitudes concerning leadership, interoperability – "the ability of a system or an organization to work seamless[ly] with other systems or organization[s] without any special effort" (Mertins et al., 2008, p.v) – and innovation – "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations" (OECD, 2005, p.46) – with 55 valid in-depth qualitative responses. The third research study was a case study of Infosistema, a Portuguese company chosen for its innovative management philosophy (servant leadership culture) and innovative products and services. The need for the case study arose as some of the exploratory student survey respondents and indeed a significant amount of the executives surveyed also, were not of the opinion that servant leadership would function in Portugal. Other studies (Laub, 2005 and Herman, 2008, as quoted in Laub, 2010) have determined that servant leadership is indeed a leadership philosophy adopted by a minority of companies, when compared to autocratic or paternalistic leadership philosophies. Infosistema is thus an important Portuguese illustration of how servant leadership leads to interoperability and to the free flow of communication, resulting in organizational innovation.

Our interest in servant leadership is relatively recent. We heard of servant leadership for the first time at an online R&D EFFE (Enabling the Fuzzy Front End of Innovation) meeting organized earlier this year (March, 2011) by one of the authors and which had participants from several parts of the World (each connected using a videoconferencing tool called Vidyo Desktop). One of the participants (Milton Sousa) is a leadership scholar and expert, with connections to both the academic as well as the professional community; and indeed that evening Milton was responsible for the lecture on "Meaningfulness and leadership". The talk was so engrossing that a copy of "Servant Leadership – Developments in theory and research" (Dierendonck and Patterson, 2010a), a book advertised on the Erasmus Centre for Leadership Studies' website[4], where Milton is undertaking doctoral studies, was ordered that night and has been a faithful travelling companion ever since. The notion that work should have meaning and that leadership has to do with the ideal of service, with attention given to the needs of followers, is believed will indeed lead to healthier corporate cultures and more satisfied workers. The material read was soon transferred to the classroom and following lectures on the subject of servant leadership on a management course, at a major university in Portugal, a survey of the students followed which, due to its remarkable results, led to the idea for this article.

"Leaders offer a vision of what is possible that mobilises, energises and empowers people to reach that vision" states Jashapara (2004, p.218). Leaders also support goal-setting and can involve employees more or less in the goal-setting process, while also gaining commitment to these goals. However, "it is noteworthy that there are no conclusive studies showing that certain leadership styles, such as a participative style

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[4] The Erasmus Centre for Leadership Studies' website is:
http://www.erim.eur.nl/ERIM/Research/Centres/Erasmus_Centre_for_Leadership_Studies#axzz1OdM0Bg2l, accessed on 17-03-2011.

or an autocratic style, are more effective than others", states Jashapara (2004, p.218). Though it may well be that studies that attest to the effectiveness (in terms of organizational financial profit generated) of a certain leadership philosophy type may be lacking, we do however firmly believe that servant leadership will undoubtedly lead to happier and more fulfilled employees, who will more willingly and readily contribute to the objectives set out for the organization. Furthermore, in current times of turbulent change, we might add that organizational objectives tend to be linked to innovation and the notion that motivated and empowered employees will lead to greater innovation output – "the lifeblood of any large organization" (Birkinshaw et al., 2011, p.50) – is the vision that now empowers us also, indeed impels us, to spread the ideal of the servant leader.

Rather than providing answers, we seek to contribute to the discussion of servant leadership, especially in countries without a track record in this leadership philosophy. We propose that servant leadership is a promoter of interoperability. Servant leadership, by unblocking and promoting communication channels between employees and leaders at all levels, by promoting knowledge sharing, must lead to greater innovation output and, thus, to greater results for enterprises. With our case study of Infosistema we provide evidence of this.

By also portraying the survey results using the Business Narrative Modelling Language (BNML) (Oliveira and Ferreira, 2011a) we bring forth several benefits, including making management concepts more accessible to a wider audience as its visual format (Oliveira and Ferreira, 2011b), in conjunction with the narrative, is simpler and more generalizable than, for example, simply using the narrative on its own (Langley, 1999). Furthermore, business patterns are more easily identified using BNML, and the business patterns resulting from the student survey and connected to servant leadership were the foundation for the Infosistema case study analysis. "Capturing knowledge has always been an objective although known to be costly and time consuming" (Páscoa et al., 2011, from the abstract). We also believe that using BNML is not only a means to capture knowledge but an avenue to decrease time and costs related to the performing of qualitative studies (Oliveira and Ferreira, 2011a).

Finally, our paper comes at a crucial time for Portugal, which is registering its worst average economic growth since World War I, its highest unemployment rate in 80 years[5], its greatest public debt of the last 160 years, and renewed high emigration levels amongst Portuguese citizens, who are going abroad in search of a better life (Pereira, 2011). Given the recent IMF (International Monetary Fund) and EU (European Union) financial interventions to bail out Portugal and save the country from bankruptcy, we feel that research connected to better leadership is crucial. Leadership which we see – and indeed our study results show – is linked to interoperability and innovation.

2. A literature review related to the research topic

2.1. Leadership, culture and innovation defined

Leadership can be defined as "the ability of an individual to influence, motivate, and enable others to contribute toward the effectiveness and success of the organizations of which they are members" (House et al., 2004, p.15; see also Schein, 1992; Kotter, 1996). Leadership influences the ever-present phenomenon organizational culture – "the accumulated shared learning of a given group, covering behavioural, emotional, and cognitive elements of the group members' total psychological functioning" (Schein, 1992, p.10; see also Deshpandé et al., 1993; Allee & Taug, 2006; Kelley & Littman,

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[5] Unemployment in Portugal was at 12.1% in mid-2011, according to the Portuguese National Institute for Statistics at http://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_main accessed on 24-10-2011.

2006) – preparing the organizational scene for innovation (von Hippel et al., 1999; Lilien et al., 2002; Cash et al., 2008; Kotler and Keller, 2009) – be it product, process, position or paradigm innovation (Tidd et al., 2005). As further concerns innovation – "seen as applying to the development of new service offerings, business models, pricing plans and routes to market, as well as new management practices" (Birkinshaw et al., 2011); and seen to include not only "brilliant" disruptive innovation but also "a great many brothers and sisters" (Moore, 2006, p.61) such as line-extension innovation and experiential innovation (Moore, 2006) and ranging from growth phase to mature phase products and services as well as to the phase where categories need to be renewed entirely (Moore, 2006); indeed "all established enterprises have the opportunity to innovate all the time" (Moore, 2006, p.62) – top management [leadership] team diversity "enhances firm performance by facilitating an innovation strategy that increases the firm's new product portfolio innovativeness" (Talke et al., 2010, p.907). Similarly, Çakar (2006) states that it is divergent thinking that contributes to an innovation capability. It is precisely this innovation capability that interests us and the role that leadership plays. Positive forms of leadership which are closely related, as they each possess a positive moral perspective and leadership with self-awareness ("an emerging process" involving the understanding by the leader of his/her values, cognitions and emotions) (Avolio and Gardner, 2005), include theories of authentic, transformational, charismatic, spiritual and servant leadership (Avolio and Gardner, 2005); servant leadership in particular, a focus of our research and described below, is seen to be a direct avenue for the promotion of the diversity and divergent thinking necessary in order to multiply innovation within the organizational context – especially as innovation occurs over time, requiring continued, concerted and often company-wide efforts (Tidd et al., 2005; Morgan and Liker, 2006).

We see leadership as being ever more important for innovation to occur in turbulent environments – turbulent environments seen as those registering "globalization, deregulation of markets, changing customer and investor demands and increasing product-market competition" (Jashapara, 2004, p.243). Other studies have researched the way leadership influences knowledge sharing and knowledge creation and subsequently innovation output – see for example Liu and Phillips (2011), a study related to transformational leadership or TFL – however our research is slightly different as is it focuses on servant leadership.

"Servant-leaders focus on identifying and meeting the needs of others, instead of just trying to acquire power, wealth, and fame for themselves. Servant-leaders focus on serving people instead of using people" (Keith, 2010, p.x). Servant-leaders also work vigorously towards "shared organizational values" (Reinke, 2004, as quoted by Prosser, 2010, p.29) which promotes knowledge sharing and results in innovation (Liu and Liu, 2008; Nonaka, 1991, as quoted in Yang et al., 2010; Liu and Phillips, 2011) due to an aligning of individual and organizational goals.

One form of organizational innovation, for example – new product development – is favoured by low uncertainty avoidance (Nakata and Sivakumar, 1996) – or tolerance of ambiguity (Usunier and Lee, 2005) – which is impacted by interpersonal relationships and, in particular, communication effectiveness (Hofstede, 2001). Individuals will feel less threatened by the ambiguous situations that innovation involves, and consequently resist innovation less (De Luque and Javidan, 2004), if they have a favourable organizational climate in which to work – where there is cooperation and trust (Lee and Yu, 2010; Oliveira and Ferreira, 2011c). This favourable climate, where innovation can occur, has to be promoted by senior management (Schein, 1992). Of note is that Portugal was found to have a very high uncertainty avoidance national culture, second only to Greece[6] out of 53 countries (Hostede, 2001; Usunier and Lee, 2005); so,

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[6] Both Portugal and Greece have been severely affected by a much publicized sovereign debt and economic crisis which, towards the end of 2011, is far from resolved.

organizational leaders in Portugal and Greece will have a more difficult task as concerns the fostering of innovation, one which will involve highly-tuned interpersonal skills, such as those of the servant leader (Spears, 2010).

What is considered good leadership "has changed dramatically" (Dierendonck and Patterson, 2010b, p.3) – heroic, hierarchical leaders with an obligation solely towards shareholders have been replaced with calls for "stewardship, ethical behavior and collaboration through connecting to other people" (Dierendonck and Patterson, 2010b, p.3). What we shall also argue is that, currently, such leadership can be found in different measures around the globe, despite a desire and demand for more societally responsible leaders in a "more caring society" (Spears, 2010, p.12). Change is often slow in arriving, meeting much resistance (Kotter, 1990; Kotter and Cohen, 2002; Jashapara, 2004), cycles perpetuating themselves much to the despair of organizational stakeholders. Irving (2010) has already researched the subject of "the cross-cultural perspectives on servant leadership" – in relation to Portuguese speaking countries leadership influence is seen to decline with the use of servant leadership practices, more authoritarian traits of leaders more in line with cultural expectations, rather than the ideal of service to followers. Thus one cannot be surprised that servant leadership is not well-known, as we shall see below, in this most Western part of Europe – Portugal. "In a Catholic culture [such as Portugal] there seems to be no clear distinction between the concept of *servant*... and the concept of *slave*" (Marinho, 2005, quoted by Irving, 2010, p.125) and so barriers exist challenging the wide-spread adoption of servant leadership as a dominant *modus operandi* in Portuguese society, where a high power distance dimension can be found (Hofstede, 1980, 2001), indeed as in Latin America, also, as a whole (Irving and McIntosh, 2009, as quoted by Irving, 2010). African countries where high power distance can be found include Morocco, Nigeria, Zimbabwe, Zambia and Namibia (Carl et al., 2004) and so servant leadership it is expected will also be an unknown leadership type in these societies. Indeed Irving (2010, p.119) quotes Kumuyi (2007) who stated that "what Africa needs for its redemption is servant leadership instead of the self-serving governance that the continent is famed for".

A high power distance (PDI) culture is one where "the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally" (Hofstede, 2001, p.98). In high power distance cultures employees will tend to agree with their superiors as they will be afraid to disagree (Çakar, 2006). In view of this we need to "approach the past, present and future" (Ferch, 2007, p.8) of our cultures, and in particular our dominant cultures, as "the oppressor will never willingly give up power" (Martin Luther King, Jr., as quoted by Ferch, 2007, p.9). On our journey to salvation, humanity will rise (Ferch, 2007), as numerous examples in history have shown us, despite other examples of the World's inhumanity. We see that as servant leadership's reach expands – servant leadership has already "gained hundreds of thousands of adherents" (Spears, 2010, p.24) – its unity will play an essential role in this process.

The case of Southwest Airlines (SWA) (McGee-Cooper and Trammell, 2010), the only airline to manage the most on-time flights, least baggage lost, and lowest level of customer complaints – or Triple Crown – which it has won for five consecutive years – is but one example of how servant leadership is a path to innovations that nurture and capture "hearts and minds" (McGee-Cooper and Trammell, 2010, p.135). We thus hope with our study to increase, in some small way, the awareness of this "art of serving others" (McGee-Cooper and Trammell, 2010, p.143) leadership philosophy.

2.2. Antecedents of innovation

Figure 1 is a result of ongoing research of ours into the process of innovation (see for example Oliveira et al., 2007; Oliveira, 2008; Oliveira et al., 2008; Oliveira and Ferreira, 2011c), and is thus a model we propose of the innovation process. We believe that servant leadership, as it focuses on serving people, promotes interoperability – and interoperability, in turn, leads to innovation.
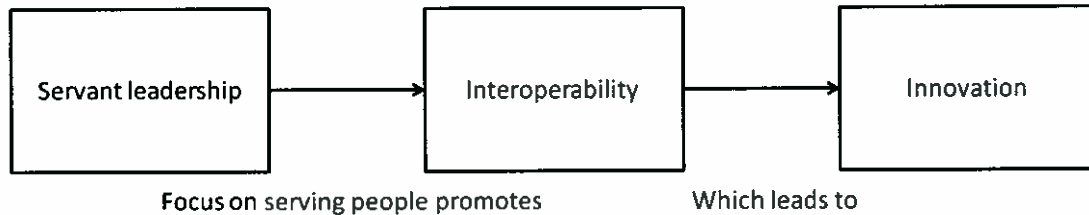
Figure 1. Antecedents of innovation

Moore (2006) provides an extensive listing of innovation types, which can be grouped into four clusters of innovation, and each cluster has, we believe, the same antecedents servant leadership and interoperability. The four clusters of innovation (Moore, 2006) are: 1) Product leadership cluster (disruptive innovation, application innovation, product innovation, and platform innovation) – which involves significant Research and Development investments and market risk and so is appropriate in growth markets; 2) Customer intimacy cluster (line-extension innovation, enhancement innovation, marketing innovation, experiential innovation) – where the core offer is not distinctive at this [mature] stage in the life cycle; 3) Operational excellence cluster (value-engineering innovation, integration innovation, process innovation, value-migration innovation) – where the aim is to lower costs and focus on richer margins in mature market segments; and 4) Category renewal cluster (organic innovation, acquisition innovation, harvest and exit) – where the market is in decline but where incentives still exist to engage with [the most valued] customers. As we shall see below, the companies surveyed each have possibilities of innovating in at least one of these innovation clusters.

The following passages from the literature provide an additional basis for our research, exemplifying antecedents of innovation:

1. A "CEO's [Chief Executive Officer] task-focused behaviors are directly linked to firm performance [and] the CEO's relationship-focused behaviors are related to employees' attitudes and, through these attitudes, to firm performance" also (Wang et al., 2011, p.92).
2. "An organization needs to establish and maintain the relationship among members, encourage high intimacy among them and increase their work efficiency to improve the innovation performance of the organization" (Lee and Yu, 2010, p.1703).
3. "Implications for management practice are that the individual-group emotional connection needs to be taken into account by a company and positively influenced to ensure good innovation performance in the organization" (Oliveira and Ferreira, 2011c, p.66).
4. Leadership behaviors are connected to innovation output as CEOs need to be creative, take risks, and in particular be "bold with innovation" (Wang et al., 2011, p.97).

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5. Furthermore, for the above to occur, some form of interoperability – relating to interactions between systems to create value (Li et al., 2008) – is a requirement – enterprise interoperability types including (EI 5C Model): communication (for the exchange of information), coordination (for the alignment of activities), cooperation (for sharing and partitioning work), collaboration (implying joint work to create innovative solutions), and channel (relating to distribution channels, for example the Internet, involving value innovation and not only efficiency and differentiation) (Li et al., 2008).

2.3. Relevance of the research topic

An analysis of the two July 2011 issues of the African Journal of Business Management reveals a dozen articles related to our research, showing how our research is up-to-date and relevant. Table 1 summarizes our findings in these aforementioned articles. Leadership (Ashraf and Iqbal, 2011; Chen et al., 2011; Islam et al., 2011; Liang et al., 2011; Tsai et al., 2011), commitment (Atak, 2011; Nawaz, 2011; Tsai et al., 2011), communication and interoperability (Chen and Chang, 2011; Islam et al., 2011), and innovation (Chen et al., 2011; Davó et al., 2011; Lee et al., 2011) are areas of research present in the July 2011 sample of articles we have selected. One of the articles (Lazenby and Radebe, 2011) also used students from a university context in its research study. Furthermore, Tabassi et al. (2011) sent out 50 questionnaires and received 32 usable sets, which is less than our survey sample sizes (54 responses by management students and 55 responses by executives from nine industries). Of note is how empirical study is the predominant type of paper (as is the case of our study); also, the questionnaire (a method we also use herein) is the preferred research method. However, none of the articles focus on servant leadership.

Table 1. An analysis of the two July 2011 issues of the African Journal of Business Management showing the relevance of our research topic

Authors	Type of study	Method	Research results
Ashraf and Iqbal, 2011	Conceptual paper	Literature review	Political intelligence of leaders "can help facilitate organizational change effectively"
Atak, 2011	Empirical study	Questionnaire	High organizational commitment is essential in the information age and needs to be increased via organizational measures
Chen and Chang, 2011	Conceptual paper	Literature review	Human competence is firm- specific and is "conceptualized in an organizational context" (e.g. organizational culture and values)
Chen et al., 2011	Empirical study	Questionnaire	The analysis "demonstrates the influence of support leadership on organizational innovation performance"
Davó et al., 2011	Empirical study	Cluster analysis	The results show that five distinct groups of countries exist in the EU-15 "characterized by different levels of technological innovation and

			competitiveness"; Portugal is in the least competitive group
Islam et al., 2011	Empirical study	Questionnaire	"Trust, communication between staff, and leadership were found to have a positive and significant relationship with knowledge sharing"
Lazenby and Radebe, 2011	Empirical study	Questionnaire	"Identification of student perceptions through research will help to guide management in transformational change processes"
Lee et al., 2011	Empirical study	Questionnaire	Knowledge application "has significant positive effect on new product development performance"
Liang et al., 2011	Empirical study	Questionnaire	"Job satisfaction was a mediator of the relationship between transformational, transactional leadership and task performance... Social distance had negative moderating effects"
Nawaz, 2011	Empirical study	Questionnaire	"The motivation of the McDonalds employees is low due to poor employer-employee relationship"
Tabassi et al., 2011	Empirical study	Questionnaire	"Human capital plays a significant role in order to have a successful organization... companies can shape the environmental and organizational settings in order to motivate staff"
Tsai et al., 2011	Empirical study	Questionnaire	"A supervisor with high emotional intelligence is able to perform excellent leading skills to elevate the employee self-efficacy [perceived capabilities to achieve a mission / belief in one's performing skills], and that employees self-efficacy results in a significant positive influence on organizational commitment"

A systematic search of the Science Direct data base, on 20-08-2011, revealed the following search form (Saur-Amaral, 2010), in table 2. However, of the five journal articles that resulted, only two seemed to be related to our research, which was not the case of: Jackson (2009) – about writing for publication; Fry et al. (2005) – focused more on spiritual leadership rather than on servant leadership; and Martin and Novicevic (2010) – related to social entrepreneurship. This led us to do another search, the results of which are visible in table 3.

Table 2. Search form Nº1

Content	Explanation
Objective of the search	Reveal whether research into the area of servant leadership has been undertaken by a significant number of researchers and reveal, also, how recent the interest is in this topic
Data base	Science Direct, as this is a major academic data base
Date of search	20-08-2011
Inclusion criteria	Articles published in journals; containing "servant leadership" in the abstract, title and keywords; in the social sciences area; all years
Total number of articles found	5
First article dating from	1991

The search described in search form Nº2, table 3, differs from that in search form Nº1, table 2, in so far as only journal titles containing "servant leadership" were a target, abstract and keywords not being included this time. The two journal articles that resulted from the search were the same two articles that interested us after our first search, as follows – Liden et al. (2008), who suggest that servant leadership, which "stresses personal integrity and serving others, including employees, customers, and communities" (Liden et al., 2008, p.161), is a multi-dimensional construct that at the individual level explains in-role performance and organizational commitment; Graham (1991) is also relevant to our research topic, and states that servant leadership is a new model of leadership, which is both inspirational and moral, describing three workplace setting examples in the process. In effect, not much research has been performed related to the subject of servant leadership.

Table 3. Search form Nº2

Content	Explanation
Objective of the search	Reveal whether research into the area of servant leadership has been undertaken by a significant number of researchers and reveal, also, how recent the interest is in this topic
Data base	Science Direct, as this is a major academic data base
Date of search	20-08-2011
Inclusion criteria	Articles published in journals; containing "servant leadership" in the title; in the social sciences area; all years
Total number of articles found	2
First article dating from	1991

A search of the Science Direct data base for journal articles relating "servant leadership" to innovation (abstract, title, keywords; social sciences; all years) led to no articles being found. The same result was arrived at for journal articles relating "servant leadership" to interoperability (abstract, title, keywords; social sciences; all years) – no articles were found. This encouraged us to write our current research paper, to add to the literature on servant leadership, interoperability and innovation.

3. Some methodological considerations

We live in the era of organizations, "nobody is anybody outside an organization" (Jordão, 1998, p.592) yet it is also possible "to often get lost inside organizations, to lose one's personal identity" (Jordão, 1998, p.592). Following this line of research we seek to answer a growing need in organizations by making evident the personal narratives of organizational actors. This we have achieved by using a qualitative research methodology, not only in the case study but also in the surveys which had open-ended questions also. We thus hope to contribute to the motivation and fulfilment of organizational characters, who might then make organizational objectives truly their own too.

There are several examples of research which have combined both survey evidence and case studies (Berman and McLaughlin, 1974-1978; and Yin, 1979; as quoted in Yin, 2003). Each method "can pose complementary questions" (Yin, 2003, p.151). While our exploratory student survey was designed to answer: 1) *How many* students desired to encounter servant leadership as professionals; and 2) *How many* students thought that this leadership philosophy would be successful in their country of origin; our survey of executives was designed to answer: 3) *How many* executives thought that servant leadership would be equally as successful in Portugal as in the USA; 4) *How many* executives think they work in servant leadership organizations; 5) *How many* executives would like to have a servant leadership philosophy in their organizations; 6) *How many* executives believe that leadership affects the type of organizational communication; 7) *How many* executives believe that easy and fluid communication [interoperability] can lead to organizational innovation (questions deemed appropriate for this research method, according to the COSMOS Corporation, as quoted in Yin, 2003). The student survey was done first and the executive survey was done second, the results of each complementing each other. Although with a similar objective the exploratory student survey was slightly modified to adapt the questions to professional rather than academic realities – resulting in the executive survey. Other studies have also surveyed students and executives to establish a contrast – for example the IBM Global CEO Study and the IBM Global Student Study (done in 2010 and again in 2012). On the one hand the surveys we undertook indicated the prevalence of a phenomenon, on the other in-depth qualitative insights also resulted as the surveys had open-ended questions rather than fixed-point answer scales – e.g. low (1) to high (7). Fixed-point measures "provide inaccurate and meager information" (Woodside, 2010, p.18); and they also fail to capture "real-life outcomes of interest" (Woodside, 2010, p.18). On the other hand, case study research "is appropriate for several research objectives" (Woodside, 2010, p.11), including the description and explanation of organizational events (Woodside, 2010). More specifically, we were interested in enquiring into *how* servant leadership practices relate to interoperability and innovation (a question deemed appropriate for the case study method, according to Woodside, 2010). Furthermore, triangulation was achieved during our case study via "direct observation by the researcher within the environments of the case" (Woodside, 2010, p.16) – during a company visit the researcher involved observed the work environment during office hours and on a work day; an analysis

which benefitted from: a) The researcher's extensive prior work experience, over three decades, including at several multinational firms; as well as b) Prior experience conducting similar research efforts. Triangulation also occurred by probing and "asking case participants for explanations and interpretations" (Woodside, 2010, p.16) during, as well as after (in person and over the telephone), the semi-structured interviews with the CEO.

4. The surveys (research studies 1 and 2)

4.1. Objectives of the exploratory student survey – Listening to the voices of the future

Scholarly studies of servant leadership are very recent and started with Farling et al.'s (1999) conceptual article (Winston, 2010). "The modern servant leadership movement is still young" (Keith, 2010, p.x) and we thus seek to add to the literature of scholarly studies on the subject as we "do not believe we really 'know' servant leadership" (Winston, 2010, p.180). This empirical study is to serve then as a basis for further discussion about servant leadership. In sum, the main objectives of our exploratory student survey were to "listen to voices of the future" and to:

1. Determine how many students would like to encounter servant leadership after graduating in management studies from university.
2. Determine how many students believe that servant leadership would be successful in their country of origin.
3. Test the Business Narrative Modelling Language (BNML) to see if it can satisfactorily represent the results of the exploratory student survey undertaken. In this process we shall be especially interested in pictorial representations but also in the narrative as we believe, using Jordão's (1998, p.588) words, that "the interpretation of more or less elaborate written or oral discourse is necessary", indeed imperative, in our case to try in whatever small way to contribute to the advancement of management science.

4.2. A description of the student survey

Educating for superior humane leadership is one of the most important jobs, socially speaking, in our view that one can have, and also one of the biggest investments in our future that we can make. Educating for leadership is even more important in the context of an undergraduate management degree – it is an investment in nations, but also an investment globally, working towards a better World, a World which is more productive, but also more cooperative and fulfilling.

During a Services Management course at the University of Aveiro (part of a BSc Management Degree), a public university in Portugal founded in 1973, with 2,500 researchers (including 1,012 academic faculty, 246 researchers and 1,196 PhD students); and a leader in Portugal in number of papers per researcher and considered to be a leader as concerns innovation (UA, 2011), we covered Servant Leadership material. We discussed in class (just under seventy students) the A-P-S Mindset Model (Laub, 2010) as well as cases concerning Southwest Airlines and TDIndustries (McGee-Cooper and Trammell, 2010). Autocratic leadership – defined as that "displayed by leaders who look for sole possession of power and control (Van Looy et al., 2003, p.235) or where leaders lead "for self over others" (Laub, 2010, p.110) – and Paternalistic leadership - where organizations are "led with a parental mindset from the leader and a corresponding child mindset and response from the workers" (Laub, 2010, p.110) – as well as Servant organizations – where leaders lead "for others over self" (Laub, 2010, p.110) – were portrayed, so that the students might be aware of what each type entails. We also had a number of students from Europe doing our program,

around 10% of the total, on what is locally known as an Erasmus student exchange. The presence of international students is seen to be a very important source of diversity and contributes greatly to the success of class discussions.

During the course[7] we asked students to answer questions concerning the leadership of services[8]. This paper discusses some of the findings of this survey (which was not anonymous but due to confidentiality reasons the names of the respondents mentioned herein are not indicated) which was undertaken by just under 60 students in June, 2011. The open-ended questions concerning leadership were as follows:

Leadership of services:

a) How does the [servant] leadership at Southwest Airlines contribute to the results of this company?

b) In your opinion, would the leadership adopted by Southwest Airlines be equally as successful in your home country (specify your country and justify your answer)?

c) If you were to go and work for a services company what type of leadership would you like to encounter there? Why?

Following a discussion of the Southwest Airlines case (a Servant Leader organization), students from Portugal would then thus discuss servant leadership in relation to their country, while European students would discuss servant leadership in relation to their home country. The final question refers to the personal preference of the students, the type of leadership they would like to encounter when they graduate, a very short-term prospect as the course is part of the final semester of their 3-year undergraduate degree in management. Of note is that none of the students in class had heard of the term "servant leadership" before the discussions in class. Indeed, one might add that the term "servant leadership" led to considerable surprise by a number of students who thought that there might be a mistake in so far as leaders cannot be servants? Surely there was a misunderstanding, they stated?

Students finalizing a degree in management at a major university are very aware of what they might encounter in the workplace, having had lectures on human resource management and other management-specific courses from experienced professors, so the opportunity to listen to their views was seen to be very positive.

The results of the questions were as follows, as represented in table 4.

Table 4. Results presented by students concerning servant-leadership (54 valid answers)

Question	Answers[9] in %
Opinion that servant leadership at Southwest Airlines (USA) contributed	Yes – 100%

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[7] Professor Irina Saur-Amaral was the Regent of the course in 2010-2011 and her insights into services management were greatly appreciated.

[8] Though the questions were asked by the lecturer in a context where the students knew they were being evaluated we believe that no additional bias was introduced. The detailed answers to the student survey, answers which were very diverse and sincere, were very similar to the results of the other executive survey as well as to the case study, both of which are also described herein.

[9] Answers include five responses from international Erasmus students – from Latvia (three students), Germany (one student) and Romania (one student). The rest of the respondents are from Portugal.

significantly to the results of this company				
Opinion that servant leadership would be successful in their home country	Yes – 20.8%	Yes, but with some difficulty – 22.6%	No – 56.6%	
Preferred type of leadership	Servant leadership – 53.7%	Paternalistic leadership – 3.7%	Democratic leadership – 33.3%	Other – 9.3%

A discussion of the survey answers, including quotes, follows below.

4.2.1. Answers to question 'a':

a) How does the [servant] leadership at Southwest Airlines contribute to the results of this company?

The totality of the students surveyed were of the opinion that servant leadership at Southwest Airlines contributed very positively to the results of this company. Some of the views of the students surveyed follow below, showing their enthusiasm with the servant leadership philosophy:

> "Southwest Airlines is a great example for all companies because of its leadership and relationship between leaders and other employees." (student from Latvia).

> "Southwest Airlines adopted the servant leadership model in which leaders serve employees. Thus, employees will work with more freedom, more maturity and more responsibility to better serve customers... Leaders also have lower salaries than in the competition and this guarantees that whoever works at Southwest Airlines enjoys what they do and likes the company." (student from Portugal).

> "This model [Servant Leadership] is characterized by the fact that the leader is seen as a "servant" of the employees. This type of leadership contributes to the results of the company as employees are called to participate, they are not afraid to participate and their opinions are taken into account and are valued. Thus employees will feel more responsible and happier and that will have an impact on customer satisfaction... Furthermore, as there is profit-sharing with employees, employees are more motivated to achieve good results for the company." (student from Portugal).

The objective of Southwest Airlines and how it impacts results is made clear by the following statement:

> "Southwest Airlines is a servant leadership [company]... The overall objective is to create an atmosphere and organizational culture of trust, where creativity and risk-taking are promoted. Employees that are hired have to be motivated and already have a positive and friendly character... Southwest Airlines puts its employees first and its customers in second place. This contributes to the success of the company because satisfied employees have a positive impact on their clients" (student from Germany).

As concerns alternative types of leadership, students stated that:

"Fear and a lack of trust are present in autocratic leadership organizations, which are based on leadership for the self and not for others, and which I don't think is the best model" (student from Portugal).

"... with this type of [servant] leadership I would feel part of a whole, all treated equally, all able to contribute with ideas and in decision-making, no-one likes to feel nullified" (student from Portugal).

4.2.2. Answers to question 'b':

b) In your opinion, would the leadership adopted by Southwest Airlines be equally as successful in your home country (specify your country and justify your answer)?

A relatively small percentage of the respondents believe that servant leadership will work well in their home country (20.8%):

"Yes, servant leadership will work, as allowing employees to be creative is essential in all countries" (student from Germany).

A slightly higher percentage (22.6%) believes that servant leadership will work in their country but with some difficulty, as the following testimonies show:

"Yes, servant leadership can be successful in Portugal, but with some difficulty – we need to change the current dominant type of autocratic leadership in Portugal. Here we have a different organizational and national culture in Portugal than in the USA – with greater power distance, a more rigid hierarchy, top-down leadership, and attitude & personality are not valued as highly as competences" (student from Portugal).

"Yes, but with some difficulty... Servant leadership would be difficult to implement due to our history as a communist nation under Russia" (student from Latvia).

Furthermore, special care will have to be paid, stated some survey participants, to the selection of human resources for servant-led companies, to make sure that "greedy" people, who seek primarily high salaries, rather than fulfilling jobs where people come first, are not selected. Also, the belief is held that older employees will have greater difficulty in adapting to servant leadership, especially in Portugal. Finally, some respondents mentioned that servant leadership would work in companies which start with this philosophy from the outset, rather than trying to change an organizational culture in an existing company to that of servant leadership:

"Yes, servant leadership would work well, but with careful selection of employees, and in a firm starting anew, not an existing firm trying to change" (student from Portugal).

The majority of respondents (56.6%), however, believe that servant leadership will not be successful in their home country. Reasons for this include cultural aspects – for example, as mentioned above, the historic tendency for autocratic leadership in Portugal. A girl from Romania stated:

"Servant leadership will not work [in Romania] due to cultural traits - politeness & humbleness are not strong points due to our communist past."

Other respondents stated:

"Great motivation to serve is lacking in Portugal; here we find the opposite of what servant-leadership requires; organizations are too paternalistic, protectionist, employees prefer to follow orders, there is an aversion to risk and

change in Portuguese culture; owners of businesses take charge of the important issues" (student from Portugal).

"The Portuguese have a very closed mentality and the culture is too rigid; people won't agree to being servants of others; lower salaries e.g. for senior management, as at Southwest Airlines, would not be acceptable for the Portuguese who are too greedy; Portuguese culture change is necessary" (student from Portugal).

4.2.3. Answers to question 'c':

c) If you were to go and work for a services company what type of leadership would you like to encounter there? Why?

As concerns the preferred type of leadership, the majority of respondents would prefer to work for a servant-leadership organization (53.7%). This is seen to be a very positive result, especially if one takes into account that 33.3% of the respondents would prefer Democratic leadership – "characterized by sharing authority and power between superiors and employees" (Van Looy et al., 2003, p.235) – but in describing this type of preferred leadership they actually describe a philosophy very close to that of servant leadership – e.g. where there are more equal relationships (less hierarchical distance between leaders and employees), where there is empowerment, dialogue, consultation and authenticity. One may be led to believe that indeed the denomination "servant leadership" does confound Catholic respondents who might be led to believe that "servant" and "slave" are similar and not compatible with leadership (confirming research by Marinho, 2005, as quoted by Irving, 2010). A positive testimony of one of the students was:

"It would be good to work in a place where people enjoy what they do" (student from Romania).

Good communication, an enterprise interoperability type as "the main purpose of interoperability is to exchange information" (Li et al., 2008, p.20), was brought up several times, as the following testimony shows:

"Working at a place with equal rights; where suggestions are accepted from below; where there is good communication, a good work atmosphere; that would be nice!" (student from Portugal).

The main tendency of the respondents is to want to work for organizations where the corporate culture is seen to be healthier, with employees enjoying their work; where creativity is valued, and where information flows freely. The desire to not encounter autocratic leadership at an employer is significant. Servant leadership is also seen to be a solution for Portugal's current economic problems, as one Portuguese student stated:

"Yes; servant leadership would be, in my opinion, important for Portugal, to have it implemented here; due to the difficult times we are living – [record] unemployment, IMF [International Monetary Fund] intervention, precarious work – people are not satisfied or motivated to serve others; however, if they are valued, for sure, from a services perspective, companies would do more favourably."

4.3. A portrayal of the results of the student survey using the Business Narrative Modelling Language (BNML)

Within organizations, particular versions of reality can be represented by the narratives of the participants (Gold and Watson, 2001). Stories and narratives have considerable

value in the process of organization learning (Gold and Watson, 2001) and thus should be used to promote the [continuous] change process. What we propose is to model the narratives in the business context using a visual language telling a story based on business patterns and ontologies. We will thus promote the generalized comprehension of primary organizational issues, leading to the creation of value, using a visual tool representing occurrences over time. Our Business Narrative Modelling Language (BNML) has evolved over time (Oliveira and Ferreira, 2010a, b, c, 2011a, forthcoming). Much as Wang et al. (2009), we also set out to [ideally] combine multiple narratives into one single narrative, in our case a BNML representation (rather than applying a forecasting algorithm as in Wang et al., 2009). This BNML representation can then be used as a road map for organizational change.

The organizational narratives gathered in our survey were first converted into a value network (Allee, 2000a, b, 2002, 2008) of deliverable exchanges, both tangible and intangible, shown in figure 2. We then added a timeline to our analysis, with business patterns also contributing to the communication of business concepts (figures 3 and 4).

The life of an organization can be represented in BNML constructions which capture its vitality. For this to be realized a certain intuitive dose of business sense is necessary, in the selection of the business patterns, but not in so large a dose as is necessary when applying other qualitative methodologies (in which we might include Grounded Theory, for example).

In applying the BNML methodology, benefits include saving time in the qualitative research process. An extensive list of business patterns is already available in Bjork and Holopainen (2005), and is recommended for use, rather than having the researcher search for original patterns to interpret and communicate organizational meanings. This is convenient but at the same time flexible enough to allow researcher creativity in interpretation. The resulting analysis is in-depth, as it combines the accuracy of the narrative and the simplicity and generality of visual mapping (Langley, 1999). Furthermore, our brain is divided into two separate parts or hemispheres "which interpret the World differently. The left-brain thinking or the L-mode is the analytical, quantitative, verbal, rational, linear, step-by-step thinking. The right-brain thinking or the R-mode is the integrative, qualitative, holistic, creative, and visual thinking" (Ramos et al., 2011, p.3). We thus seek to appeal to both sides of the brain when using BNML in the research process, "to improve the learning processes and the mechanisms of communication" (Ramos et al., 2011, p.3).

Figure 2 shows the result of the student survey narratives and is the first step in the BNML process, showing a value network for a servant-led organization.

In figure 2 the roles of the seven organizational actors, represented by the oval shapes, as well as the tangible (continuous lines) and intangible transactions (dotted lines) are evident. The story starts with recruitment and selection. Recruiting and selecting new employees is seen to be a very important activity and the department in charge must seek the right values and attitude in candidates, as the following survey testimony testifies:

> "*Servant leadership, such as that found at Southwest Airlines, so profoundly concerned with the well-being and development of its employees, could be as equally successful with Portuguese employees – for that to happen great attention to recruitment and selection is a requirement, in order to hire those who could work effectively under this type of leadership, otherwise this way of working in organizations seems utopia in Portuguese society*" (student from Portugal).

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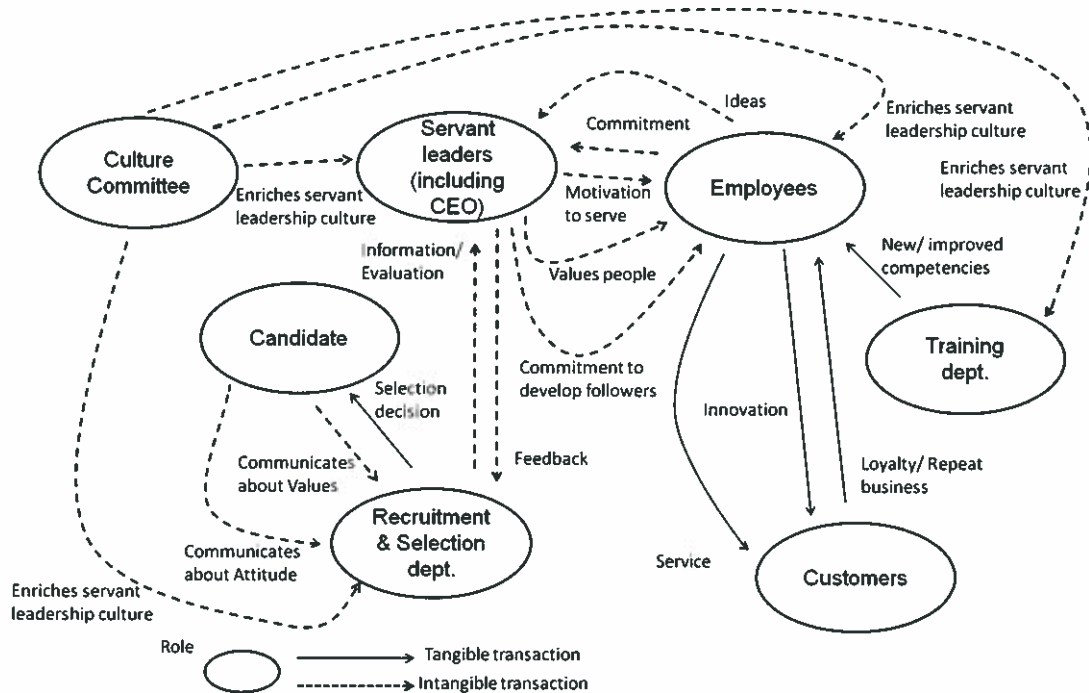
Figure 2. A value network used here to portray servant leadership according to "voices of the future"

An evaluation of the candidates would normally be passed on to the CEO or other servant leaders who might give some feedback but, due to the empowering of employees, the decision to hire will rest with the recruitment and selection department. Furthermore, Upper-Echelon Theory (Hambrick and Mason, 1984, as quoted in Winston, 2010) states that there will be a flow of the servant leader's (CEO's) values and beliefs to employees and is apparent in the motivation to serve and importance attached to people (values), which the CEO passes on. Employees respond with commitment and ideas to improve the business. Furthermore, employees, having been hired for their values and attitude, are developed by the training department, who will thus ensure new competencies are gained. Employees are thus in a position to serve their customers well and feel free to innovate in their service delivered. Customers respond with repeat purchases (loyalty), a valuable organizational resource. Finally, the Culture Committee, as described in McGee-Cooper and Trammel (2010), was also brought up by the students in the survey:

> "*Servant leadership is present in all aspects of the organization, being an integral part of its culture... to ensure that this unique culture is inculcated in all of the members of the organization there is a Culture Committee...*" (student from Portugal).

The Culture Committee is responsible for organizational survival and "recursive self-maintenance" (Bickhard, 2002, as quoted in Aveiro and Tribolet, 2007) – a process of creating and enriching the servant-leader culture. In servant-led companies "an important part of our culture is to be self-correcting" (McGee-Cooper et al., 2007, as quoted in McGee-Cooper and Trammell, 2010, p.136).

Figure 3 shows another view of the student narratives captured in our in-depth survey (BNML). Here we see events occurring over time, as in a story, from recruitment and selection – to the capture of value (the reward for superior service is customer loyalty)

– and finally on to 'resilience dynamics' (Christensen, 2002, as quoted by Aveiro and Tribolet, 2007) interpreted in the final pattern 'Chargers'. Organizations are like engines which need to charge batteries (perform resource substitutes) to function properly and the pattern Chargers ensures that attention is given to the charging / replenishing and repairing of the various departments and individuals when they depart from the norm. To the pattern sequence – commencing with the alignment of attitude and values to servant-led organizations – is added ontology detail (Uschold et al., 1998; such as "Critical success factor" – recruiting candidates who value people above money) which is attached to each event (deliverable exchange).
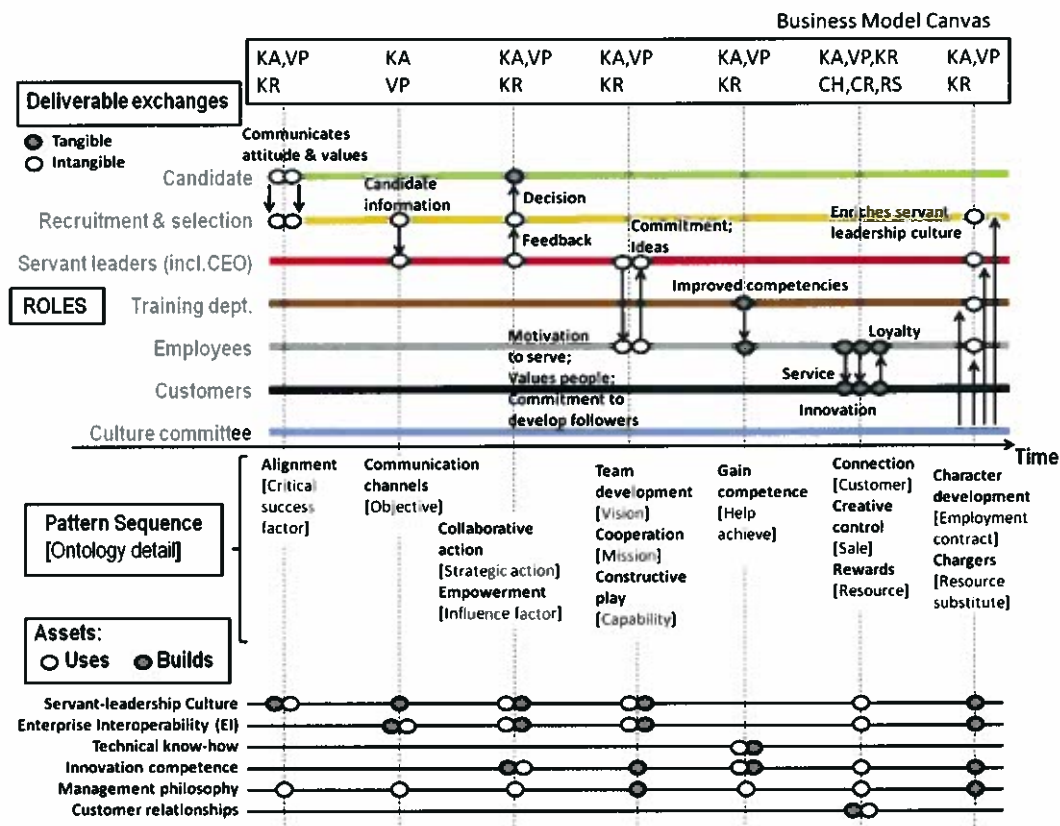
Figure 3. Deliverable exchanges between roles; a pattern sequence over time; assets built in a servant-led company (BNML)

In figure 3 we can also see that the pattern communication channels (a form of interoperability) is seen to be an objective (ontology detail in brackets). The pattern collaborative action (another type of interoperability) which occurs between recruitment and selection and the servant leaders is seen to be strategic, the former being empowered to make recruitment decisions. The patterns team development (of a unified vision), cooperation (having a sense of mission, which comes into being through yet this other type of interoperability) and constructive play (a capability) are also evident in exchanges between the servant leaders (including the CEO) and employees – with no "gate-keepers" involved (actors who might inhibit the communication exchange and thus have a negative influence on enterprise interoperability). The training department helps employees gain valuable competencies in order to perform their work tasks (given that employees have the right attitude and values, for which

they were selected). Ideas flow and employees connect with customers. Finally, creative control leads to sales and to innovation. In servant-led organizations, due to the empowered value network, there is no fear of innovating and contributing with unique insights. This is seen to be in stark contrast to autocratic leadership organizations where a lack of interoperability exists due to the fear of reprimand, due to the fear of being terminated if things go wrong following risk-taking. Autocratic leadership leads to the extinguishing of ideas and creativity in the organization. In servant-led organizations creative control will lead to rewards such as customer loyalty, also evident in figure 3.

Of note is that in figure 3 the assets (at the bottom of the figure) appear in a given order – the servant-leadership culture and corresponding management philosophy (which exists at the outset) precede an enterprise interoperability (EI) capability – which is progressively built as communication, collaboration and cooperation are encouraged to occur freely, without constraint. It is only after the EI capability has come to function that an innovation competence is progressively built and used – fruit of the aforementioned communication, collaborative actions, cooperation and empowerment. So, eventually, innovation will be the result of the servant-leader culture and EI. The servant leader(s) and EI are thus antecedents of innovation – innovation which is a deliverable and which appears on the front line in the innovative employee-customer service interactions.

Student survey testimonies which are very relevant and that provide evidence as to leadership and interoperability being antecedents of innovation are as follows.

Servant leadership leads to a free flow of information in the organization, thus promoting interoperability:

> "Yes I would like to work in a servant leader organization where leadership allows for a free communication flow in the organization, contrary to authoritarian leadership where the voice of lower hierarchies is censored or filtered or altered by the time it reaches higher hierarchical levels" (student from Portugal).

Servant leadership is also seen to lead to innovation by promoting free channels for communication:

> "Servant leadership allows you to feel more "free" to make suggestions for innovation and you are not scared to be insulted or even fired" (student from Germany).

> "The main benefits of servant leadership are that with servant leadership the focus is not only on the leader; there is a sharing of power & responsibility, there is more autonomy and empowerment, with the possibility to contribute with ideas" (student from Portugal).

> "With servant leadership people are valued above money and creativity is encouraged; there is a healthy work environment; leaders serving others before self" (student from Portugal).

The Business Model Canvas (Osterwalder and Pigneur, 2010; Oliveira and Ferreira, 2011b) is also present in figure 3 (at the top). The Business Model Canvas is a tool which can be used to make evident who we are creating value for, and how. It has nine basic building blocks, six of which can be seen in figure 3 (KA, VP, KR, CH, CR, RS). Recruitment and selection is a key activity (KA). Current and future employees are key resources (KR). The value proposition (VP) is delivered due to the servant-led culture / employees. Very significantly, the stage involving contact with the customer is where the most business model canvas building blocks are used (six). Innovative servant-led (VP) empowered service (KA) is delivered via employees (KR, CH) in a service company; who develop customer relationships (CR) – which are the resource stream

(RS) of the company. Finally, as mentioned above, we can see the culture committee ensuring character development and a 'charging' of:

1. The servant-led corporate culture;
2. Enterprise interoperability;
3. The innovation competence; and, ultimately,
4. The management philosophy.

Figure 4 offers another BNML representation, complementing figure 3. The seven character storylines come together for social interaction, portrayed by the wavy lines moving around and connecting in grey clouds. Progress is dynamic in the value network and the narrative occurs over time, according to patterns (the same patterns as can be found in figure 3).
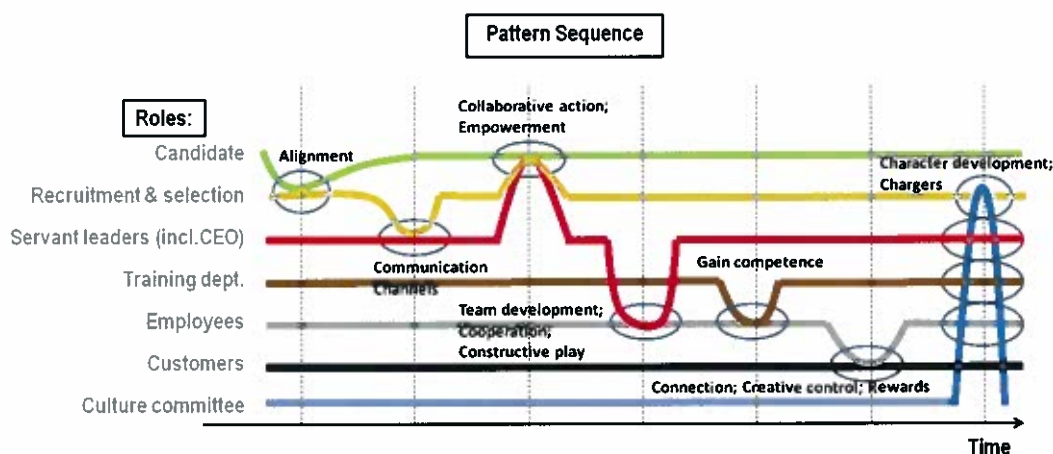
Figure 4. Roles and corresponding pattern sequence over time (BNML) in a servant-led company

The patterns in figure 4 are in fact key organizational terms: proper alignment from the outset, with communication channels in place, leads to collaborative action; empowerment leads to team development, cooperation and constructive play; as employees gain competencies they connect with customers through creative control and rewards are then reaped (innovation leads to superior products and service and consequently to additional sales and customer loyalty). Finally, characters are continuously developed and the organization charged. How the characters achieve this, who they have to interact with over time, is shown in figure 4.

We feel that with our BNML visual representations of narratives that the communication of essential organizational concepts is easier and more far-reaching, thus contributing to the interoperability of management concepts, now made more accessible to a wider audience, including outside the academic arena.

4.4. Survey 2 - Objectives and discussion of the executive survey

The executive survey was distributed during the month of October 2011, in Portugal, to nine companies in nine different industries, as follows: automotive seat manufacturing, automotive glass repair and replacement, food and beverage services, wood distribution / civil construction, telecommunications, information systems consulting, management software manufacturing, electric equipment manufacturing (motors and fans / ventilators), and metal dish / pot manufacturing. Company CEOs [Chief Executive Officers] and Directors were approached in order to gain access to their

organizations for survey purposes. Of note is that after reading the survey in all cases the survey was deemed appropriate for executives rather than for "rank and file" employees, who are not in touch with the debate concerning leadership. The survey was anonymous, as the survey topic was considered to be quite sensitive e.g. a discussion of current and preferred leadership types, and each company was given a distinct Internet (Google Docs) address to access the survey. Some insistence with the companies was necessary in order to improve the response rate from their executive teams as there is not a strong tradition in Portugal of companies participating in academic research efforts. Indeed one company which was contacted decided to not participate in the study at all. Respondents to our executive survey are Company Presidents, Company Owners with executive responsibilities, CEOs (Chief Executive Officers), as well as functional directors (such as Quality Directors, Production Directors, Financial Directors, Sales Directors, Continuous Improvement Directors and Marketing Directors). The format was slightly modified in relation to the exploratory student survey as Servant Leadership had to be defined, as well as Autocratic Leadership and Paternalistic Leadership. Students did not have to be given such information as leadership types had been a subject of discussion in class. An objective of the study was to complement the student survey, which had had very interesting results. Furthermore, our executive study focused specifically on interoperability and innovation: What is the relationship between interoperability and innovation? While a relationship is likely to exist, according to the literature (Gasser and Palfrey, 2007), it is seen to be very hard to prove (Gasser and Palfrey, 2007) and this is thus a main objective of this paper. The executive survey format can be found in the annex of the article. Table 5 summarizes the quantifiable findings.

The majority of respondents (60%) believe that servant leadership can be successful in Portugal, much as it is in the USA. The leadership type thought to exist in the companies where the respondents work is: 1) Autocratic Leadership (38.18%); 2) Paternalistic Leadership (32.73%); 3) Servant Leadership (7.27%); 4) Other (21.82%). Thus autocratic leadership is the predominant type of leadership however paternalistic leadership follows close behind. Servant leadership, with less than 8% of the answers, is lacking in the sample of Portuguese companies. A somewhat surprising result concerns question 5 – "Indicate the type of leadership which you would like to find at the company where you work." The vast majority would prefer to work in a servant-led organization, with 65.45% of the executive respondents indicating this preference (we recall that the student survey revealed a very similar tendency). This might signify that a certain degree of dissatisfaction with current leadership styles is present in the sample. The executive respondents were unanimous in stating that leadership type affects organizational communication. Given that the respondents also believe that easy and fluid communication (interoperability) leads to corporate innovation (100% of the respondents answered "Yes" to question 10), and that this can only occur in the absence of autocratic leadership (autocratic leaders lead to employees fearing to give their honest opinions and contributions), one may be led to believe that, given the percentage of autocratic leaders encountered in the sample (close to 40%), Portuguese companies may be losing innovation opportunities and failing to tap into the potential of their employees.

Table 5. Executive survey findings – A summary of the quantifiable answers

Question	Answers in %			
1) In your opinion, would this type of leadership at Southwest Airlines – Servant Leadership – be equally as successful in Portugal?	Yes – 33 (60%)		No – 22[10] (40%)	
3) What type of leadership do you think exists in the company where you work?	Autocratic Leadership – 21 (38.18%)	Paternalistic Leadership – 18 (32.73%)	Servant Leadership – 4[11] (7.27%)	Other – 12 (21.82%)
5) Indicate the type of leadership which you would like to find at the company where you work.	Autocratic Leadership – 2 (3.64%)	Paternalistic Leadership – 9 (16.36%)	Servant Leadership – 36 (65.45%)	Other – 8 (14.55%)
8) In your opinion, does the type of leadership which exists in a company influence the type of communication?	Yes – 55 (100%)		No – 0 (0%)	
10) Can easy and fluid communication [interoperability] lead to corporate innovation?	Yes – 55 (100%)		No – 0 (0%)	

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[10] One respondent stated that servant leadership would not be applicable at multinational companies (such as where the respondent works) but only in SMEs (Small and Medium Enterprises).
[11] One respondent stated that a mix between democratic and servant leadership exists at his / her company. This was considered a servant leadership answer.

4.5. Some qualitative contributions of the executive respondents

The executives confirmed what the students said about servant leadership, interoperability and innovation. This may mean that at top academic institutions students are being well-prepared for the "real" World. Furthermore, this may also mean that executives at well-performing organizations remain connected to academia, be it through training and / or the reading of key books and reports. Executive survey comments follow below.

4.5.1. Comments to question 1) In your opinion, would this type of leadership at Southwest Airlines – Servant Leadership – be equally as successful in Portugal?

Servant leadership, for the majority of the executive respondents in our survey, is seen to be an avenue to bring out:

> "... the best from inside of each employee" (executive participant);

Thus being a leadership type which:

> "Will bring the most success to the company and that will for certain improve the social environment in the company" (executive participant).

However, 40% of the executive respondents, which is significant, stated that servant leadership is not applicable in Portugal (40% is still lower than the 56.6% registered in the student survey – so the executives surveyed appear to be more optimistic than the students, with 60% believing that Portugal can implement this leadership philosophy). One executive respondent, who believes that servant leadership is not applicable in Portugal, stated that:

> "The Portuguese are not prepared to be led [by servant leaders]. The Portuguese at work are normally small-minded, they dissimulate, they are sly, they do not like doing much, they are concerned with stepping on their colleagues to stand-out, and consider themselves to be under-paid and exploited by their employers. Thus Portuguese employees are in essence too small to understand this type of [servant] leadership."

Another executive stated:

> "[Servant leadership] wouldn't work in the Portuguese culture. The Portuguese are excellent employees when they are told [ordered] what to do, with well-defined tasks, and always controlled."

Yet another executive stated that:

> "...I would say that the average Portuguese worker would have some difficulty in working as described at Southwest Airlines. It could be an "urban / organizational myth" but the average Portuguese does not react badly to a leadership type which is autocratic."

Surprisingly, another respondent stated that they have autocratic leadership at his / her company and this is the desired type of desired as:

> "... leadership should be like that [autocratic] otherwise it is not really leadership."

Somewhat in contrast, and suggesting that Portuguese employees are not happy at work, an executive stated that:

> "I think that servant leadership could be successful, as we increasingly give less importance to people and more to the results of the company, we are in a period where the focus is results and nothing more. With this type of [servant]

leadership we could probably achieve the same results, but with satisfied employees, a situation which in my opinion doesn't occur nowadays."

However, servant leadership was also thought to not be viable in Portugal for other reasons. One executive stated:

"A service culture is not yet sufficiently disseminated [in Portugal] like in the USA (X amount of aviation companies operating for X amount of years) which requires taking big risks in new leadership models and of service differentiation."

Yet another executive stated that the issue is not whether servant leadership will be successful or not in Portugal, which is reducing the problem. Rather:

"Servant leadership will have much more to do with the culture or even micro-culture of a given organization and the tissue / situation in which it operates, rather than with nationality."

4.5.2. Other leadership types found at the companies where the executive respondents work; comments concerning other preferred scenarios

A significant percentage of respondents – 21.82% - indicated "Other" as an answer to question 3. The "Other" leadership type indicated varied among respondents. One executive described a leadership type quite close to that of servant leadership:

"Our company has a model known for the importance given to the training of employees, to their involvement in decision processes."

The executive called this a Participative or Collaborative Leadership type in which the main people are heard before the taking of decisions and where people are given the autonomy and conditions so that the "implementers" will have the environment in which to be successful. Another interesting leadership type, again preferred and practiced at the respondent's company, was described as follows:

"I would call it Technocratic Leadership – Leadership by professional / technical / management competencies... a sum of personal (soft skills) and professional / technical (hard skills) – competencies which need to be demonstrated along diverse "achievements" in order to guarantee the environment which will have the greatest success."

Another leadership type indicated as existing at one of the sample companies was Democratic Leadership:

"... where the leader delegates competence and tries to define strategies with his / her team."

Yet another leadership type seen to be existing in a company which was a part of the survey is a mix between Paternalistic and Servant Leadership. However, in these two latter cases, servant leadership as a leadership type would be a preferred scenario (over Democratic Leadership and the mix between Paternalistic and Servant Leadership).

One executive respondent stated that he / she would like to work under a shared leadership model, albeit with a strong influence of the leader, focused on corporate objectives but also on the creation of more jobs and excellent conditions (those possible) for the workers. Given the current poor economic situation in Portugal, where currently lay-offs are very commonplace and widespread, this might not come as a surprise.

4.5.3. Comments to question 8) In your opinion, does the type of leadership which exists in a company influence the type of communication?

One respondent stated that:

> "Communication is directly linked to the leadership type, the more open the leadership is with the team the better communication will flow."

Another respondent stated, showing the importance of interoperability, that:

> "We cut two levels in the hierarchy so that communication and information would flow more clearly and quickly."

Another respondent added that:

> "Autocratic leadership might lead to non-information, for fear of failing."

A similar comment by another respondent was that:

> "Who wants to communicate with an autocratic leader? Who wants to say "No" or suggest different paths? Only someone committing suicide does that."

As the predominant leadership type in our survey is autocratic leadership, this may mean that good / honest communication is simply not occurring in those companies.

4.5.4. Comments to question 10) Can easy and fluid communication [interoperability] lead to corporate innovation?

The sample was unanimous in saying "Yes" to this question, which we see as being instrumental in answering the research question: *what is the relationship between interoperability and innovation?* Easy and fluid communication – interoperability – is seen to lead to innovation, according to the 55 executives surveyed. One respondent stated that fluid and uninhibited communication encourages maturity and a sense of responsibility in the workers, which is seen to be very positive. Another respondent stated that fluid and fast communication makes the company "go" faster; leading also to less bureaucracy, which will mean company processes are more agile and this will make innovation possible. On the other hand, continued this respondent, less fluid communication and more difficult (bureaucratic) communication leads to people being lax and with a lack of initiative, corresponding to less innovation. Yet another executive stated that if people feel at ease to communicate then the subsequent exchange of ideas will lead to innovation occurring. Another executive stated simply that:

> "From discussion comes the light".

Surprisingly, in a company where there is a predominantly autocratic leadership type, seen to be desirable in that company by this respondent, and meaning that communication will probably be inhibited, nonetheless the respondent acknowledged that the more you discuss and communicate the more new ideas and solutions will result, which will facilitate organizational innovation. Are some companies resigned to the fact that innovation is not for them? Finally, one executive stated interestingly that good communication can lead to a good development of the company but that this in the vast majority of cases will not mean innovating at all! In the cases where there is innovation, continued this executive, the applied development will have to have had good communication:

> "These processes are born from team work in the majority of instances – it is necessary to bring together to the same table those with market knowledge, those who know the technology / projects, and those who know the manufacturing side or logical chain."

5. Leadership, interoperability, innovation and competitiveness

5.1. A discussion of the situation in Portugal in view of the student and executive survey results

Hofstede's analysis of Portugal was quoted in the exploratory student survey by a student. Hofstede, in particular – "a Dutch social psychologist who did a pioneering study of cultures across modern nations"[12] which led to Hofstede being "internationally the most cited professor among Dutch economists... With 3240 citations, Hofstede's work in the field of organizational culture leaves other economists far behind"[13]; Hofstede having been included in an elite group of the top twenty most influential management thinkers Worldwide, named by the *Wall Street Journal* (White, 2008; Hofstede et al., 2010) – stated that as Portugal is seen to have a high power distance culture (20 points above the European average, on a scale of 0-100[14]; Hofstede, 1980, 2001), characterized by "employees being afraid to express disagreement with their managers" (Hofstede, 2001, p.85) and "information constrained by hierarchy" (Hofstede, 2001, p.108), autocratic and paternalistic leadership are the dominating leadership philosophies in this country (Hofstede, 2001). This was confirmed by our executive survey and may mean that an environment conducive to innovation, in Portuguese organizations, is not occurring, even though it is especially in need, given the recent turbulent environment felt globally. Given Portugal's diminishing competitiveness, according to the Global Competitiveness Index 2010-2011, where Portugal is ranked 46th (World Economic Forum, 2010), down from 22nd in 2005-2006, healthy leadership, where employees contribute without fear of reprimand and where information flows freely – a high degree of interoperability between systems existing – may need to be made a national priority. The need for enterprise interoperability (EI), in our current age of ubiquitous technology undergoing constant, and rapid, change, will in turn require information and communication technologies (ICT) as an enabler. EI will in these conditions lead to innovation and in turn to economic growth. The cycle will then continue, as the need for EI is self-perpetuating. In such an environment, servant leadership principles will be an underlying assumption.

A nation's culture may take as long as one hundred years to change (Hofstede, 2001). There is then not a day to be lost. The turn towards servant leadership needs to occur, not only to result in healthier organizations, but to improve the global competitiveness of organizations and nations alike, also. Furthermore, this is the predominant desire of both the younger generation, who are soon to be graduating from university, as well as the executives in our sample – that they be empowered to serve and to contribute to a better future for their organizations and countries.

5.2. Some additional conclusions of our research – The building and usage of an enterprise interoperability (EI) capability

Building on our discussion of the narratives in the surveys leads to the following BNML interpretation in figure 5 concerning the building and usage of an enterprise interoperability (EI) capability. This figure represents a servant-led company in motion, not taking into account, for example, recruitment and selection as in figures 3 and 4 (recruitment and selection was not brought up by the executives surveyed).

So, it is an EI capability (an asset at the bottom of figure 5) which will lead to innovation, first occurring in the communication channels pattern (also present in figures 3 and 4). Communication will evolve into knowledge sharing, involving all employees, so essential for innovation to happen and evident in the last pattern

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[12] http://www.geerthofstede.nl/, accessed on 26-08-2011.

[13] http://www.fdewb.unimaas.nl/os/diversity.htm, accessed on 26-08-2011.

[14] http://www.geert-hofstede.com/hofstede_portugal.shtml, accessed on 29-08-2011.

collecting (collecting resources or revenue streams from customers). Servant leaders, by opening up communication channels, by encouraging collaborative action, and by empowering employees (three patterns in figure 5), manage to increase organizational commitment, trust, and employee motivation – appearing in figure 5 as intangibles. These intangibles are instrumental for the appearance of the asset recursive self-maintenance (to charge the enterprise) and are essential also for the patterns constructive play and creative control to occur. Innovation is then delivered to the customer. The Business Model Canvas is also present in figure 5 (at the top) – making politically intelligent decisions is just one of a number of key activities (KA) in servant-led companies; organizational commitment, trust and motivation are examples of key resources (KR) present in servant-led companies; and finally, it is the value proposition (VP) to be able to continuously change – creatively – that will lead to superior customer relationships (CR) and a consistent revenue stream (RS).
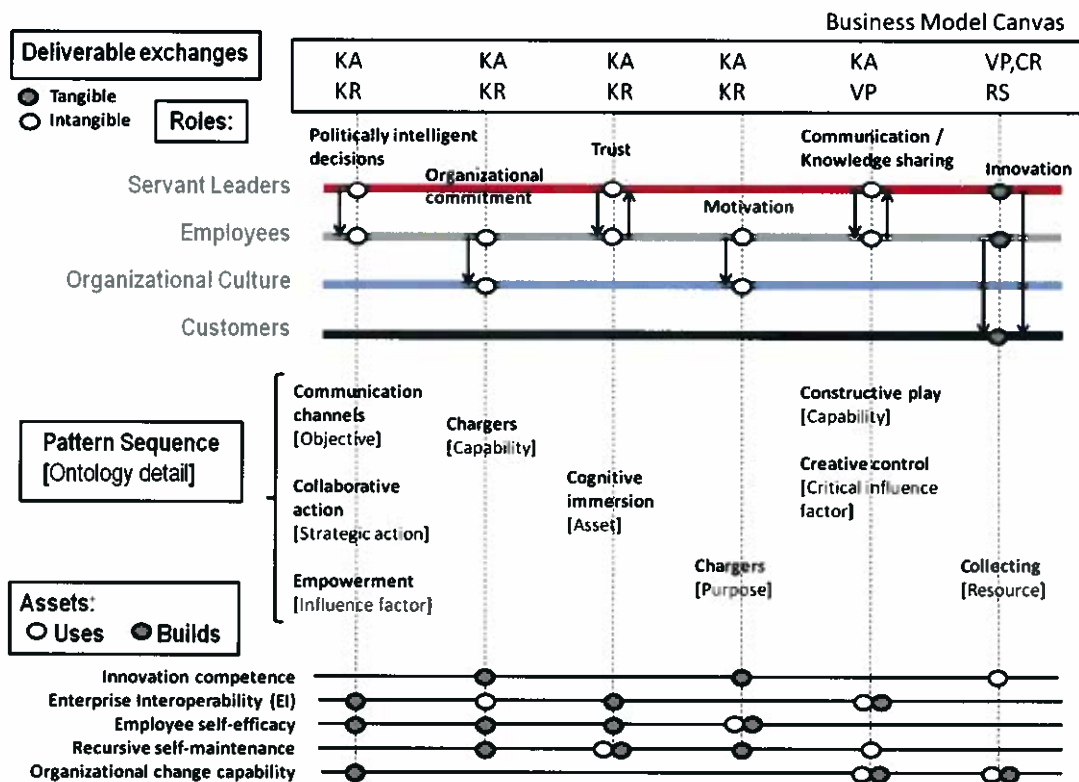
Figure 5. The building and usage of an enterprise interoperability (EI) capability

Our additional research conclusions, building also on our literature review, are thus that:

1) Servant leaders are seen to be politically intelligent, thus facilitating organizational change (innovation).
2) Furthermore, servant leaders increase organizational commitment by acting on the organizational culture.
3) Servant leadership increases trust and communication between staff, thus increasing knowledge sharing which may lead to innovation.
4) Servant leaders increase employee motivation due to good employer-employee relationships and by shaping the environmental and organizational settings.

5) Servant leadership elevates employee self-efficacy – an employee's perception that he / she can achieve a mission – which is essential to organizational success as "self-confident people are more likely to keep at it and succeed" (Tsai et el., 2011, p.5322).

6. The case study (research study 3)

6.1. Infosistema – A case of servant leadership in Portugal

For research study 3 we did a case study of Infosistema, which was chosen for its innovative practices and products and for its servant leadership philosophy. Infosistema was founded in February, 1996. Infosistema, currently with three managing partners, employs sixty people and had annual sales of just under 3 million Euros in 2010. The status of *PME Lider* was given to Infosistema by IAPMEI, Turismo de Portugal, and seven major partner banking institutions operating in Portugal (Barclays, Banco BPI, Banco Espírito Santo, Banco Espírito Santo dos Açores, Caixa Geral de Depósitos, Banco Millennium BCP, Banco Santander Totta), based on rating notations and on economic and financial criteria. This means that Infosistema is a leading SME (small and medium sized enterprise) in Portugal with excellent management indicators (efficiency and competitiveness). Infosistema customers include the following seven banks: Banco Santander de Negócios Portugal, Banco Santander Central Hispano, Banco Espírito Santo, Caixa Geral de Depósitos, Banco Mais Tecnicrédito – Grupo BCP, Banco Santander Totta, and Banco Português de Negócios.

The CEO and one of two founding partners, Jorge Pereira, is an engineer who studied engineering at Instituto Superior Técnico, in Lisbon, having also a Master's degree from Universidade de Trás-os-Montes e Alto Douro / UTAD. Jorge Pereira was interviewed twice in 2011 – once for one hour, at an international conference where Jorge Pereira presented a paper, the second time during a company visit by one of the authors to the head office of Infosistema, in Lisbon, Portugal, this time over a 90 minute period.

CEO Jorge Pereira, after learning about the servant leadership philosophy with one of the authors, agreed that Infosistema was definitely a case of servant leadership. This is evident in their hiring for attitude and values more than for technical competencies; in their concern for developing their employees; in their preoccupation with serving others – employees, customers, and community; and in their promotion of the sharing of ideas and knowledge through unhindered communication channels. Furthermore, the CEO is a leader who also exists to develop and serve others, according to Jorge Pereira, and this is how he sees his job.

6.2. Objectives of the case study

Qualitative research methods, for example using in-depth interviews and the case study method, can help us deepen our understanding of servant leadership (Winston, 2010). The interviews we performed had the general objective of enquiring into servant leadership practices and also into the relationship between this leadership philosophy and interoperability and innovation.

Following the gathering of company information and information about the interviewee's background, the semi-structured interview questions followed a script with the following additional questions:

1. What do your work functions involve?
2. With whom do you have to interact in order to perform your work functions?
3. What deliverables do you exchange?
4. Do the deliverables exchanged follow patterns, for example of cooperation?

5. How is value created in the organization with your interactions?
6. How do you describe your interactions with customers?
7. Are customers a source of innovation?
8. Do you see your functions changing in the near future?
9. Do you have an R and D (research and development) department?
10. How much do you invest per year in innovation?
11. How can a "culture of innovation", receptive to and promoting of innovation, be created by a company's leaders and aided by technology?
12. "Do certain common principles guide uncommonly innovative companies down the risk-riddled road to value creation?" (Zien and Buckler,1997)
13. What is the strategic role of ICT (information and communication technologies) in the promotion of innovation?
14. How do Information and Communication Technologies (ICT) affect organizational intangibles?
15. How can a corporation "institutionalize and routinize innovation" (Tzeng, 2009, p.375), in order "to render a previously ad hoc innovation into a routine, which is a repeatable economic event" (Tzeng, 2009, p.376)?
16. How does interoperability relate to innovation (Gasser and Palfrey, 2007)?

Additionally, other subjects of interest were pursued as they were brought up during the course of the interviews.

6.3. A description of the case study

Despite the well-publicized crisis in Portugal, it having been necessary for the International Monetary Fund (IMF) and the European Union (EU) to provide financial aid to Portugal, annual sales have not been adversely affected at Infosistema. Infosistema is an information systems consultancy which sells technological solutions to its customer base, customers which are mainly from the banking, insurance and public administration sectors. Infosistema has four main business units: business consulting, IT (information technology) consulting, SAAS (software as a service), and technology. The focus is on innovation and improving the performance and productivity of its customers, implementing technologies that lead to growth. Infosistema is a certified partner of Microsoft, Oracle and OutSystems; as well as being certified by APCER according to the norm ISO 9001:2008. Furthermore, Infosistema spends between 5% and 15% on R and D activities, annually. Jorge Pereira's main activities are: making the business more dynamic; creating new business and new opportunities; getting new customers; negotiation and sales; and, more recently, training senior managers to become project managers who will also be responsible for creating a new business offering and getting new customers. Jorge's career in the past has always been closely linked to technology. Jorge has thus also performed more technical tasks such as giving training in operating systems, giving training in data base administration, gaining certification in Oracle data bases, as well as Oracle Applications installation – of the technological component in the financial area (for a period of two years the only person in Portugal to do this for Oracle). Currently Jorge is a consultant who is able to easily maintain a dialogue with information systems and technology managers at customer companies, helping to define architectures, software policies, and information systems strategy to efficiently support businesses. Products sold include home and mobile banking, mobile insurance, and (in the future, if the market improves) mobile public sector services solutions to support citizens. Smart phones and iPads are some of the tools / technologies focused upon, namely as an evolution of traditional Internet services in the public and private sectors, to more mobile channels. The goal is to provide innovative technological solutions which are efficient and cost-effective and which benefit their customers' businesses. "Comfort" for end users is also a focus – comfortable meaning being able to do the same things in a more simple fashion and

within their own space (normally domestic, in a place where they like being). The first interview with Jorge was recorded in audio while the second interview was registered in hand-written notes. Other sources of information were the corporate web site (www.infosistema.com) as well as product brochures and other marketing material provided.

6.4. Promoting innovation at Infosistema along the BNML pattern sequence

"Phenomenological in-depth interview studies result in extensive data that the researcher codes into concepts, patterns, and an interpretation of the subject's lived experience of the phenomena" (Winston, 2010, p.180). The authors followed this methodology to uncover how a number of factors contribute to innovation at Infosistema.

The student survey results represent a more academic look into servant leadership and thus the patterns identified in this initial study served as a basis for the case study discussion. A discussion thus follows of how the 13 patterns present in figures 3 and 4 – BNML representations resulting from the exploratory student survey into servant leadership – tell a story of servant leadership, interoperability and innovation at Infosistema:

1. Alignment pattern:

> Much in line with the servant-leadership philosophy, at Infosistema people are recruited for their attitude, for their motivation and for their capacity to learn and to solve problems. Employees are generally carefully hired straight out of university – mostly engineers, for internships, receiving token salaries of between 400 and 600 Euros per month, for between two- to six-month periods.

2. and 3. Communication channels and empowerment patterns:

> The project managers are responsible for the hiring of human resources for their projects. They may consult the CEO, face-to-face or by e-mail, before deciding, but have the autonomy necessary to decide on new-hires for themselves.

4. Collaborative action pattern:

> The human resources working at Infosistema are recognizably the greatest asset, according to CEO Jorge Pereira, both leaders and followers alike, much as Keith (2010) advocates should be the case with servant leadership organizations. "*We constantly promote an innovation culture*" (Jorge Pereira, CEO Infosistema) in which programmers collaborate in product development.

5. Team development pattern:

> "*In terms of promoting innovation it is essential for our company and business, in order for us to have any chance of success. We can say what went well but it is easier to say what went wrong, which is often a lot.*" (Jorge Pereira, CEO Infosistema). They have found at Infosistema that stress is an enemy of creativity. So that employees may relax at work and thus be more creative, Infosistema has a meeting room which is easily converted into a playroom with four Wii joy sticks / command sticks plus console and screen for moments of leisure. Furthermore, fruit, coffee and biscuits are free and available in a common room which is equipped with a fridge and a micro-wave oven. The office space is also open, to promote a relaxed atmosphere and a sense of collective belonging amongst employees.

6. Cooperation pattern:

It is company policy to share work practices and indeed it is made quite clear that this is a part of the corporate culture which employees must assimilate. Programming practices vary considerably between programmers, for example, and so the sharing of programming routines used, between programmers, is very important and contributes to the efficiency of Infosistema in the marketplace. The objective is "to do more with less" (Jorge Pereira, CEO Infosistema).

7. Constructive play pattern:

"IT, such as e-mail and our Intranet system, is an operational vehicle for innovation." (Jorge Pereira, CEO Infosistema). Corporate communication happens via e-mail (all employees are encouraged to communicate with senior management about whatever topic they deem to be important whenever they want to), over the Infosistema Intranet (which has several levels of restricted access, some sales and financial information not available to everyone), as well as in face-to-face meetings. There are also several corporate / teambuilding events held every year where the corporate vision and future company policy / strategy is communicated and other important information is disseminated amongst employees and managers. Feedback is also gathered at these events from all levels in the organization. Brainstorming sessions with senior project managers also result in innovation.

8. Gain competence pattern:

Once hired employees then receive in-depth technical training, which has "pros" and "cons". On the one hand employees grow with the company (following an internship Infosistema increases salaries of employees typically to 1,200 Euros per month), on the other hand they quickly gain notoriety in the market and are often approached by rival companies once they have specific (and valuable) know-how, and then they are enticed to leave. CEO Jorge Pereira says that this is a risk which they have to take, they don't forbid people from leaving the company, indeed cannot do so according to Portuguese law. Investments in human resources of 10,000 Euro each (gradually, over time) are relatively easy. Technical books are also readily available for employees to further their learning, as are computer-based training programs.

9. Connection pattern:

Other training which employees receive is linked to negotiation, marketing, and presentation skills. Namely project managers and senior consultants are invested in by Infosistema, which prepares them for future challenges. Thus senior employees will easily connect to customers in the fashion required by Infosistema, to ensure a sustainable future for the company.

10. Creative control pattern:

Besides 2-3 people working flexibly in Research and Development (R and D) on-site, additional R and D is actually carried out off-site, near the Portuguese University in Covilhã, in a center with a software product development and implementation team of 4-5 people (working part-time). Sales come easier when products and services offered are innovative. Innovation normally comes from inside Infosistema and not, for example, from customers (who only exceptionally contribute with innovative ideas). For the last three years in particular they have been working in the direction that Infosistema is a consultancy, not a reactive company responding with technology to a problem. Infosistema tries to stay a step ahead and carries out research into scientific research about technological innovation – Innovation which they may adopt and take to customers, to help them to better support their businesses. There are

international studies which point with some certainty to certain directions as future tendencies in technology and Infosistema does applied research into those areas. i-Flow, for example, is a BPM (business process management) product which Infosistema has developed for the BST bank, to de-materialize business and management processes.

11. Rewards pattern:

Customer loyalty and superior sales follow creative control, ensuring growth even in times of economic crisis. Some senior managers at Infosistema are responsible for large project teams and significant amounts of sales with major customers.

12. Character development pattern:

Some Infosistema employees are very talented in ensuring superior contact and service to customers. In the case of extremely talented individuals, and to ensure high levels of motivation and loyalty to the company, Infosistema does give a minority share holding of the company to employees (as mentioned occurs in other servant-led companies — See for example McGee-Cooper and Trammell, 2010).

13. Chargers pattern:

The 'engine' of Infosistema is charged constantly: *"To achieve an effective culture of innovation you have to share success, disseminate success, and impose practices so that people can overcome the initial barriers – you have to give them the chance to see the results of success. It is a constant effort. Often without achieving the objectives we want."* (Jorge Pereira, CEO Infosistema). Change and innovation at Infosistema are taken very seriously, especially certain routines such as sharing the laurels of successful innovation: *"People were not made by nature for innovation. There is a constant natural intrinsic reaction, almost animal-like, in humans against change. Everyone is like that. It is only human to resist that which we don't know. Innovation is a very complex cycle. There are resistances. For innovation to occur we have to impose practices and routines, and we have to share some of the successful results when innovation happens."* (Jorge Pereira, CEO Infosistema). Finally, Aveiro and Tribolet's (2007) concept of organizational survival and recursive self-maintenance gains life via the project managers, who are constantly monitoring project health. Microgenesis processes (Aveiro and Tribolet, 2007) involve organizational micro changes required for adaptation to new environments – nothing is taken for granted as *"currently, we live amid constant change... Businesses are volatile – Trends and best practices evolve very quickly and when we talk of innovation, nowadays, it is becoming less and less clear to me what that means... Very formal methodologies, which are very time-consuming, have no chance for survival in companies which essentially work with technology"* (Jorge Pereira, CEO Infosistema).

Figure 6 shows, diagrammatically, how value is created and exchanged within Infosistema's value network, summarizing much of the above discussion about the promotion of innovation.

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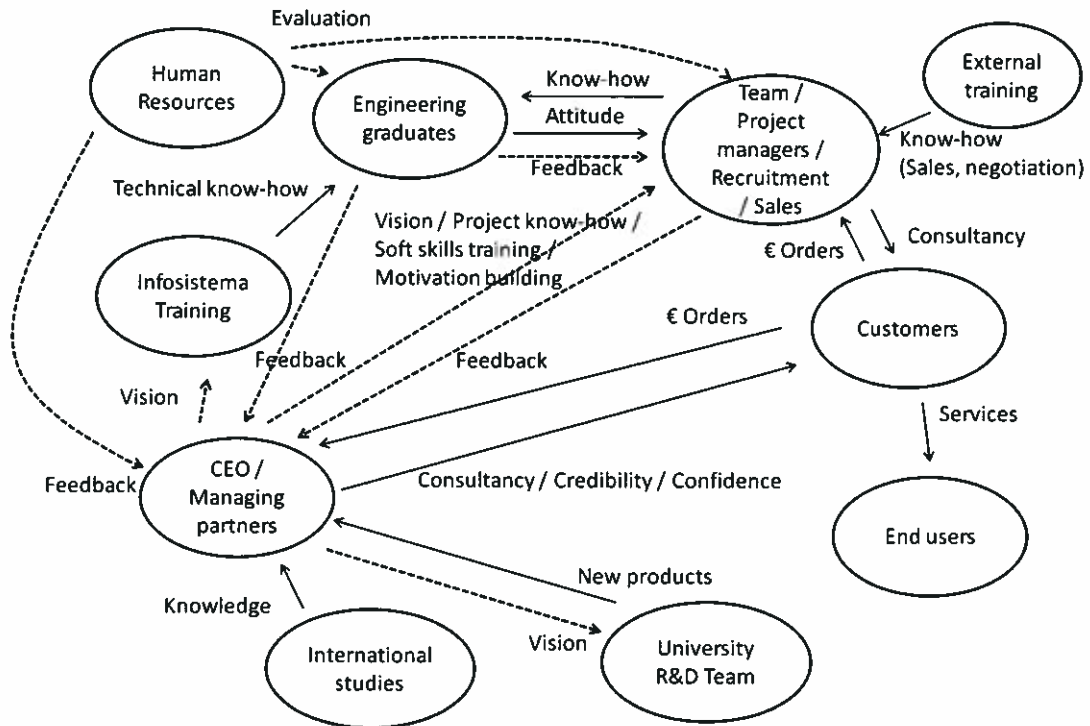
Figure 6. The value network at Infosistema

6.5. Antecedents of innovation at Infosistema

Figure 7 is a development of figure 1. Figure 7 exemplifies how servant leadership leads to interoperability and then to innovation at Infosistema.

SERVANT LEADERSHIP	INTEROPERABILITY	INNOVATION
Infosistema – A case of servant leadership - Hiring for values and attitude	Interoperability involves understanding the problems of others & leads to innovation	Innovation is the joining together of pieces of innovation of others
The CEO's job is to serve others	Knowledge sharing leads to innovation	
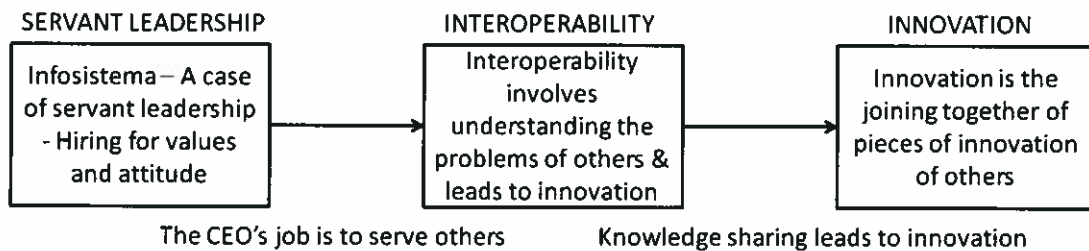
Figure 7. Antecedents of innovation at Infosistema

CEO Jorge Pereira sees it as being his job to promote communication at Infosistema, as this will lead, given the right human resources, to innovation:

"Any act of communication [interoperability], human or technical, leads to innovation, because we understand the problems of others. We gain knowledge with the problems of others and in seeing our own limitations. Those are motives for us to seek innovation in some form... Having a constructive attitude to understand the problem and then to reunite from previous innovation efforts, by others, that which can be used to solve this problem, is a way of contributing

to innovation – joining together pieces of innovation of others" (Jorge Pereira, CEO Infosistema)

Knowledge sharing and innovation do not occur naturally, however, and certain measures need to be imposed by senior management for knowledge sharing and innovation to happen. Servant leadership is not about being soft and servant leaders can be tougher than benevolent dictators (Covey, 1994, as quoted in Prosser, 2010), as Jorge Pereira stated when referring to the need to impose a culture based on knowledge sharing and innovation at Infosistema:

"Interoperability involves human competences and technology. We seek to provide all of the necessary tools to our employees to allow for technical interoperability. Interoperability at a different level also exists – interoperability between people – and has to do with knowledge sharing. We have levels on our Intranet system for technical knowledge sharing between our teams. It is a constant challenge. Often unsuccessful. Technicians in general do not have the motivation, training, routine or objective to share... In social and human relations terms we have the objective to get people to share but in reality the results are far from what we desire. Sharing happens when we make them share." (Jorge Pereira, CEO Infosistema)

In sum, we did the case study of Infosistema in order to show that servant leadership organizations can and do exist in Portugal. This also illustrates that other high power distance cultures, such as those found in Africa, can turn to servant leadership as an avenue to increased competitiveness and innovation.

7. Discussion of the three research studies: Interoperability fosters innovation

"One of the reasons why we tend to like interoperability is that we believe it leads to innovation," stated Gasser and Palfrey (2007, p.ii). However, "the relationship between interoperability and innovation, while it likely exists in most cases, is extremely hard to prove" (Gasser and Palfrey, 2007, p.ii). Our study demonstrated that servant leadership is a promoter of interoperability – "the ability of a system or an organization to work seamless[ly] with other systems or organization[s] without any special effort" (Mertins *et al.*, 2008, p.v). Servant leadership unblocks communication channels between employees and leaders at all levels (see also Greenleaf, 1970 and, more recently Dierendonck and Patterson, 2010a), in stark contrast to more autocratic leadership companies (as Hofstede, 2003 and Dantas, 2011 also state). This enterprise interoperability leads to greater innovation output, where all contribute without fear of reprimand, and thus to superior organizational results (see also Nakata and Sivakumar, 1996; Dantas, 2001; and Dantas, 2011).

Table 6 summarizes the findings of the three research studies. The relationship between interoperability and innovation has been demonstrated, the former being an antecedent of the latter. The 55 executives were unanimous in their view that interoperability (easy and fluid communication) leads to innovation. The 55 executives were also unanimous in stating that leadership type influences organizational communication – autocratic leadership inhibits while servant leadership practices promote interoperability. The students also believe that interoperability leads to innovation and the case study evidence points in that direction too. Indeed, the three studies revealed similar results though the executives surveyed, in particular, showed a more positive outlook than the students as concerns the applicability of servant leadership in Portugal – thus perhaps feeling more in control of their destinies than the students and more capable of effecting the necessary culture change to make servant leadership and the resulting interoperability and innovation happen in Portuguese organizations. Certainly we are living in times of profound change in Portugal, with the presence of the "Troika" Committee (including the European Commission, the

European Central Bank and the International Monetary Fund) providing strong aid as to what should and should not be done to move Portugal forward, out of the current economic crisis.

Table 6. A summary of the three research studies

	Research study 1	Research study 2	Research study 3
Method	In-depth student survey	In-depth executive survey	Case study
Sample size / description	54 students finalizing BSc degree in management	55 executives from nine companies in nine industries	Infosistema - Information systems consultancy
Main research objective	Does interoperability lead to innovation?	Does interoperability lead to innovation?	Does interoperability lead to innovation?
Secondary research objectives	What is the role of servant leadership?	What is the role of servant leadership?	What is the role of servant leadership?
Data	Students' answers (quantitative and qualitative)	Executives' answers (quantitative and qualitative)	Two interviews with CEO; analysis of company practices; observation during company visit
Research tools	Statistics; Value network analysis; BNML; student testimonies	Statistics; BNML; executive testimonies	Interview excerpts; Value network analysis; BNML patterns from student survey
Opinion that servant leadership would be successful in their home country	Yes – 20.8%; Yes, but with some difficulty – 22.6%; No – 56.6%	Yes – 60%; No – 40%	Servant leadership appropriate only for particular types of organizations; very difficult to implement in Portugal
Applicability of servant leadership	Specific national and organizational cultures required	Specific national and organizational cultures required; appropriate in specific situations	Specific national and organizational cultures required
Preferred type of leadership	Servant leadership – 53.7%; Democratic leadership – 33.3%; Paternalistic leadership – 3.7%; Autocratic leadership – 0%;	Servant Leadership – 65.45%; Paternalistic Leadership – 16.36%; Autocratic Leadership – 3.64%; Other – 14.55%	Servant leadership for particular types of organizations; not easy to implement in Portugal

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	Other – 9.3%		
What type of leadership do you think exists in the company where you work?	-------	Servant Leadership – 7.27%; Paternalistic Leadership – 32.73%; Autocratic Leadership – 38.18%; Other – 21.82%	Servant leadership
Relationship between interoperability and innovation	Students believe that interoperability leads to innovation	55 executives unanimous that interoperability leads to innovation	Case study evidence that interoperability leads to innovation
Relationship between leadership and organizational communication	Students believe that autocratic leadership inhibits while servant leadership promotes interoperability	55 executives unanimous that leadership type influences organizational communication; autocratic leadership inhibits while servant leadership promotes interoperability	Case study evidence that servant leadership promotes interoperability
Need for servant leadership in Portuguese companies	Yes – High priority	Yes – High priority	Yes – High priority

Figure 8 shows the pattern sequence (generated by Graphviz software) made evident by the surveys and demonstrates how communication channels (interoperability) leads to innovation (creative control). The three management tools collaborative action, communication channels and empowerment start a process of organizational charging (of both capabilities and purpose) and cognitive immersion. Constructive play and creative control (innovation) then lead to the collecting of revenue streams.

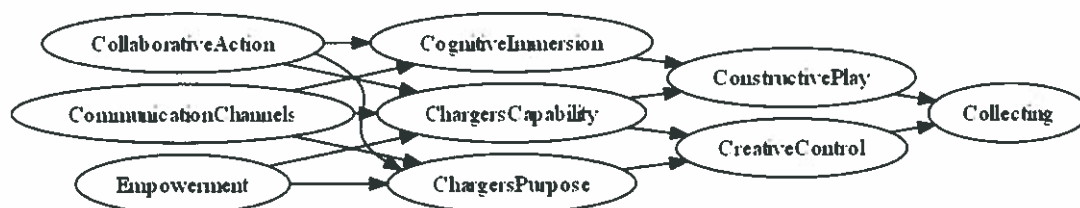**Figure 8.** Pattern sequence showing how interoperability fosters innovation

While there is some skepticism as to the possibility of servant leadership being able to be successful in Portugal, the desire for leadership styles to change is significant, especially away from autocratic leadership and more in the direction of servant leadership. One executive went as far as saying that disagreeing with an autocratic

leader is "suicide". This is not seen to be a very propitious environment in which innovation may occur. Another executive stated that:

> "A leadership style which creates fear in the employees, either due to repressive acts, or due to frequent and disproportionate or unjust "punishments", inhibits internal communication."

Significantly, over one third of the executives surveyed viewed their companies as being autocratic. On the other hand, one executive stated that at his company two hierarchical levels had been recently eliminated in order to speed up and facilitate communication / information flows. This is seen to be a clear move in the direction of interoperability and being able to seamlessly interoperate with others is a determinant of organizational competitiveness – indeed "enterprise interoperability has become a strategic necessity in all industries" (Li et al., 2006, p.1). One executive stated:

> "Only with transparent information can one improve and innovate."

Another executive stated:

> "Communication and the exchange of ideas are always positive as we can thus see different points of view and not only ours and thus reach a better final result."

Finally, in the case study of a servant leadership company – Infosistema – a leading SME (small and medium sized enterprise) in Portugal with excellent management indicators and which has managed to escape the economic crisis felt for some time in Portugal and Worldwide – the CEO and other senior managers are seen to be dedicated to serving followers, characterized as being motivated employees also, equally committed to the success of the company.

8. Conclusion

The study we undertook is unique in so far as it involved Portuguese students, Portuguese executives and a Portuguese company which was the subject of a case study. We feel that such research comes at a crucial time for Portugal, given the current serious economic crisis Portugal is in. We hope to point a way forward, in the long term, for Portuguese companies, which are the engine of the economy.

We are on the one hand satisfied with how BNML was able to describe the series of events characterizing a servant leadership company. On the other hand we are satisfied that we were able to demonstrate that servant leadership and enterprise interoperability are both antecedents of innovation. Enterprise interoperability is an asset which is first built and then used by an organization. The leadership type in an organization will have a significant influence on organizational communication channels (interoperability) and subsequently on innovation output and revenue streams.

9. Limitations of the research studies and suggestions for future research

By listening to what students have to say we are indeed listening to voices of the future. Our student survey, while providing ground for further discussion into the servant leadership philosophy, would benefit from other survey efforts enquiring into the applicability and desirability of servant leadership in organizations located in different geographic regions Worldwide. Similarly, other survey efforts discussing servant leadership, interoperability and innovation, and involving executives, are encouraged. Furthermore, our case study of Infosistema provided a good example of servant leadership in Portugal. More cases need to be brought to the fore, however, for this leadership philosophy to gain more followers. Qualitative research methods, involving for example interviews, are seen to be appropriate to deepen our

understanding of such phenomena. Servant leadership is seen to be a way to contribute to a more caring society. Thus, more studies on the subject are needed, with a greater number of respondents sharing their in-depth views.

10. Acknowledgements

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ANNEX I – EXECUTIVE SURVEY

(TRANSLATED FROM THE PORTUGUESE VERSION)

Based on Dierendonck and Patterson (2010a)

Anonymous survey about Leadership – A study by the Faculty of Engineering of the University of Porto (FEUP)

In a company where there is Servant Leadership the leaders serve their followers and help them to develop. There is a feeling of the organization as a family. Most important in these companies is the attitude and desire to innovate in the small things, so that the company may move forward successfully. People enjoy working for Servant Leadership organizations and customers actually come in second place, after the employees. In these companies people are valued above money and power. A case of Servant Leadership is Southwest Airlines, in the USA, a case of great success in its industry.

* Required

1) In your opinion, would this type of leadership at Southwest Airlines – Servant Leadership – be equally as successful in Portugal? * Choose an option please.

    ◯ YES

    ◯ NO

2) Please justify your previous answer. *

3) What type of leadership do you think exists in the company where you work? * Please indicate a type.

    ◯ Autocratic Leadership – where the leader leads for himself / herself over others

    ◯ Paternalistic Leadership – where the leader assumes himself / herself as a "father / mother" and the collaborators as "sons / daughters"

    ◯ Servant Leadership – where the leader leads for others over self

    ◯ Other

4) If you chose "Other" in the previous question, please specify another type of leadership.

[text input box]

5) Indicate the type of leadership which you would like to find at the company where you work. * Please indicate a type.

○ Autocratic Leadership – where the leader leads for himself / herself over others

○ Paternalistic Leadership – where the leader assumes himself / herself as a "father / mother" and the collaborators as "sons / daughters"

○ Servant Leadership – where the leader leads for others over self

○ Other

6) If you chose "Other" in the previous question, please specify another type of leadership.

[text input box]

7) Why would you like to find this type of leadership which you indicated? *

[text input box]

8) In your opinion, does the type of leadership which exists in a company influence the type of communication? * Choose an option please.

   ○ YES

   ○ NO

9) Please justify your previous answer. *

10) Can easy and fluid communication lead to corporate innovation? * Please answer Yes or No.

   ○ YES

   ○ NO

11) Please justify your previous answer. *

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Interoperability and innovation and the Business Narrative Modelling Language: Comments on Cabello-Medina et al. (2011)

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Paper VI (submitted for review to an international peer-review journal)

Theme: A summary of theoretical and empirical work

Contribution of the paper to the research topic:

This article discusses and summarizes our doctoral research (table 1 has a list of the twenty-two interviewees involved in the research project and table 3 has a summary of the eight case studies performed) while commenting on another paper by Cabello-Medina et al. (2011). We thus establish a comparison between our innovative qualitative research methodology (which actually combines various research tools, with the objective of facilitating and standardizing qualitative research while also aiming to reach a more diverse audience) and the more traditional quantitative methodology followed by Cabello-Medina et al. (2011) (data collection via survey with 181 responses and using measurement scales). Similarly to Cabello-Medina et al. (2011) we have also sought to focus our research on different types of companies, some more and others less innovative (as figure 5 shows). Additional empirical research findings include: Type 1 and Type 2 firms (figure 5) leverage less interoperability types than the more innovative Type 3 and Type 4 firms (figure 5); furthermore, the latter type of firms produce more types of innovation. These findings emerged from the data, much as Elharidy et al. (2008) propose. The various BNML research phases are presented for example in figure 1 (value network analysis), figure 2 (BNML storyline view), and figure 3 (integrated BNML view). Table 2 is a novelty as it shows some of the storyline BNML view data (figure 2) parameterized into an Excel sheet (Table 2 – ExpressGlass case) so as to make possible the creation of an integrated BNML view (figure 3). Table 2 shows that patterns (red single-line octagons in figure 3) have inputs and outputs (blue rectangles in figure 3), are triggered by organizational actors (red double-line octagons in figure 3), have a plot (red arrowed boxes in figure 3) and also a state variable (black dashed-line rectangles) to control for objective fulfillment and completion. Figure 3 for example shows that Var_PartnerSatisfaction measures stakeholder (insurance companies and brokers) satisfaction, part of the CommunicationChannel3 pattern which will build an innovation competence if managed correctly. Var_Stock also needs to be controlled as stocking glass is a significant cost in the ExpressGlass case.

Interoperability and innovation and the Business Narrative Modelling Language: Comments on Cabello-Medina et al. (2011)

Abstract

The aim is to provide a commentary on "Do best and worst innovation performance companies differ in terms of intellectual capital, knowledge and radicalness?", an academic paper written by Cabello-Medina et al. (2011), published in the African Journal of Business Management, 5(28): 11450-11466. Though our research has similarly aimed to contribute to the innovation literature, and in particular to how interoperability is an antecedent to innovation, we have chosen a very different research method to do so. Namely, we have used the Business Narrative Modelling Language (BNML) to support the collection, processing and analysis of qualitative data. We set out to be creative about research methods and to use this creativity to overcome biases concerning qualitative research methods. Throughout our article we have contrasted more quantitative research methods (such as that used by Cabello-Medina et al., 2011) with more qualitative research methods, which we tend to favour. Comparative studies such as Cabello-Medina et al. (2011) drive home a deep message about innovation. We have also focused on researching all types of companies, from high technology firms to less innovative firms. By combining various research tools we hope to reach a more diverse audience than by using other more traditional research methods.

Key words: Interoperability, innovation, research methods, BNML.

Discussion

The aim is to provide a commentary on "Do best and worst innovation performance companies differ in terms of intellectual capital, knowledge and radicalness?", an academic paper written by Cabello-Medina et al. (2011), published in the African Journal of Business Management, 5(28): 11450-11466. Much as Cabello-Medina et al. (2011) we aim to provide reference models so that companies may learn and become more innovative – with innovation defined as "the adoption of new approaches for an organization and suitable environment" (Lee and Yu, 2010, p.1704) and which often depends upon organizational relationships, cooperation and trust (Oliveira and Ferreira, 2011a). Accelerating the innovation process is not an option but more a question of survival and continuity in today's global marketplace. We also agree that best practices – "tactics or methods that have been shown through real-life implementation to be successful" (Cabello-Medina et al., 2011, p.11450, quoting Dooley et al., 2002) – need to be disseminated in order to aid companies improve their innovation performance. Our research has thus focused on how interoperability – involving easy and fluid communication (for information exchange, much as Lam and Schaubroeck, 2011, discussed), coordination (to efficiently align activities), cooperation (for sharing work), close collaboration (implying joint goals and responsibilities to create innovative solutions) and channel (which involves leveraging the Internet) (Li et al., 2008) – accelerates and improves innovation output. We have also however been concerned with novel ways to communicate how companies can innovate faster and better – namely by using the Business Narrative Modelling Language (BNML) (Oliveira and Ferreira, 2011b) to help establish a roadmap for current as well as future organizational activity.

While Cabello-Medina et al. (2011) have used a more quantitative approach to their research we have preferred a more qualitative approach. Rather than previously reading up on all that has been written on a subject, as Cabello-Medina et al. (2011) did in their very thorough literature review, we instead read up on theory pertaining to our study initially (identifying a gap in the literature) but also as the project progressed, in the manner of Grounded Theory (Glaser and Strauss, 1967). According to Corbin and Strauss (2008, pp.35-36) "there is no need to review all of the literature in the field beforehand, as is frequently done by researchers using quantitative research approaches. It is impossible to know prior to the investigation what salient problems or what relevant concepts will be derived from this set of data. There is always something new to discover. If everything about a topic is known beforehand, there is no need for a qualitative study. Also, the researcher does not want to be so steeped in the literature that he or she is constrained and even stifled by it", which can lead to a state of "researcher paralysis".

Performing empirical inquiries into contemporary phenomena in real-life contexts can be seen to be "exciting and important" (Mason, 2002, p.1) and a completely distinct challenge to what Cabello-Medina et al. (2011) set out to do, as the following passage illustrates: "I suppose in the academic world it's all clear-cut; but it isn't really you know. When you come down here, it's all a hell of a big mish-mash, all inter-related influences. It's not clear cut and logical. It looks completely illogical, but that's how it happens. And I'm sure we're no different from any other outfit. And you'll go back and say "what a load of idiots". But that's how it happens" (Scapens and Roberts, 1993, p.1). Indeed Jordão (1998) in her PhD Thesis [Acknowledgements] makes reference to information which can be obtained "intentionally or not, from diverse sources" which exemplifies well what may be involved in a qualitative study performed in the field, a journey of understanding, exploration and interpretation (Jordão, 1998, [Abstract]). Jordão, who carries out case studies (see for example Jordão, 2001, and Jordão and Brandão, 2005), maintains that to understand a reality, especially a social (or

organizational) reality, the object cannot be considered in isolation but should rather be considered as a pair "object-observer" (Jordão, 1998, p.3).

Thus we set out to be creative about research methods and to use this creativity to overcome biases concerning qualitative research methods, seen to be unsystematic and inferior (Mason, 2002), with case studies in particular seen to be less rigorous and less objective (Yin, 2003). We have sought to provide structure and system to qualitative research without becoming too mechanistic in the process (Elharidy et al., 2008). Furthermore, we intended with BNML to determine the relationship between interoperability and innovation, a task seen to be difficult by the literature (Gasser and Palfrey, 2007).

Our research involved two in-depth qualitative surveys (performed in 2011, with 109 valid responses) and twenty-two official semi-structured in-depth interviews (a list of the interviewees involved in our research can be found in table 1). Our interviews had an interview script, for interviewees from eight different companies, averaging around 50 minutes each interview, each having been audio recorded. The transcribing of these interview recordings normally involves considerable effort by research teams, in normal circumstances around eight hours per hour of audio-recorded interview. Furthermore, we also had a considerable amount of hand-written notes, resulting from the corporate observation of company workers and working environments by the researchers, during company visits. A very relevant problem which constitutes a challenge is "how we deal with this amount of data which by virtue of its qualitative nature does not lend itself to easy summary or codification?" (Savage, 2011, p.175). BNML is a solution to overcome the above, by using pre-defined game patterns (Bjork and Holopainen, 2005), business ontologies (for example Uschold et al., 1998, and the Unicist Ontology of innovation), and the Business Model Canvas (Osterwalder and Pigneur, 2010; Oliveira and Ferreira, 2011c). Also, by using BNML the need to integrally transcribe interview recordings is surpassed. Fundamental in this process is the timely development of the corresponding BNML diagrams, for example within 24 hours of the interviews. This means that only partial sections of the interviews had to be listened to again and transcribed, to complete notes taken and BNML figures drawn during the interviews.

Table 1. Interviewees involved in the research project (22 interviewees[15] from 2006-2012)

Name	Institution / Affiliation
Anabela Santos	Financial Director at IP BRICK
Aníbal Campos	CEO of Silampos (Portugal); CEO of Silampos UK
Célia Soares	Quality Director at Silampos
Filipa Campos	Marketing and Design Director at Silampos
Gilberto Pinto Rachão	Production Director at Yazaki Saltano
Hélder Rocha	Director of Support and Implementation at IP BRICK
João Campos	Continuous Improvement Officer at Silampos
João Miguel Cunha Pinto	Managing Director of Diafresh
Jorge Alves	Managing Director of BTM Travel

[15] Some of these interviewees were interviewed more than once. This was the case of João Miguel Cunha Pinto, Jorge Alves, Jorge Pereira, and Jorge Santos Carneiro.

Jorge Pereira	CEO of Infosistema
Jorge Santos Carneiro	CEO of Sage Portugal and Sage Brazil
José Alberto Silva	Finance and Information Systems Director at Silampos
José Carlos Cunha	Sales Director at ExpressGlass
Maria Antónia Costa	Sage Portugal Nº2 (financial director and director of control and management – encompassing human resource management, logistics, administrative aspects, and internal systems)
Masashi Kono	Former Vice President (for Belgium and Portugal) at Yazaki Saltano Electrical Products
Miguel Ramalhão	Director of I&D at IP BRICK (IP BRICK product line)
Paul Bradley	Managing Director of an independent Yazaki Technical Centre set up in Portugal
Raúl Oliveira	CEO of IP BRICK
Susana Pinheiro	Sales Director at IP BRICK
Telma Salgueiro	Director of I&D at IP BRICK (iPortalDoc product line)
Tiago Lafluente	Engineering Director at Silampos
Tiago Prista	Administrator and CEO of Executive Committee at ExpressGlass

We need new ways to communicate as the World is moving at an ever quicker pace, we are bombarded daily with exponentially more information than we were a decade or two decades ago, and never before has there been so much pressure from shareholders on professional managers to grow their businesses. Given this setting we see that much can be gained from using BNML – a method which uses the narrative as the narrative is "especially relevant to the analysis of organizational processes because people do not simply tell stories – they enact them" (Pentland, 1999, p.711) – but also from using visual graphic representations as "they allow the simultaneous representation of a large number of dimensions, and they can easily be used to show precedence, parallel processes, and the passage of time" (Langley, 1999, p.700). This passage of time, shown by BNML, and which other visual representations for example by Allee (2008) do not show, enabled us to determine the relationship between interoperability and innovation – the former being an antecedent of the latter.

Combining more than one strategy to understand organizations has its advantages (Langley, 1999). For example, the narrative ranks high in accuracy while visual mapping is simpler and more generalizable (Langley, 1999). BNML thus combines two approaches in order to better communicate organizational phenomena. Cabello-Medina et al. (2011) have written a paper with a very important message along three axes: intellectual capital, the knowledge-based view, and innovation. We believe that their undeniably important message could be more far-reaching if they had added visual communication methods to their in-depth discussion and portrayal of results. Visual representations foster a deeper understanding and sense-making of organizational stories (Woodside, 2010), and Cabello-Medina et al. (2011) have a very interesting story to tell indeed, one that characterizes "the best and worst innovative companies". With visual representations (or visual narrative art) our emotional side and not only our rational side is encouraged to take part in processing activities (Woodside, 2010).

Figure 1 is an example of Allee's (2000a, 2000b, 2002, 2008) value network mapping applied to a case study we undertook at ExpressGlass, which performs specialized glass repair and glass replacement in the automotive industry after-market. Allee's value network thus portrayed is the first step in our BNML process (Oliveira and Ferreira, 2011b) and it gives a very good view of the actors involved in the process of value creation.

ExpressGlass has annual sales of 17 million Euros in Portugal (at the end of December 2010), where it has around 100 repair shops (one third owned by ExpressGlass, two thirds owned by third parties under a franchise agreement with ExpressGlass), each opened since ExpressGlass was founded in 2002. ExpressGlass is also present in other countries, such as Brazil, where it already has annual sales of 34 million Euros after just two years of operations there, though under a different business model than that represented in figure 1 for Portugal. The dashed lines in figure 1 represent intangible deliverable exchanges and the solid lines represent tangible deliverable exchanges (they are tangible exchanges if they are worth money i.e. involve recording in the General Ledger). Companies need to find a balance between the intangible and tangible deliverables exchanged in their network. Oftentimes the challenge is to transform intangible deliverables into tangible ones (Allee, 2008), thus bringing in more corporate revenues.
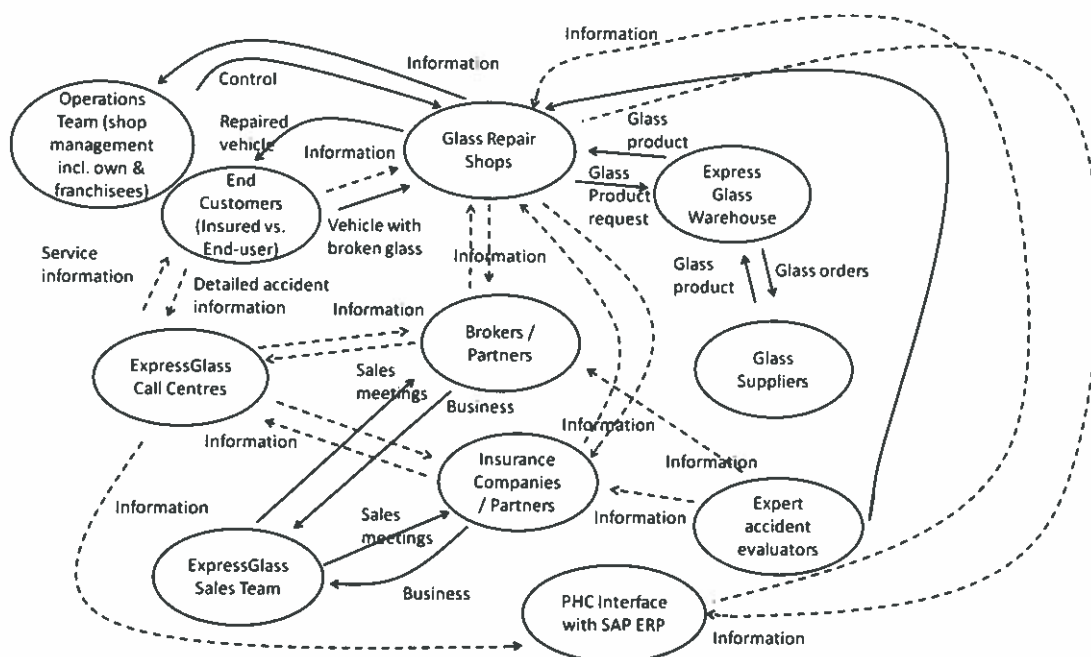
Figure 1. ExpressGlass Portugal value network (application of Allee, 2008)

The BNML in figure 2 adds the passage of time and the notion of precedence to figure 1, issues that Langley (1999) speaks of. Figure 2 is our BNML storyline representation of tangible and intangible delivery exchanges at ExpressGlass, along a pattern sequence – pre-existing patterns taken from Bjork and Holopainen (2005), such as Alignment (between the end-customer and ExpressGlass's service) and Closure Points (ExpressGlass's Mission is after all to deliver repaired vehicles to end-users). Uschold et al.'s (1998) Enterprise Ontology provides further detail (e.g. For Sale, or Activity) to

the pattern descriptions – ontologies being "an explicit specification of a conceptualization" (Páscoa et al., 2011). At the bottom of figure 2 we can see assets created and assets used (assets such as customer relationships and enterprise interoperability – EI; note how EI exists before the innovation competence comes into being, indeed is an antecedent of it). The building blocks of the Business Model Canvas (Osterwalder and Pigneur, 2010) have been added to the top of figure 2 to show which activities are related to the value proposition (VP) and which are related to revenue streams (RS), for example.

ExpressGlass has moved forward due to process innovation rather than to product, paradigm or position innovation (Tidd et al., 2005). With process innovation the product or service is created and delivered differently (Tidd et al., 2005). Concerning the process, technology has had much to do with ExpressGlass's expansion, not only in Portugal but in Brazil too. Figure 2 shows how technology is all-important – the actor PHC interface with SAP ERP, represented by the green line. At ExpressGlass in Portugal the big technology leap and consequent leap in sales came from an association with a Spanish partner, in 2005. Though the business relationship did not endure, the technology transfer did, which revolutionalized how ExpressGlass operated, eliminating paper from day-to-day operations. This greatly improved what we call their enterprise interoperability capability – free flowing information being readily available to those who need it. Management information processing tools are essential if one is looking to grow a business while keeping the head count down and efficiency up.
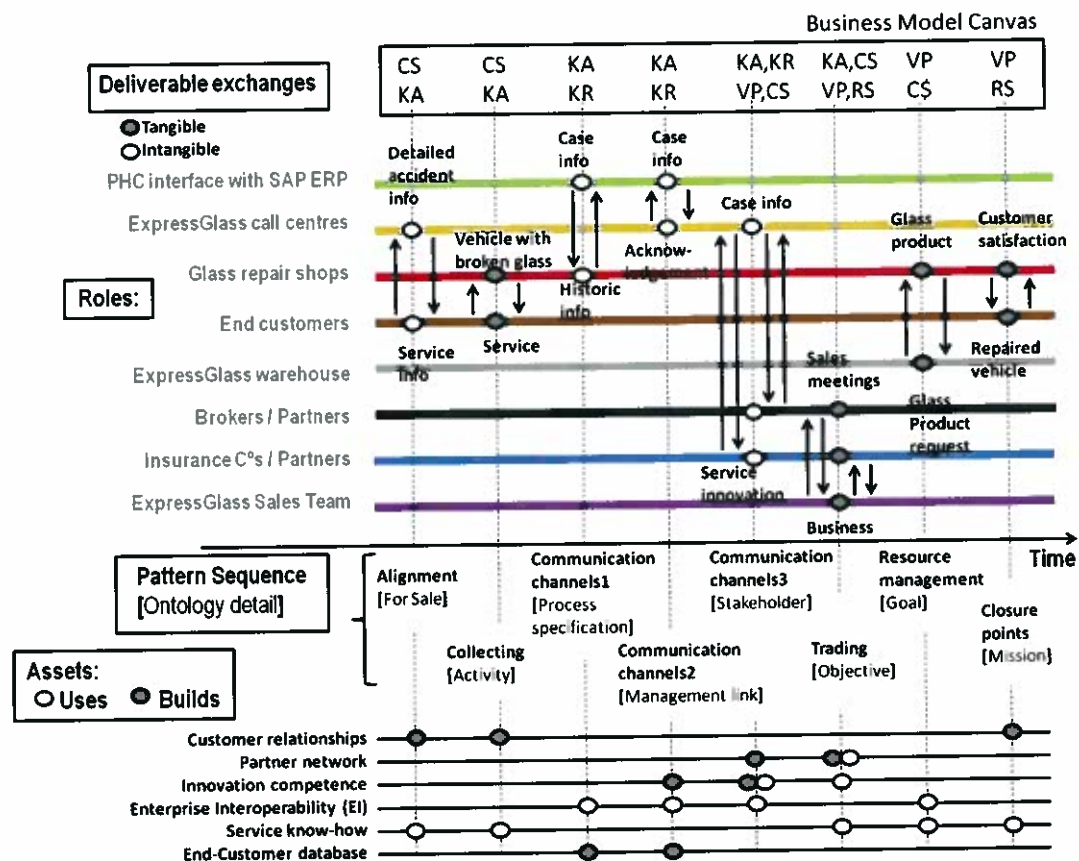

Figure 2. BNML representation of value creation at ExpressGlass (Portugal)

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ExpressGlass in Portugal has 120 people to achieve its 17 million Euros in sales. Brazil is a different case altogether, as it crosses an immense geographical territory and thus has numerous cities and thousands of smaller neighborhoods. However, it has similarly been technology (and process innovation) which has been seen as the solution to solve the problem of growth. It is almost an impossible task to locate travelers in need of aid without the proper technology in Brazil. The well-known SAP platform of German origin is also being implemented in Brazil, with both ERP – Enterprise Resource Planning – and CRM – Customer Relationship Management softwares, along with a geo-referencing system, so that operators in the field can always locate end users, in need of glass repair, both quickly and efficiently.

Figure 3 shows a mix of the BNML storyline view (figure 2) and the BNML plot view. Plots are functions and processes evident in the Uschold et al. (1998) Enterprise Ontology pattern detail in figure 2. Thus figure 3 is an integrated view which was inspired by Aveiro and Tribolet's (2006) work on an ontology for organizational functions (Process Specification, Goal, ManagementLink and [Share w/] Stakeholder). Figure 3 shows how enterprise interoperability leads to innovation, involving three actors – GlassRepairShops, PHC interface with SAP ERP, and CallCentres. Note that innovation is only measured (as a state variable Var_InnovationCompetence) after the stakeholders have been involved in the process (in the pattern Communication channels3) and so innovation is considered from the partners' (or stakeholders – insurance companies and brokers) point of view. Partner (insurance companies and brokers) satisfaction is also measured as a state variable (Var_PartnerSatisfaction). These state variables (other state variables in figure 3 are Var_HistoricalRecord, Var_Stock, Var_DataBase, and Var_CaseInfo) need to be measured at specific points in the process so that management may act when a departure from the norm has been registered (resilience mechanisms, according to Aveiro and Tribolet, 2006). Cabello-Medina et al. (2011) make reference to organizational capital – institutionalized knowledge – such as routines and standard operating procedures as being present in the best innovative companies – more so than in the less innovative counterparts – and we see this as including state variable processes as in the integrated BNML view.

Figure 3 is based on the same literature as figure 2 but also on the Unicist Ontology of innovation and Li et al.'s (2008) interoperability interaction types. Interoperability is a reality at ExpressGlass, according to the CEO of the Executive Committee Tiago Prista – all important events are shared and communicated between all of the interested parties, namely by e-mail by those involved, revealing a genuine preoccupation with the asset interoperability. The use of advanced technology such as SAP also contributes to enterprise interoperability at ExpressGlass. Innovative service results (figure 3). "The collective ability of employees to exchange and combine knowledge is really the base of innovation success" (Cabello-Medina et al., 2011, p.11463).

In Enterprise Interoperability

Var_HistoricRecord

ProcessSpecification

CommunicationChannels1

GlassRepairShops

Var_Stock

In-EnterpriseInteroperability

Goal

ResourceManagement

UsesEnterpriseInteroperability

Out Innovation Competence

Var_DataBase

PHC interface with SAP ERP

ManagementLink

CommunicationChannels2

Out-InnovationCompetence

Var_CaseInfo

BuildsInnovationCompetence

CallCentres

[Share w/] Stakeholder

CommunicationChannels3

Var_InnovationCompetence

Out Innovative Service

BuildsInnovativeService

Out-InnovativeService

InsuranceCompaniesBrokers

Var_PartnerSatisfaction

Figure 3. Integrated BNML view of how interoperability leads to innovation at ExpressGlass

Figure 3 is arrived at by parameterizing the Storyline BNML view data (figure 2) into Excel sheets, much as engineers do. Table 2 is an example of some of this parameterized data in the ExpressGlass case. What happens, for example, in the Alignment pattern? Service know-how ("IN") is used to build customer relationships ("OUT"), triggered by the (actors/roles) End-customer and Call-centres, in the "For Sale" plot (Enterprise Ontology detail); state variables involved (check-up points along the process indicating whether corrective action is needed) are concerned with Accident info and Service info – are these accurate and complete? Once the Excel sheets have been finished, an Excel functionality for data analysis is then used – Pivot Tables – to help find hidden relationships in the data. Certain sections of the data may then be selected to provide us with a view that we want – such as In-EnterpriseInteroperability, Out-InnovationCompetence, and Out-InnovativeService (visible in figure 3).

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Table 2. An example of parameterized data in Excel sheets – How we go from the Storyline BNML view (figure 2) to the integrated BNML view (figure 3)

Pattern	Input-Output	TriggeredBy	Plot	StateVar
Alignment	"In-ServiceKnowHow"	EndCustomer	ForSale	Var_AccidentInfo
Alignment	"Out-CustomerRelationships"	CallCentres	ForSale	Var_ServiceInfo
Collecting	"In-ServiceKnowHow"	EndCustomer	Activity	Var_VehicleForRepair
Collecting	"Out-CustomerRelationships"	GlassRepairShops	Activity	Var_CustomerSatisfaction
CommunicationChannels1	"In-EnterpriseInteroperability"	GlassRepairShops	ProcessSpecification	Var_HistoricRecord
CommunicationChannels1	"Out-CustomerDataBase"	GlassRepairShops	ProcessSpecification	Var_CaseRecord
CommunicationChannels2	"In-EnterpriseInteroperability"	CallCentres	ManagementLink	Var_CaseInfo
CommunicationChannels2	"Out-CustomerDataBase"	CallCentres	ManagementLink	Var_Acknowledgement
CommunicationChannels2	"Out-InnovationCompetence"	PHC interface with SAP ERP	ManagementLink	Var_DataBase
CommunicationChannels3	"In-EnterpriseInteroperability"	CallCentres	Stakeholder	Var_CaseInfo
CommunicationChannels3	"Out-InnovationCompetence"	CallCentres	Stakeholder	Var_InnovationCompetence
CommunicationChannels3	"In-InnovationCompetence"	InsuranceCompaniesBrokers	Stakeholder	Var_ServiceInnovation
CommunicationChannels3	"Out-InnovativeService"	InsuranceCompaniesBrokers	Stakeholder	Var_PartnerSatisfaction
CommunicationChannels3	"Out-PartnerNetwork"	InsuranceCompaniesBrokers	Stakeholder	Var_PartnerNetwork
Trading	"In-ServiceKnowHow"	SalesTeam	Objective	Var_SalesMeetings
Trading	"Out-PartnerNetwork"	InsuranceCompaniesBrokers	Objective	Var_PartnerNetwork
Trading	"In-InnovationCompetence"	SalesTeam	Objective	Var_PartnerSatisfaction
Trading	"Out-Business"	InsuranceCompaniesBrokers	Objective	Var_Sales
ResourceManagement	"In-EnterpriseInteroperability"	GlassRepairShops	Goal	Var_Stock
ResourceManagement	"In-ServiceKnowHow"	Warehouse	Goal	Var_DeliveryTime
ClosurePoints	"In-ServiceKnowHow"	GlassRepairShops	Mission	Var_DeliveryTime
ClosurePoints	"Out-CustomerRelationships"	EndCustomer	Mission	Var_CustomerSatisfaction

We feel that large-scale studies may have some difficulty in capturing success stories, as they tend to not probe into enough detail when gathering data; they are not designed to capture individual stories and they are not part of an interactive process with two-way communication occurring between informants. Qualitative research makes this possible, a process which we favour, even though we recognize that quantitative approaches are good for solving certain problems also, such as researching larger samples from which to generalize theory, as Cabello-Medina et al. (2011) have done. Indeed, Cabello-Medina et al. (2011) "contribute to the innovation literature providing a pretty full picture of best and worst innovative companies."

Figure 4 shows another example of a BNML representation. Figure 4 represents servant leadership (Greenleaf, 1970; Dierendonck and Patterson, 2010) in action, the result of a survey we performed of fifty-five executives from nine different industries. We can see how servant leaders interact with employees to create an organizational culture which delivers superior service to customers. Servant leaders seek out employees but are also able to meet them mid-way in their social interactions. Note also how in figure 4 servant leaders and employees actively serve customers in a team-effort to deliver value.
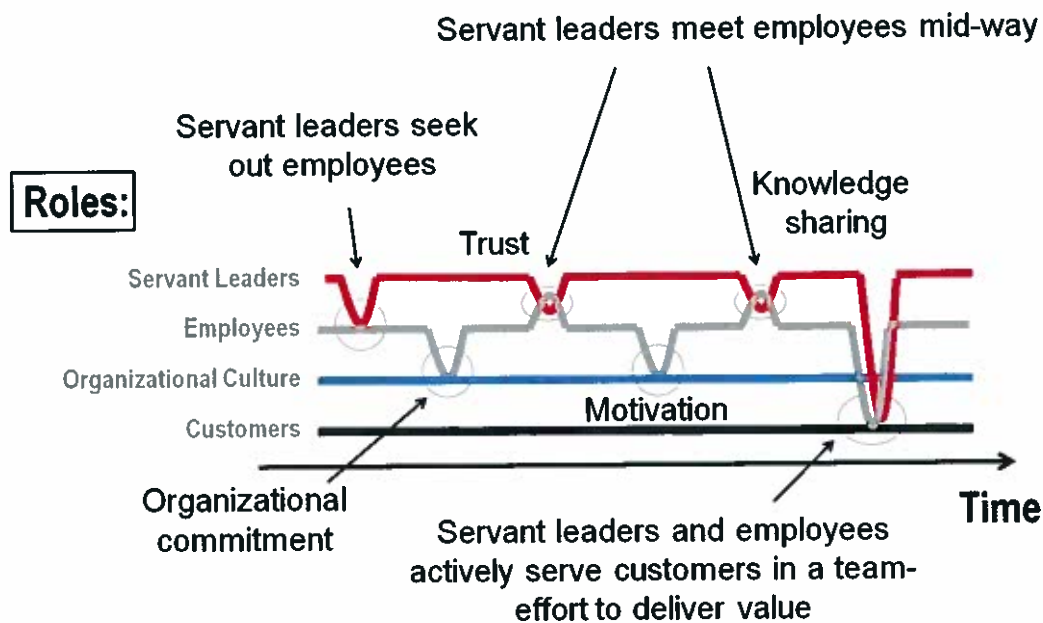
Figure 4. BNML representation of servant leadership in action

Cabello-Medina et al. (2011) mention the same key words and concepts, as can be seen in figure 4, in their research into the creation of value and innovation, within as well as between organizations: "Encouraging techniques [for example servant leadership] specifically designed to promote trustworthy collaborations not only within the firm but with other firms/institutions seems to foster innovation success. In general, managers should keep in mind that knowledge sharing and combination are characteristics of the most successful innovators, who usually develop more radical innovations in the sense that they provide uniqueness or new customer benefits" (Cabello-Medina et al., 2011, p.11464). Cabello-Medina et al. (2011) use, however, a different, more traditional form for communicating key management concepts. What we are trying to do is to create movement in our communication. As António Damásio, a highly cited researcher and neuroscientist, stated – consciousness evolves from a narrative without words but with characters and over time (Damásio, 1999). Indeed, "the first problem of consciousness relates to the way in which we build a <film in the brain>" (Damásio, 1999, p.28).

Besides achieving a communication objective, beyond what words alone can communicate (Woodside, 2010), such BNML visual representations of stories are also "inherently and uniquely fulfilling / pleasurable / healing" (Woodside, 2010, p.85) to those who carry them out. However, BNML also seeks to provide additional satisfaction to audiences too, much as the viewing of a film will provide. One might recall that such visually-based mediums were being used for storytelling in Europe over 30,000 years ago, with cave paintings conveying messages "in societies with high levels of illiteracy" (Woodside, 2010, p.86). Academics should have the ambition of reaching such diverse audiences also. We believe that the narrative, combined with images, will best achieve this.

Cabello-Medina et al. (2011) created and compared two separate groups of firms – a successful group of 63 firms and an unsuccessful group of 71 firms, compared along a financial dimension of innovation success (according to recorded profit, sales and

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market share); and a successful group of 72 firms and an unsuccessful group of 83 firms, compared along a nonfinancial dimension of innovation success (involving impact on company image, impact on loyalty of existing customers, enhanced profitability of other products, new customers attracted, and competitive advantage generated). The least successful companies were below the 35th percentile, the most successful companies were above the 65th percentile (for both dimensions of success separately). This is a practice which needs to be replicated as the norm is to focus mainly on successful endeavours. In figure 5 we can see that our recent research on innovation has involved all types of companies, not just the successful "winners" one hears about in the media, though we have studied those too.

Our research at Diafresh, which commenced in January 2010, led us to classify Diafresh as a Type 1 firm: "Don't know what or how to change" (Tidd et al., 2005, p.570). Diafresh is a micro company, founded in 2002, and located in the North of Portugal, operating in the food distribution industry, and with seven full-time employees in 2011. Diafresh was quite aware that it was in serious difficulty, fighting for survival, but had no strategic plan to improve its situation. Our research effort at Diafresh resulted in our first BNML output (Oliveira and Ferreira, 2010).
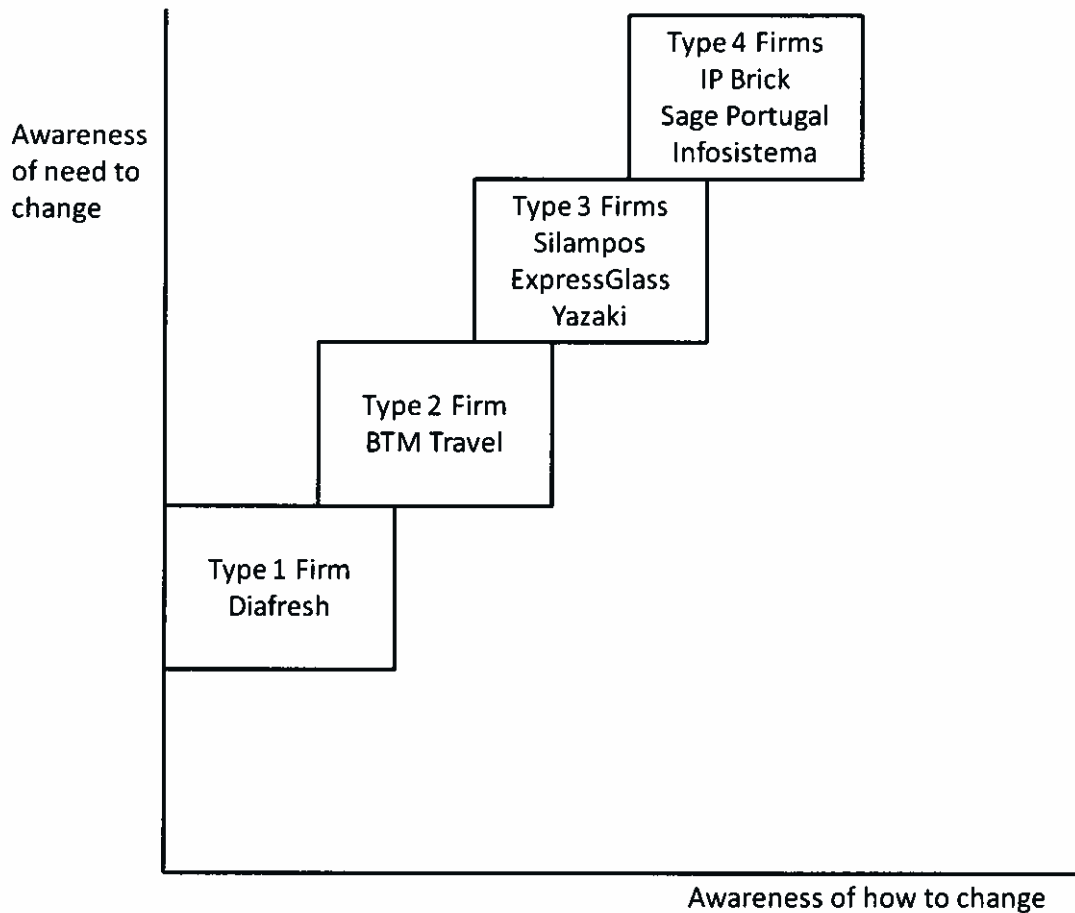

Figure 5. A selection of our most recent case studies according to their innovation capability (application of Tidd et al., 2005, p.570)

Yazaki is an entirely different company operating on an entirely different scale to Diafresh. This represented a challenge for us, to be able to represent the creation of value at this much larger corporation following exploratory BNML research at Diafresh. Yazaki is a private-owned Japanese multinational corporation in the automotive industry with, in 2010, annual sales of approximately €10.5 billion. Several employees were interviewed in-depth: a Japanese vice president, a British general manager and a Portuguese Director. The end result can be seen in figure 6. Interview evidence pointed to how interoperability, "the ability of an enterprise to interact with other organizations, to exchange information and to use the information that has been exchanged" (Li et al., 2006, p.4), leads to innovation. Yazaki, being a Toyota supplier, was drawn into the Toyota supplier "web" where information was shared, interoperability leading to innovation – product, process, position and/or paradigm innovation (Tidd et al., 2005) – as the following quote shows from Gilberto Rachão, Production Director at Yazaki Saltano (in Portugal):

"There is an example, which I think is a fabulous example, and I think that most companies should follow it or at least seriously think about following it, which is Toyota. Something called TPS exists – Toyota Production System – and I am sincerely a faithful follower of TPS. And at this moment Toyota, in Europe, is doing something which I think is extraordinary, something called T.E.A.M. – Toyota Europe Association of Manufacturers – where there are 180 suppliers of Toyota. And what did they decide to do? They selected 42 suppliers, some better, some medium, some very good; and they put them in 7 groups of 6, and those companies will visit each company, and do a sort of consulting service – always with a Toyota member with them. What is Toyota trying to achieve with this? They are elevating the level of all of their suppliers and it is Toyota herself who is going to benefit with this (T.E.A.M. was mainly put together to elevate supplier levels in the following areas – quality, cost, delivery times, and for the sharing of production knowledge). I think Toyota has a fabulous strategy... I am really convinced of that... But we go to those suppliers, too. They come and visit our factory, we go and visit their factories, and we give our suggestions, and that's how Toyota intends that all improve their level of quality, productivity, deliveries. For example, there was a company that took great advantage of our system of warehousing and deliveries. Because we have 100% delivery performance and they had around 60+%. In consequence of this Toyota benefited and that company benefited also, logically."

This passage reveals how Toyota and its suppliers are actually almost a family of companies, each helping each other so that they all may benefit. As Morgan and Liker (2006, p.114) stated in their book about Toyota: "Knowledge is the fundamental element (material) in the development of products". In order to take advantage of existing knowledge one requires a certain degree of interoperability – seamless communication between roles in the value network (figure 6).
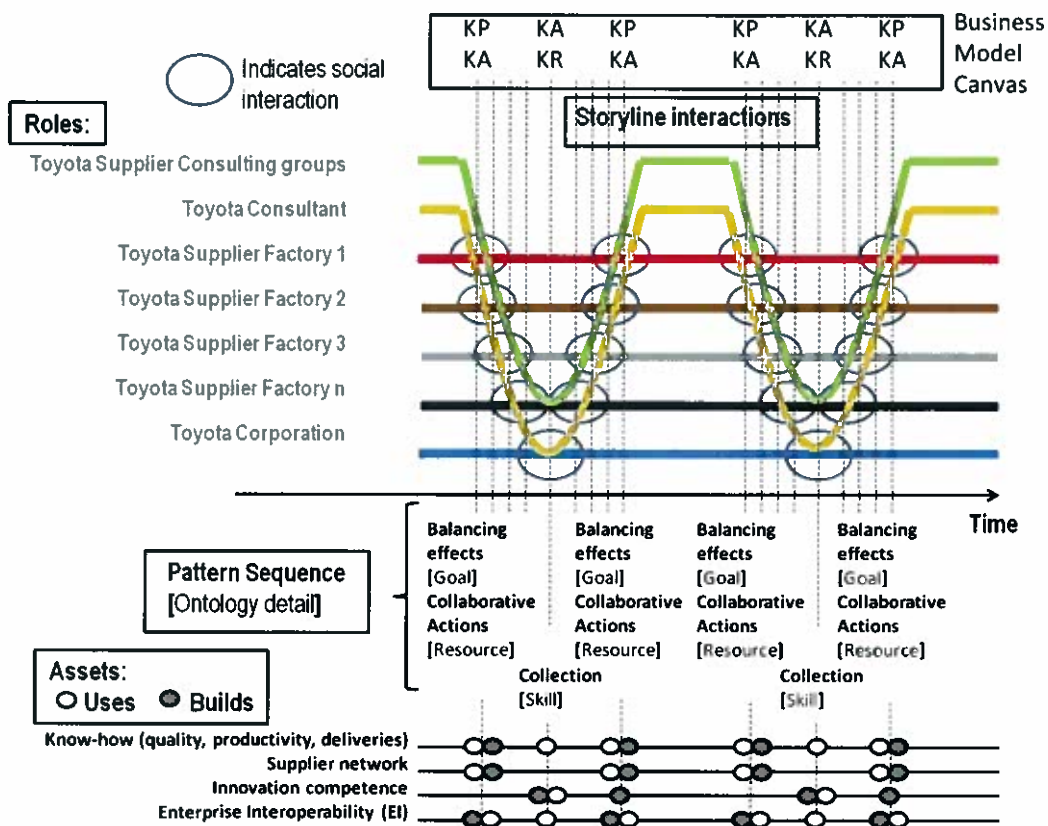
Figure 6. The Toyota Production System (TPS) which also involves Portuguese supplier Yazaki Saltano

Note how in figure 6 the Toyota Supplier Consulting groups (represented by the green line) travel with a Toyota Consultant (represented by the orange line) to other Toyota Supplier factories. These social interactions use and build know-how (such as to improve quality, increase productivity, improve warehousing and / or improve on-time delivery), an asset at the bottom of figure 6. These interactions build and use enterprise interoperability (EI), another asset; which leads to an innovation competence, especially when the Toyota consultant brings all that he / she has learned back to the Toyota Corporation. Without this type of free-flowing communication, the Toyota Supplier Network would not be nearly as valuable as it is in reality to the Toyota Corporation.

Referring again to figure 5, IP BRICK, Sage Portugal and Infosistema are all high technology firms, producing and selling innovative software solutions to companies. They were classified as Type 4 firms: "Technologically capable to generate and absorb" (Tidd et al., 2005, p.570). The Type 3 firms ExpressGlass, Yazaki, and Silampos – the latter an example of a small- and medium-sized enterprise (SME) where family ownership is "combined with active family management and control" (Chu, 2011, p.833), leading to superior performance – were classified so as they "know they need to change and have some ability to generate and absorb technology" (Tidd et al., 2005, p.570). BTM Travel, a micro firm made up of four experienced professionals, was classified as a Type 2 firm: "Know they need to change but not how or where to get resources" (Tidd et al., 2005, p.570).

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Table 3 summarizes our recent research concerning innovation capability. Six of the eight companies were part of research performed between 2010 and 2012. Sage Portugal and Yazaki, however, were initially part of an earlier research effort. In all of the eight case studies semi-structured interviews (audio recorded) were undertaken. These interviews had open-ended questions, with interviewees being allowed to speak of topics they deemed important to the success of their companies. Valuable data was actually gathered towards the answering of the same research question, concerning interoperability and innovation, in the earlier as well as in the later studies. This was achieved as we sought to develop theory interpretively, as suggested by Elharidy et al. (2008), conversing with the "voices in the data" in a reflective / reflexive manner. We thus went "back-and-forth" (Elharidy et al., 2008, p.145) between theorizing and data collection, including an analysis of previous cases, as Elharidy et al. (2008) stated can be done – in an eclectic[16], diverse and flexible overall research effort. Grounded Theory in particular, and especially when used in conjunction with BNML, encourages "greater creativity" and "interaction with data" (Elharidy et al., 2008, p.140), leading to reality eventually being found. Though very different from the method followed by Cabello-Medina et al. (2011), both approaches set out to analyze "what is seen without any prejudice" (Ghauri and Gronhaug, 2005, p.14) – and this must be the basis of all good research aiming to make original contributions.

Table 3. A summary of our recent research into interoperability as an antecedent to innovation capability using BNML (eight cases from 2006-2012)

Organization	Year of foundation	Industry	N° of employees (2010)	Annual sales (2010)
BTM – Viagens e Turismo, Lda.	1994	Travel / Tourism	4[17]	1.4 million €
Diafresh – Serviços de Apoio à Restauração, Lda.	2002	Fresh food distribution	7	502 thousand €
ExpressGlass - Vidros para Viaturas, S.A.[18] (part of the Auto Sueco group, since 2010)	2002 (Portugal); 2008 (Brazil)	Automotive glass repair and replacement	120 (Portugal); 270 (Brazil)	17 million € (Portugal); 34 million € (Brazil)
Infosistema – Sistemas de Informação, S.A.	1996	Information Systems consultancy	60	3 million €
iPortalMais - Soluções de Engenharia para	2000	Software house / Software manufacturer	50	4 million €

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[16] Eclectic defined as "deriving ideas... from a broad and diverse range of sources" (Oxford Dictionaries online, http://oxforddictionaries.com/definition/eclectic?q=eclectic, accessed on 20-01-2012).
[17] BTM had, in 2012, five employees.
[18] ExpressGlass is also present in Cabo Verde and Angola. These subsidiaries were not discussed in the interviews.

Internet e Redes, Lda. [also known as IP BRICK]				
Sage Portugal – Software, S.A.	2000 (Portugal); 1981 (Worldwide)	Management software	150 (Portugal); 13,400 (Sage Worldwide)	1,685 million € (Worldwide)
Silampos, S.A. (Portugal); Silampos UK	1951 (Silampos, Portugal); 2000 (Silampos UK)	Manufacture of stainless steel pots and pans (Silampos, Portugal); product distribution (Silampos UK)	185 (Silampos, Portugal); 60 (Silampos UK)	13 million € (Silampos, Portugal); 27 million € (Silampos UK)
YAZAKI Saltano de Ovar Productos Electricos, Lda. (YSE), YAZAKI Porto Technical Center (PTC), YAZAKI Corporation (privately-owned family company)	1986 (Portugal); 1929 (Japan)	Automotive (electrical distribution systems, electronics, components)	1,800 (Yazaki Saltano in Ovar, Portugal, 2011); 200,000 (approx. Worldwide) (Europe 30,000 Asia-Oceania 90,000, Japan 21,000 Americas 52,000)	130 million € (Yazaki Saltano in Ovar, Portugal); 1,090 billion Yen or 10,481,400.43 € (Worldwide) (Sales by region: Europe 14%, Japan 45%, Asia-Oceania 15%, Americas 26 %)

Very evident in table 3 is the search for diversity in the case studies performed. Much as Cabello-Medina et al. (2011) we sought to compare two separate groups of firms – a not-so-innovative group (types 1 and 2 in figure 5) and a very innovative group (types 3 and 4 in figure 5). The scale of the project is very different, qualitative research involving a much smaller sample of firms than more quantitative initiatives. Other studies have chosen not to focus on comparing companies. See for example Nonaka and Takeuchi (1995) who focus essentially on successful Japanese firms (though they also provide an interesting discussion, for example, of top-down, bottom-up and middle-up-down management models); Simon (1996) who focuses on 500 hidden champions which have attained over 70% of global market share; von Hippel et al. (1999) who focus on the innovative company called 3M; Kelley and Littman (2001) who focus on lessons to be learned from the American design firm IDEO; Morgan and Liker (2006) who delve into the Toyota product development system; de Rond's (2008) ethnographic account of the elite Cambridge University Boat Club team in preparation for the annual Varsity race; and Lafley and Charan (2008) who use Procter and Gamble as the basis for their discussion on innovation. However, one has much to learn from different companies with differing innovation capabilities (Tidd et al., 2005). Table 4 shows the main findings for each of the eight case studies we undertook – the focus is on showing the interoperability types and types of innovation that result from

the various companies we studied. These results were arrived at as a consequence of company visits, in-depth semi-structured interviews and BNML analyses.

Table 4. The main contribution of each of our case studies to the understanding of the relationship between interoperability and innovation

Organization	Main contribution to our research into the relationship between interoperability and innovation
BTM – Viagens e Turismo, Lda.	In times of economic crisis smaller companies must focus on what they do best – for example providing customized service to their niche of customers by being available to them 24 hours, 7 days a week, 52 weeks per year; this interoperability (communication and channel types) will lead to more efficient service (service innovation) – giving ever more (electronic check-in, for example, which avoids customers wasting time queuing up, as well as over-booking and bad seating problems) for the same price
Diafresh – Serviços de Apoio à Restauração, Lda.	Create a community of followers by opening and promoting the use of new communication channels (such as Facebook) – such interoperability (communication and channel types) leads to marketing innovation which creates a loyal customer base[19]
ExpressGlass - Vidros para Viaturas, S.A.	Connect customers, partners, repair shops, call centres and other employees using up-to-date technology and team work as such interoperability (communication, coordination, cooperation, collaboration and channel types) will enable the company to capitalize on process innovation resulting in service innovation
Infosistema – Sistemas de Informação, S.A.	Software developers program very differently and by promoting communication and the sharing of programming routines between them (communication, coordination, cooperation, collaboration and channel interoperability) process and product innovation will result
IP BRICK	By rewarding, both financially and emotionally, interoperability between colleagues, as well as with customers and partners (communication, coordination, cooperation, collaboration and channel interoperability types), will lead to product, process, service and marketing innovation
Sage Portugal – Software, S.A.	Promote and reward interoperability (communication, coordination, cooperation, collaboration and channel interoperability types) between regional subsidiaries as well as with customers to increase product, process, service and marketing innovation
Silampos, S.A.	Maintain an on-going dialogue with customers and between employees as such interoperability (communication, coordination, cooperation, collaboration and channel types) increases product and marketing innovation
YAZAKI	Participate in the promotion of interoperability (communication,

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[19] This customer base was not, however, seen to be significant enough to ensure the continuity of the company which was undergoing serious difficulties in 2012. A severe downturn in the market was felt from October 2011 onwards, with several important customers (restaurants) disappearing / closing down, due to the internal crisis in Portugal as well as to the international crisis felt globally. Bad debt became significant.

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Corporation	coordination, cooperation, collaboration and channel types) between Toyota suppliers to increase innovative output (process and service innovation, for example)

Concluding remarks

More studies need to focus on the not-so-good, not only on the good. Comparative studies such as Cabello-Medina et al. (2011) drive home a deeper message about innovation than just speaking of innovation champions in business. For example, best-selling author Collins (2001) provides a good discussion on how companies can go from good to great. More importantly Collins compares and contrasts good-to-great companies with others which "failed to make the leap". We believe that as Cabello-Medina et al. (2011) use the same basis for their research that it will be a very important paper as it focuses on innovation, establishing comparisons between organizations concerning this essential process, thus providing a basis for managers to rely on in their quest for organizational development.

Cabello-Medina et al. (2011) address three bodies of literature, in which internal social capital is included. Given the times of global crisis that we are currently in, which requires cost-cutting across industries, the internal organizational environment mentioned that leads to being an innovative best performer may represent a big challenge for enterprises. Internal social capital – defined by Cabello-Medina et al. (2011) as existing when there is "a high level of quality of the relationships between individuals involved in innovative activities" which has "irreplaceable benefits for knowledge transmission" involving proximity and trust for cooperation – is difficult especially during downsizing initiatives. Interoperability, which our research has proven leads to innovation, will thus be all the more difficult to achieve. Subsequently we advise companies to be cautioned against such re-structuring projects.

We have found that Type 1 and Type 2 firms (figure 5) leverage less interoperability types, for example only communication and channel interoperability (table 4); as compared to the more innovative Type 3 and Type 4 firms (figure 5) – which tend to leverage the full scope of interoperability interaction types at their disposal – communication, coordination, cooperation, collaboration and channel interoperability types (table 4). Furthermore, the latter type of firms produce more types of innovation – at least two types of innovation, versus only one type in less innovative firms (table 4). These findings emerged from the data, much as Elharidy et al. (2008) propose.

We also use the visual Business Narrative Modelling Language (BNML) in this article so that the article's message may reach other audiences outside the academic arena. What interests us is the communication of emotion and communication which will arouse emotions, emotions being so important to organizational outcomes (Li, 2011). Companies are made up of people who have emotions. BNML intends above all to tell stories with a beginning, a middle and an ending, much as occurs in consciousness (Damásio, 1999), and that arouse emotions in people. When using more traditional methods this is difficult. One would normally have to tell very long stories to arouse emotions in people, long stories which are cumbersome in today's information-overload World. We therefore suggest that more research in future should focus on novel approaches to communicate important findings intended for a variety of audiences.

Acknowledgements

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General discussion

We have presented a novel Business Narrative Modelling Language (BNML) (paper I; paper IV also further refines the language) given the need for a more popular alternative to existing qualitative research approaches. We have sought to improve the usability and standardization of the qualitative research approach, which in turn should lead to greater credibility of such research results. BNML, through its use of the narrative and of visual representations, also seeks to bring practitioners, in particular those with little academic training, closer to academic discussions – discussions which could be, for example, about innovation and strategies for value creation. The BNML framework can also be used to facilitate strategic change communication, linking patterns and plots made evident by the business narratives of value network actors.

A research problem we applied BNML to was to the determining of the relationship between interoperability and innovation. This led us to comment first on an article by Lee and Yu (2010) about producing innovation (paper II). The importance of innovation, seen to be an avenue out of economic crises, led us to provide several definitions of what innovation is understood to involve. Lee and Yu (2010) discuss the importance of relationships, cooperation and trust, and how these positively impact innovation output. Such concepts are seen to be closely linked to the concept of interoperability.

During our literature review one publication in particular caught our attention: the book *Business Model Generation: A handbook for visionaries, game changers and challengers* (Osterwalder and Pigneur, 2010). This book is in itself an example of great interoperability between 470 practitioners, from 45 countries, who co-created the publication. We saw this global collaboration effort as having led to a very creative and innovative outcome, a theme of this PhD research. This led us to the publishing of paper III, which is thus a book review. In paper III we also performed a review of Osterwalder and Pigneur's earlier work which led up to their book. In so doing we applied, in the paper, the Business Model Ontology Canvas (Fritscher and Pigneur, 2010), a visual tool much like BNML, to some of our empirical research which we had performed to date. The term "ontology" has existed since the early 18th century (Oxford Dictionaries, 2012a) but the ontologies field has recently seen important developments, especially since 1990 (Páscoa et al., 2011). An ontology can be a collection of terms and definitions relevant to a particular domain (such as business) (Páscoa et al., 2011). Ontologies can also propose "a framework for modelling organizations" (Páscoa et al., 2011, p.2), such as the Business Model Ontology Canvas. We decided to add an additional dimension to BNML, related to the Business Model Ontology Canvas, after the writing of paper III.

Using BNML representations the relationship between interoperability and innovation, seen to be hard to prove, was determined in paper IV. In paper IV we discuss how BNML is a pivot between the data we gather from the interviewees and the research analysis. A BNML storyline view and a BNML plot view showed how interoperability is an antecedent of innovation at IP BRICK, an innovative Portuguese software firm where we performed an in-depth case study. The level of detail to which one goes, exemplified below, will depend on the specific research project need. How plots unfold, for example, can be explained using terms from the Unicist ontology of innovation or the Unicist ontology of human learning. This has some advantages as certain limits are put into research projects concerning the terms to be used, providing more standardization across cases, but also saving researchers the trouble of having to search for appropriate terms as these already exist, for the most part. Preparing for a sale, a plot in the Team Play1 pattern in our IP BRICK analysis (paper IV, figure 4, p.48), is a "cognitive process" (Unicist ontology of human learning term), involving product information given to Sales and to Support & Implementation by the R&D product line departments; coming up with new product features, again a plot in the

Team Play3 pattern in the IP BRICK analysis (paper IV, figure 4, p.48), can be seen to be a "maturative evolution" (another Unicist ontology of human learning term), resulting from Support & Implementation's reflections on the products offered by IP BRICK (Support & Implementation spend some time with customers, providing support and implementation services, which puts them in a unique position as concerns product knowledge). The use of ontologies is important as it lends some standardization to research projects, especially if they are international efforts involving various teams in different countries – for example indicating that the term "customer" should be used instead of the term "client" (Uschold et al., 1998). Aveiro and Tribolet (2006) also created an ontology for organizational functions and discussed "the recursive self-maintenance mechanism of the enterprise" concerning departures from the norm and the organizational fight for survival. For example, in our IP BRICK case study we introduced the concept of state variables (Aveiro and Tribolet, 2006) – an instance being Var_CommunicationChannels, a form of interoperability which can be measured using a number of monitoring tools and is so important for innovation to occur, as we demonstrated. State variables indicate, for example to the CEO / senior management, whether corrective action is necessary. Var_CommunicationChannels rationale: Are key actors sharing information as they should do, in order to propel the company forward? With departures from the norm resilience dynamics come into being (Aveiro and Tribolet, 2006) which permit companies to endure and grow successfully into the future.

At IP BRICK (paper IV) knowledge management, and in particular enabling digital-knowledge-management tools (ICT), as well as a dynamic organizational innovation culture, are essential to their success. BNML made this very evident from the outset and the research effort was much more agile and dynamic as compared to other previous research experiences, by the PhD candidate, using more traditional qualitative research methods – lacking, for example, a framework of pre-defined game patterns (Bjork and Holopainen, 2005, provide a list of 296 such patterns, thus covering a significant number of situations) to interpret the data; and business model canvas building blocks to make evident key activities as well as the company's value proposition; as well as other ontologies such as the Enterprise Ontology by Uschold et al. (1998) (during the MBA done by the PhD candidate, in the United Kingdom, from 1992-1993, qualitative research was performed though without BNML it was an extremely difficult and time-consuming process). Graphviz software was also introduced into our analysis to produce the BNML plot view. Graphviz software made evident a pattern sequence, for example, showing Enterprise Interoperability types as antecedents of the three innovation phases.

Paper V, based on three research efforts – two in-depth surveys and a case study of the innovative Portuguese firm Infosistema – also focuses on how interoperability fosters innovation. The results of the study show that servant leadership leads to interoperability and that both are antecedents of innovation. We conclude also that the servant leadership philosophy is seen to be a distant reality from the majority of Portuguese enterprises. Less free-flowing communication and subsequently less innovation output are to be expected in such an environment, where paternalistic and autocratic leadership styles predominate. This might partly explain the economic crisis Portugal is currently going through. According to one international analyst, writing for *The Wall Street Journal*, "the problem was simply that it [Portugal] couldn't compete within a single currency with much stronger economies. Now the country [Portugal] is being plunged into a full-scale depression — as bad as anything witnessed in the 1930s — by monetary union" (Lynn, 2012). "Innovation is the basis for economic growth" (the Unicist ontology of innovation, p.1) and freely communicating and sharing information, in sum being interoperable, within as well as between organizations are, we have demonstrated, essential to innovation output. Culture change is thus seen to be necessary at the national level (North, 2005) – but also at the individual, team, inter-

team and total organizational levels (Coghlan and Rashford, 2006). Organizational success will follow on from successful change and strategy, as Coghlan and Rashford (2006) state. However, these authors continue, organizations are complex systems, made up of subsystems, and it is not sufficient to focus on the tasks at hand – relationships need to be taken into account – which brings us to the informal but complex concept of culture. So, innovation is essential, but the appropriate interoperable environment must be created for it to occur often and consistently. Innovation can impact both differentiation and costs (Porter, 1980; Dantas, 2001) and is thus seen to be a sure way to gaining a better competitive standpoint in the marketplace (Dantas, 2001), so essential to Portuguese organizations, today and in the future.

Finally, paper VI summarizes our global research effort, which has involved a total of eight case studies. This paper drew also upon earlier research into innovation and culture and thus required re-visiting research notes and interviewee testimonies gathered at the start of the candidate's PhD project, before the PhD research theme matured. Interviewees were however contacted to confirm the new research direction and findings, which they duly validated. "Eclecticism allows researchers the flexibility to seek understandings from the field by listening to multiple voices (including those of previous researchers or other cases)" state Elharidy et al. (2008, p.142). We certainly felt that our research was greatly enriched by listening thus to the "multiple voices in the data" (Elharidy et al., 2008, p.151) and by allowing theory to emerge, much as Grounded Theorists do, as "GT [Grounded Theory] is method designed to allow theory to emerge" (Elharidy et al., 2008, p.151). We felt at home with this qualitative approach and what it does *not* represent: "qualitative research – whatever it might be – certainly is not a unified set of techniques or philosophies, and indeed has grown out of a wide range of intellectual and disciplinary traditions" (Mason, 2002, p.2). It is precisely this diverse universe of intellectual traditions which we sought to add to by creating BNML. As BNML evolves it is ever more apparent that it contributes with an engineering perspective to qualitative research – apparent in the construction of the Excel sheets (please see table 2 in paper VI) and the subsequent use of pivot tables – but one which leaves room for some subjectivity, so important to the "art" of qualitative researching. Research should not be mechanical but rather it should be a creative process (Oliveira, 1997, as quoted by Vilelas, 2009). Science does not advance in a mechanical fashion (Vilelas, 2009).

BNML offers a number of tools which the researcher can decide to use, or not use, and as such is "user-friendly" (Gonçalves and Oliveira, 2010; Gonçalves et al., 2011). For example, we have used in the PhD project value network analysis (Allee, 2008), a BNML storyline view, a BNML plot view, Graphviz software, Excel table parameterization of data, the Business Model Canvas (Osterwalder and Pigneur, 2010), as well as a number of different ontologies, among other approaches. Much as can occur with a video camera or with an automobile end-users may not want or even be aware or be able to use all of the functionality made available by the product designers and manufacturers. In terms of using more or less of the BNML "functionality", this does not subtract from the validity of research analyses and results, which need to be tailored to each situation (as we have shown in paper VI, with figures 4 and 6).

It is this new research method called BNML – which promotes the rapid comprehension of subject matters through its pictorial representations and accompanying narratives – which we contrast in paper VI to another more traditional research method used by Cabello-Medina et al. (2011). In the process we present additional research findings. Our research study, in sum, has focused on the outstanding but also on the less innovative, thus making possible a comparison between cases, much as Cabello-Medina et al. (2011) did. We found that the more innovative companies in the sample

tended to leverage the five interoperability types enunciated by Li et al. (2008) – namely communication, coordination, cooperation, collaboration and channel interoperability types – while the less innovative companies only leveraged one or two such interoperability types. This in turn resulted in the production of more innovation types by the more interoperable companies (such as product, process, service and marketing innovation by Sage Portugal) versus the other set of companies.

It has been argued that theorizing from process data and theory building involve three processes: induction, deduction and inspiration – so why not iteratively or simultaneously mobilize both inductive and deductive approaches as inspiration guides us (Langley, 1999)? The inductive approach finds support in data-driven generalization; the deductive approach has as its basis theory-driven hypothesis testing; but theory building can involve inspiration and be "driven by creativity and insight" (Langley, 1999, p.708). We have subsequently been inspired, as Langley (1999) suggests, by empirical research and by reading; and we feel that "there is room in the organizational research literature for more openness within the academic community toward a variety of forms of coupling between theory and data" (Langley, 1999, p.691); and "there is also room for developing new strategies for understanding processes... that take a new tack entirely" (Langley, 1999, p.708) – such as is the case with BNML, as we have demonstrated, which seeks to use the creative plus the systematic, promoting both the insight and the imagination of researchers.

We would like, finally, to again emphasize that BNML is fundamentally about stories - stories about events in people's lives. This indicates that there is no limit to what BNML can be applied to. BNML is a philosophy, a research approach, based on a number of [business] tools to provide structure.

As an anonymous reviewer of the *Journal of Business Ethics* commented on a paper we recently published (Gonçalves et al., 2012 – please see Annex A), a paper with five BNML visual and narrative representations (figures 6-10 on pp.167-169 herein) and focusing on the realm of web site accessibility: "The BNML roadmap could have a significant impact... [and] hopefully bring about change in the area and increase accessibility levels." Another anonymous *Journal of Business Ethics* reviewer stated further that we brought a much-needed practical perspective to the sphere of web site accessibility, an important area of research, due in large part we feel to our novel BNML representations. Our study found that enterprise website accessibility levels are in need of significant improvement. We concluded further that "greater interoperability between systems and organizations, to make communication seamless (Mertins et al., 2008)" (Gonçalves et al., 2012) is essential; and, indeed, "for Web accessibility purposes, [this interoperability] needs to be a focus in future" (Gonçalves et al., 2012). We thus hope that our research on interoperability, as well as concerning the development of BNML, will contribute in some small way to an improved quality of life of fellow human beings; not only in Portugal, which has been the main focus of our research, but in other countries as well.

Limitations of the study

This PhD research project was performed with the objective of having an up-close and in-depth understanding of a small number of cases seen to be interesting and distinctive enough to result "in new learning about real-world behavior and its meaning" (Yin, 2012, p.4). Surveys address the question "How often something has happened" (Yin, 2012, p.5) – thus, our study does not identify, for example, how many Portuguese companies use the whole spectrum of interoperability types at their disposal. Similarly, we do not identify how many innovation types are produced by the majority of Portuguese companies. These results need to be attained by other larger-scale studies. Finally, our study focused on the Portuguese context and has been limited to companies in mainland Portugal. Thus we suggest that other studies involving companies from other regions be performed in order to ascertain whether our results are region-specific or not.

Conclusions and directions for future research

We thus conclude the following, based on the original articles presented herein:

1) The novel Business Narrative Modelling Language (BNML) is a valid alternative to other qualitative research approaches and is a useful tool to use in conjunction with other interpretive research methods such as case study analysis and Grounded Theory (papers I, IV, V and VI).

2) Interoperability is an antecedent to innovation (papers IV, V and VI).

3) A dynamic organizational innovation culture is instrumental and ICT is seen to be an enabler in the process mentioned above (mainly paper IV; but also papers V and VI).

4) Servant Leadership leads to interoperability and thus both are seen to be antecedents of innovation (paper V and also paper VI).

5) Culture change is necessary in Portugal – at the national, organizational, and individual levels – to enable companies to be more open in their communication and thus more interoperable (especially paper V; but also paper IV).

6) The more interoperable an organization is – i.e. the more interoperability types it leverages – the more innovative it will tend to be (paper VI).

We have used BNML to prove that interoperability is an antecedent to innovation. We have concluded that the more interoperability types a company leverages the more innovative it will tend to become. We would like to see, in future, additional larger scale research efforts studying the interoperability types leveraged by Portuguese firms, comparing this information, afterwards, to the innovation output generated by these firms. Also, other regions other than Portugal should be the object of such research.

We would also like to see other research performed, in future, in other fields, using our Narrative Modelling Language. We have applied this research tool to the business and management context but we foresee that it could be applied to a variety of contexts – it is only a question of changing the ontologies (such as the Business Model Canvas (by Osterwalder and Pigneur, 2010) and Uschold et al.'s (1998) Enterprise Ontology, which can both be replaced) and other basic elements currently underlying our language. We thus see BNML as being rather [X]NML, where the X can refer to other scientific domains based on other ontologies. Scientific domains such as, for example, the life sciences – "the sciences concerned with the study of living organisms, including biology, botany, zoology, microbiology, physiology, biochemistry, and related subjects" (Oxford Dictionaries, 2012b). The World-renowned, award-winning, and best-selling author and researcher Richard Dawkins, a former Reader in Zoology at New College,

Oxford University, wrote *The Selfish Gene* (1ˢᵗ edition 1976, 2ⁿᵈ edition 1989) which discusses some of the themes which we have brought up, also, in this thesis, namely culture, a concept not unique to "we animals" (Dawkins, 2006, p.xxii) but found for example in birds too (Dawkins, 2006). We agree that "most of what is unusual about man can be summed up in one word: culture. I use the word not in its snobbish sense, but as a scientist uses it. Cultural transmission is analogous to genetic transmission in that, although basically conservative, it can give rise to a form of evolution" (Dawkins, 2006, p.189). We have discussed culture in this doctoral thesis as pertaining to countries as well as to organizations and individuals, and we maintain that "man's way of life is largely determined by culture rather than by genes" (Dawkins, 2006, p.164). This we hope sends out a positive message to our readership, in so far as change for the better, out of our current somewhat dire situation, is always possible. Thus we see that differing areas of knowledge, as they discuss similar themes, may also use similar methods to address those problems. By way of this PhD thesis we thus hope to have contributed, in some small way, to a possible future approximation between differing fields of science by way of using our proposed research method [X]NML.

We recently gave two training sessions for researchers (22ⁿᵈ and 29ᵗʰ of March, 2012) in the auditorium at INESC TEC about what BNML involves and how to apply it (with fourteen participants in the first training session and nine participants in the follow-up session). Given the interest shown in BNML more training sessions have already been planned (namely at FLUP – Faculdade de Letras da Universidade do Porto; in May, 2012). It will be interesting to see how BNML evolves given the feedback of other researchers.

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ANNEX A

PUBLICATION USING BNML AS A RESULT OF THE CANDIDATE'S DOCTORAL STUDIES

Complete reference and details	Contribution of the paper to the research topic:
Gonçalves, R., Martins, J., Pereira, J., Oliveira, M.A., Ferreira, J.J.P. (2012). Enterprise web accessibility levels amongst the Forbes 250: Where art thou o virtuous leader? Published online 8th April, *Journal of Business Ethics*, DOI 10.1007/s10551-012-1309-3 (ISSN: 0167-4544 – print version; ISSN: 1573-0697 – electronic version; ISI INDEXED JOURNAL; IMPACT FACTOR 1.125). Key words: WCAG, Section 508, web site evalution, web site accessibility levels, BNML Editor: Springer	This is an article about web site accessibility levels amongst the Forbes 250 largest enterprises which used BNML as a result of the candidate's doctoral studies. We concluded that significant improvements are necessary to enable enterprise web site accessibility for all. We also further concluded that, in Europe as well as globally, greater interoperability is required between systems and organizations to improve web site accessibility levels. The importance of interoperability, a major topic of the candidate's doctoral thesis, is thus again emphasized. BNML was used in this article (with a total of five BNML visual and narrative representations – figures 6-10 on pp.167-169) to analyse research results and to portray a way forward to better web site accessibility levels Worldwide. Comments from anonymous *Journal of Business Ethics* reviewers, concerning BNML, were very encouraging and BNML was seen to bring a much-needed practical perspective to web site accessibility research, being also a tool which "will hopefully bring about change in the area and increase accessibility levels." The article is reproduced in full, below, with kind permission of Springer Science and Business Media.

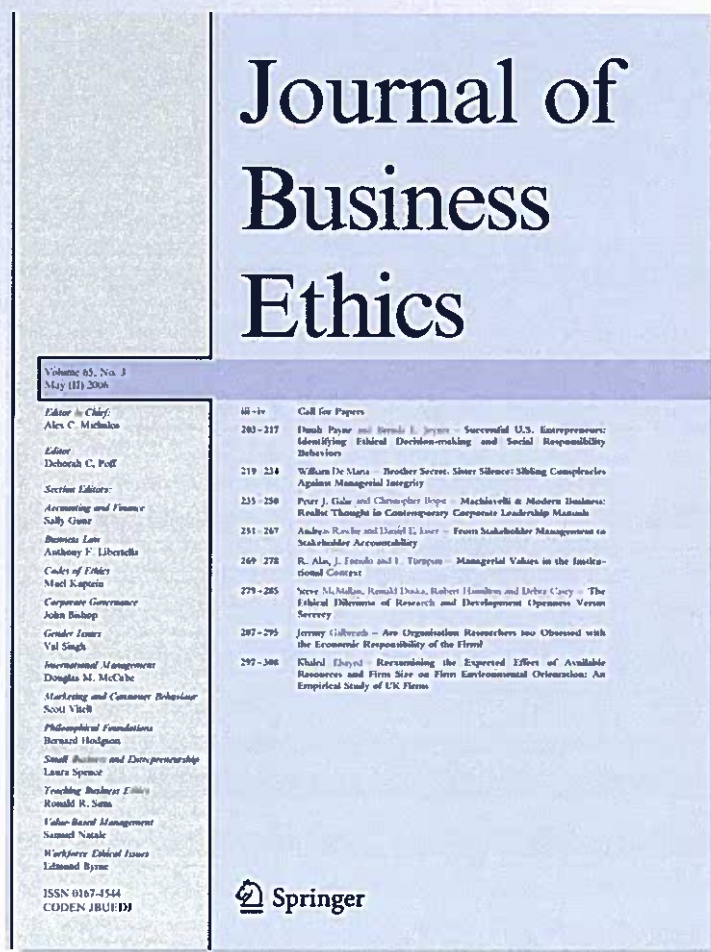# Enterprise Web Accessibility Levels Amongst the Forbes 250: Where Art Thou O Virtuous Leader?

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Journal of Business Ethics

Enterprise Web Accessibility Levels Amongst the Forbes 250: Where Art Thou O Virtuous Leader?

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Manuel Au-Yong Oliveira · João José P. Ferreira

Abstract The research team measured the enterprise web accessibility levels of the Forbes 250 largest enterprises using the fully automatic accessibility evaluation tool Sortsite, and presented the compliance of the evaluated websites to WCAG 1.0, WCAG 2.0 and Section 508 accessibility levels. Given the recent attention to organizational leaders having ethical duties towards their dedicated employees, we propose that 'societal citizenship behaviour' concerns ethical duties of organizational leaders towards society in general and in particular to those who have less means to assert their needs. In effect, we found enterprise website accessibility levels to be in need of significant improvement. An interpretation of a positive path forward to better enterprise website accessibility levels is put forth based on a focus-group interaction and using BNML—a novel Business Narrative Modelling Language.

Keywords WCAG · Section 508 · Website evaluation · Website accessibility levels · BNML

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Introduction

An objective of this article is to increase global awareness of the enterprise web accessibility problem. In order to achieve this objective, we performed a study in which we chose as our sample for analysis the 250 largest enterprises of the year 2009 according to the Forbes listing of 'The Global 2000' (Forbes.com 2011). We are in agreement that organizational leaders have ethical duties towards their dedicated employees (Lee 2010; Caldwell 2011). We propose further, however, that 'societal citizenship behaviour' (SCB) is also essential, concerning ethical duties of organizational leaders towards society in general and in particular to those who have less means to assert their needs. The largest 250 Forbes enterprises were seen to be a good example of where one should find SCB as this set of companies should set the standard which other smaller companies (with less financial means) should follow. Our research results, however, have proven otherwise.

In the era of the Internet, web accessibility, or a lack of it, can constitute a serious barrier to integration in society and not only to commercial transactions. Corporations are 'very powerful modern institutions that enjoy many of the legal rights of humans' (Beets 2011, p. 193), and so it is only fitting that corporate websites thus be made accessible to all, and not only to the privileged, even if they are the minority.

The effect of leaders on followers outside the organization has been less researched than the leader–follower relationship within organizations. For example, recent research by Hayibor et al. (2011) discusses value congruence between CEOs and their top management teams. Interestingly, however, servant leadership (Greenleaf 1970; McGee-Cooper and Trammell 2010; Spears 2010) brings to the fore the notion of leadership as a service,

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where all are winners due to a motivation to serve, including customers and the community at large. Leaders can also be servants, according to the visionary Greenleaf (cited in Trompenaars and Voerman 2009) and servant leadership is a management style which combines serving and leading at the same time. What our research would also like to emphasize is the need for the effects of leadership to be felt also on corporate followers or potential or actual customers who fall outside the hierarchical relationship within organizations. Being followers, often even avid followers, potential or actual customers deserve to be considered worthy of 'servant service' as well. Potential and current customers are fundamental stakeholders in a company's future and service is due not only to salary-earning employees. Thus, websites must be made accessible to all as a service which companies must provide. 'A servant-leader is servant first' (R. K. Greenleaf quoted in Spears 2010, p. 11). Indeed, Spears (2010) does focus upon the inclination to serve others and the need to build a better and more caring society; and positive change within the Forbes 250 (our sample) is seen to be instrumental due to the far-reaching effect they have in society.

In an ultra-high-tech age, technology can alienate or connect citizens to organizations (Gonçalves and Oliveira 2010). There is an area of research which has dedicated attention to universal design, to universal accessibility and to 'the importance of feeling included in groups and ultimately in society as a whole' (Gonçalves and Oliveira 2010, p. 259). This will make for healthier people who are also more resilient. Furthermore, it makes commercial sense to make our corporation's products and services available to as many people as possible. We thus feel that this topic of web accessibility and the notion of service to followers outside the organization could not be more worthwhile.

The Council of the European Union (EU 2010) also brought forth important conclusions concerning digital connectivity in Europe and the subject of bottlenecks, which need to be tackled, is also present. In their communication, they stated that 'The wider deployment and more effective use of digital technologies can provide Europeans with a better quality of life through, for example, better health care, safer transport, new media opportunities and easier access to goods and services' (EU 2010, p. 2). Better quality of life throughout society is an aim of our research, and this article is organized to address corporate website accessibility as follows: first, we focus on defining web accessibility; then we evaluate and analyse the results of our studies, using Sortsite and the Business Narrative Modelling Language (BNML) (Oliveira and Ferreira 2011); and, finally, we advance conclusions of our research.

Web Accessibility: Definition and Regulation

The second section of this article presents an overview on the concepts behind the web accessibility issue.

An initial presentation of the existent definitions of accessibility is made, as well as a brief description of the various perspectives surrounding the theme. We also present arguments and elements on how accessibility can affect and influence one's quality of life. We finalize this section by describing, from a macro point of view, other studies that present similar intents and methodologies.

Contextual Background

According to W3C (2005) and Thatcher et al. (2006), the widespread use of Information and Communication Technologies (ICT) in enterprise markets and in cultural and social activities is providing a clear need for high accessibility levels to these technologies. If this need is satisfied, the benefits emerging from the use of ICT will be available to all, including those with impairments or disabilities.

The ability of a person with disabilities to access a given service or product or execute a given activity in an equal manner as a person who does not have any kind of disability, is the definition of accessibility we adopt in our article. In the world of ICT, the term accessibility can be simply defined as the existence of interfaces that can be used, acknowledged and perceived in the same manner by all users, whether they are disabled or not (W3C 2008a).

When we pass over to the world of the web, we also need to have the concept of accessibility very present. This kind of accessibility, commonly known as 'Web Accessibility' can be characterized as the existence of web interfaces that, just as with non-web interfaces, must be perceivable and usable in the same easy way by both users with and without disabilities (W3C 2008a; Bradbard and Peters 2010).

According to the World Wide Web Consortium (W3C), the existence of accessibility in web content is directly related to factors such as the web content developers' technical and personal skills, the ability of the existing authoring tools to provide a mechanism for creating accessible web content and also to the capabilities of the accessibility evaluating tools that evaluate web content against the existent web accessibility regulations (Brewer 2006; Chisholm and Henry 2005). Although W3C considers that the web content developers' technical capabilities are one of the issues related to the amount of accessibility faults, these same developers claim that this issue is mainly due to the difficulty in interpretation/implementation of the existent regulations and due to the high level of difficulty in using not only the available test tools but also the existent development tools that consider

web accessibility features (Trewin et al. 2010). Accessibility has therefore to be looked at with its deserved care and attention and, to this end, the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C) was launched as an organized effort to tackle this issue (W3C 2008a; Shneiderman and Hochheiser 2001; Easton 2011).

Currently, several organizations, besides W3C, bring forth studies regarding the regulation and spreading of web accessibility content. Amongst these are the International Organization for Standardization—ISO (ISO 2002, 2006), the European Union (EU 2005, 2006, 2010) and the United States of America Congress (ITAW 2010).

Guidelines, Legal Regulations and Global Panorama

Web accessibility has been the core subject of several regulations across the World (Becker 2008; WHO 2006). This can be perceived by analysing not only international regulations but also the numerous national regulations that aim to regulate and implement web accessibility.

Examples of international regulations are those proposed by the International Organization for Standardization—ISO TS-10071, ISO 9241-110 and ISO 9241-171 (ISO 2002, 2006, 2008). Other examples of international regulations are the W3C's Web Content Accessibility Guidelines 1.0 (WCAG 1.0) and the Web Content Accessibility Guidelines 2.0 (WCAG 2.0).

When, in the late 1990s, the W3Cs WAI initiative was founded, its goal was to create several tools that would help in improving web accessibility levels (W3C 2008b). One of the tools created by the referred initiative was the WCAG 1.0. These were a series of indicators gathered in a document fashion that explained how to create accessible web content. However, as technologies evolved, this first version of the accessibility guidelines became obsolete and needed to be updated. This evolution became a reality when WAI published WCAG 2.0. This newer version of accessibility guidelines presented several differences and only a few similarities to its predecessor (W3C 2008a). WCAG 2.0 also makes use of the functional concept of principles [used in some other works, such as ISO Dialogue Principles (ISO 2006) and Nielsen's Usability Principles (Preece et al. 2002)].

WCAG 2.0 was defined according to the following four principles (W3C 2008a):

- Be perceivable—information and user interface components must be presented to users in ways that they can perceive them. This means that users must be able to perceive the information being presented (it cannot be invisible to all of their senses);

- Be operable—user interface components and navigation must be operable. This means that users must be able to operate the interface (the interface should not require interaction that a user is not able to perform);

- Be understandable—information and the operation of user interfaces must be understandable. This means that users must be able to understand the information as well as the operation of the user interface;

- Be robust—content must be robust enough so that it can be interpreted reliably by a wide variety of user agents, including assistive technologies.

Although there are several differences between WCAG versions 1.0 and 2.0, we can still see some similarities. One of these similarities, though mild, is the definition of conformance levels. WCAG 1.0 checkpoints were divided into a certain priority (1, 2 or 3) where the conformance level of a website was due to meet these same checkpoints in accordance with the following criteria:

- Conformance level A—implementation of all priority 1 checkpoints (those that must be met);

- Conformance level AA—implementation of all the checkpoints of priority 1 and 2 (those that should be met);

- Conformance level AAA—implementation of all the checkpoints of priority 1, 2 and 3 (those that can be met).

The WCAG 2.0 standards are organized according to a set of success criteria of a certain level of importance (A, AA and AAA) and are similar to what existed in WCAG 1.0, where the conformance levels of websites was directly linked to the fulfilment of the success criteria, this relationship being described as follows:

- Conformance level A—compliance with all success criteria for level A (those that are indispensable for the document information to be accessible to all). It is the lowest level of conformance;

- Conformance level AA—meeting all success criteria for levels A and AA (those that are very important for the document information to be accessible to all);

- Conformance level AAA—compliance with all success criteria for levels A, AA and AAA (those that even being optional, make information more easily accessed by all). Presents itself as the highest level of conformance and one that ensures that information is available to all.

Besides the W3Cs, which have existed for almost one and a half decades, and which are making efforts towards promoting and regulating web content accessibility, this issue has also been in the agenda of several countries, such as the USA, for a long time.

The concern in the USA with disabled people has been in existence since the 1973 Rehabilitation Act. However, with the introduction of Electronic and Information Technologies—EIT in Federal Agencies, the need for these technologies to become accessible to all became clear. In order to satisfy this need, in 1998, the USA Congress amended existing regulations, forcing all Federal Agencies to transform the referred technologies for them to be accessible to all citizens, including those with impairments. With the knowledge acquired by the application of these regulations, the scene was set for the creation of the 'Section 508' law (ITAW 2010; USAB 2010). By enforcing this law, the USA Congress intended to remove all of the different types of barriers when accessing ICT allowing, as a direct result, disabled people to benefit from these same technologies and from a new range of opportunities.

Although Section 508 was created to intervene in government institutions, not all have adopted this ruling because it is more directed to the websites of high levels of government. In order to solve this problem, some local government authorities have created their own regulations based on Section 508 itself, trying to legally cover the local government institutions. Apart from this issue, there is still the problem of the difference in coverage between the statutory public websites and those belonging to the private sector. Still, there is a conceptualization that, not very widespread or accepted in an assertive manner, Title III of the Americans with Disabilities Act (ADA), may somehow regulate the websites of private entities, provided that such websites or companies have an activity that fits in a set of predefined activities.

From WCAG 1.0 (1999) to WCAG 2.0 (2008)

One of the main features of the world of ICT is its constant evolution and change. This reality made the WCAG 1.0 (which was mainly technical) out-of-date in only a few years of existence. This fact, coupled with a need for facilitating the understanding and use of policies and the right way to test them (automatically or manually), forced the W3C to carry out the process of creating a newer, more current and comprehensive version of the Web Content Accessibility Guidelines, that could respond to most of the criticisms made to WCAG 1.0.

Given the aforementioned situation, on 11 December 2008, the W3C published the WCAG 2.0, representing the evolution and adaptation to a new situation regarding concerns about the accessibility of web content.

The development process of WCAG 2.0 represented in itself a break from traditional methodologies. This was mainly because this time the W3C chose a collaborative development methodology, thus taking advantage of the feedback that various Internet users (including several specialists) and several international institutions were giving at the same time that W3C launched draft versions of the document that would eventually come to be the final version of WCAG 2.0.

Another innovative aspect of the WCAG 2.0 development process was the creation of manuals and handbooks on how to transit from WCAG 1.0 to WCAG 2.0, and the creation of technical documents that could/should be used to implement policies, as well as other support materials.

While the WCAG 1.0 was mainly composed of technical nuances, version 2.0 of the standards was more comprehensive, thus aiming to 'escape' technological limitations. This aspect has made the WCAG 2.0 become much more targeted towards the majority of web technologies and more adaptable to future technological developments and innovations.

Despite the innovation presented by WCAG 2.0, this standard has been the target of several critics. The majority of these critics state that this new version of W3Cs accessibility guidelines still has faults and is still incoherent concerning some topics. One of the most important consequences of this discussion is the fact that several web content creators are still using WCAG 1.0 as the web accessibility standard when creating websites or making documents available online.

Web Accessibility and Usability

Although the general consensus is that usability can be viewed as a quality factor associated to all software applications, several definitions have been presented. These definitions vary according to the models that they are based upon.

According to Nielsen (1993), the concept of usability is not a closed definition, but a group of concepts, such as Learnability, Efficiency, Memorability, Few Errors and User Satisfaction. These principles can also be specialized and decomposed into finer-grained criteria, allowing for a wider group of validation criteria, methods and tools. As a result, usability is systematically and continuously evaluated, approached and improved upon (Nielsen 1992, 1993).

The standard that is currently accepted by the community of usability specialists is ISO's International Standard ISO 9241, according to which usability can be viewed as an 'extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use' (ISO 1997).

As concerns accessibility, it can be viewed as an extent and complement to the concept of usability, defined above, as it sets down the conditions for users to achieve goals with effectiveness, with a high level of knowledge acquirement, while addressing, at the same time, the use of a given web content in a specific context (Matera et al.

2006; Lew et al. 2011). The usability of web content puts its focus on fewer errors occurring; the accessibility of web content aims for it to be used and accessed by everyone (Theofanos and Redish 2003; Hull 2004).

Web Accessibility: Similar Studies

There are several published studies regarding the web accessibility topic. These studies were mainly accessibility evaluations of a defined set of websites that, in their great majority, present results showing that the web accessibility levels of the evaluated websites is extremely low. Given the fact that these studies concern a universe of websites composed by both public and private entities, it is possible to claim that the web accessibility issue is global and not just a problem of a restricted group of entities (Kurniawan et al. 2001; Pernice and Nielsen 2001; Drews 2008; Cullen et al. 2009; Lazar et al. 2010; Gonçalves et al. 2011; Kurt 2011).

One of the international organizations that has been actively concerned with the web content accessibility issue is the United Nations—UN, through the Secretariat for the Convention on the Rights of Persons with Disabilities (SCRPD). One of the main UN achievements was the creation of the United Nations Enable website which aims to publish information on disability related topics and on the UNs work concerning disabilities. One of the UNs most significant actions towards web accessibility was the publication of a report that resulted from an audit, performed in collaboration with Nomensa, of the 100 leading websites from 20 countries from around the world (UN 2006). This audit used W3Cs WCAG 1.0 as the accessibility standard to test against and, as other studies with 'smaller' target groups also announced, its results indicated that the accessibility levels of the evaluated websites were very low. Despite presenting results similar to other web accessibility audits (including the one presented in the present work), this study also highlighted that several of the evaluated websites could be easily changed to be conformant with the web accessibility standards.

Evaluation and Analysis of Results

The existence of websites created with more emphasis on visual aspects rather than equal access to all users (Bradbard and Peters 2010) goes against the concept of web accessibility. This fact emphasizes the need for a valid and assertive effort to perform a web accessibility evaluation study to acknowledge what is the reality of the web content accessibility level.

Methodology

In order to proceed with a correct assessment of the accessibility levels presented by a given website, one should understand the suggested (or imposed) methods to be used for that process. W3C has published a series of indications and steps that one should follow to do a correct, impartial and technically flawless evaluation (W3C 2006). With this in mind, we have decided to follow W3Cs evaluation methodology. As a result of these decisions, several steps had to be taken before the start of the actual evaluation process. These steps are, according to W3C, the following:

- Definition of the evaluation scope;
- Definition of the evaluation tools;
- Definition of the proceedings for manual evaluation;
- Definition of the resulting reports.

To characterize the evaluation scope, we identified the evaluation criteria and defined the intended target group. Given our ambition for obtaining the best, most accurate and most foolproof results we decided to use USA Government Section 508 and W3Cs WCAG 1.0 and WCAG 2.0 'AAA' as the set of regulations used to serve as the evaluation conceptual basis. As concerns the target group, we chose the 250 largest enterprises of the year 2009 according to the Forbes 'The Global 2000' list (Forbes.com 2011).

Although W3C does not recommend any specific tool for evaluating the accessibility levels of a website, this consortium presents a list of tools that are able to do so and that have given proof of their value. From this list, we chose the 'Sortsite' tool because it delivers a fully automatic accessibility evaluation of an entire website and presents a simple and very easy to understand report of this evaluation (Sortsite 2010).

As a result of our time and human resources limitations, we had to put aside the manual evaluation process, even though we recognize that it may be important as a complement for an accurate and fully representative accessibility evaluation.

The reports that are going to be delivered as an outcome of the evaluation process are mainly statistical indicators gathered in tables and, also, bar charts presenting the dispersion of the existent accessibility errors and presenting the compliance of the evaluated websites to the accessibility indicators presented by Section 508, WCAG 1.0 and WCAG 2.0.

Target Group Analysis

For this project, we searched for a target group that could present itself as being solid and big enough to be

representative. At the same time, we sought a target group that could be important enough for the public eye. This search led us to Forbes Magazine and its 'best of' and 'largest' annual lists, more precisely to 'The 2009 Global 2000' list where the largest 2000 enterprises in the world are listed according to business volume. 'The Forbes Global 2000 are the biggest, most powerful listed companies in the world' (Forbes.com 2011). Given the dimension of the referred list, we decided that an evaluation that targeted the top 250 enterprises should also be significant and representative of a global reality. As a result, for the evaluation of the target group we chose the 2009 Forbes Magazine top 250 enterprise list. Of note is that 'the corporate dominance of the developed nations is steadily receding;' (Forbes.com 2011), and so these 250 corporations represent an ever more diverse global reality (including India, Mexico, Taiwan, Colombia, Russia, Thailand, Panama and Portugal). In the top twenty alone, we can see an assortment of companies from the USA, the Netherlands, Japan, the United Kingdom, Spain, France, China, Russia, Germany and Italy, with other countries being represented in the top one hundred— countries such as Brazil, Switzerland, Luxembourg, South Korea, Canada, Australia, Norway, Hong Kong, Finland and Saudi Arabia.

Although our initial target group had 250 members, following an initial analysis of these enterprise websites, we found that not all were compatible with the tool that we chose to use to proceed with this project and that the compatibility also diverged with the regulations/guidelines that were used.

When analysing the early results of the initial target group evaluation, we were able to perceive that not all of the target group websites could be evaluated.

As we can see in Fig. 1, only 94 % of the initial target group could be evaluated. The remaining 6 % could not be evaluated because the website structures and technology didn't allow Sortsite to proceed with an accessibility evaluation. It is a known fact that technologies such as Macromedia Flash and JavaScript pose several accessibility limitations to websites. This issue has also been transposed to the evaluation tools used to perform evaluation studies similar to the one presented, that when doing their work routines over a website built with one of these technologies, they tend to stop these routines because of difficulties in crawling within the web pages of those websites.

Given this situation, the accessibility evaluation could only be done for 236 websites instead of the initial 250.

In order to achieve results that could better represent the reality of each target group website, we carried out the accessibility evaluation on the totality of each of the website's pages. Still, the relative complexity of each of
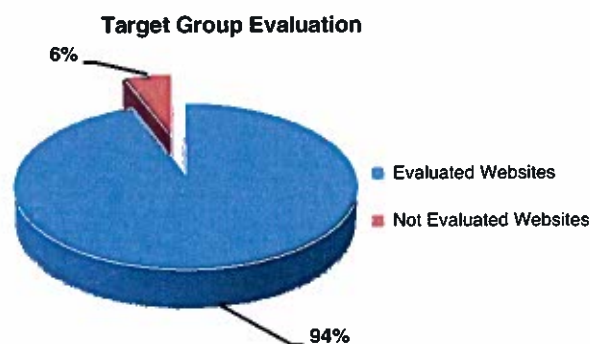

Fig. 1 Relation between the target group websites that were evaluated and those that were not

the target group websites was taken into account when analysing the evaluation results.

Evaluation Results

The evaluation starting point was the target group analysis. With this analysis we aimed to check the number of enterprises (belonging to the 2009 Forbes 250 largest) that had an available and tool-compatible website.

After defining the target group, the website evaluation step was started. The available websites were tested against both the W3C/WAI accessibility guidelines and Section 508 regulation with the help of the Sortsite tool. This test was done manually by introducing each enterprise website in the Sortsite tool and also by manually treating the returned results in a way that they could be analysed and statistically treated.

Keeping in mind the main goal for this project— reaching indicators for the accessibility levels of the Forbes 250 largest enterprises for 2009—we took into consideration the methodology defined above and started evaluating the target group websites. After reaching the evaluation results, we performed an initial analysis where it was possible to perceive the existence of several abnormal values that, in our opinion, could compromise the entire sample. In order to solve this situation, a statistical analysis had to be performed on the evaluation results. This resulted in a need for a statistical treatment that consisted of applying the outlier definition to the referred results (Mendenhall and Sincich 2007). A deviation of the experimental data that is being analysed is, according to Muñoz-Garcia et al. (1990) an outlier. However, this definition is simplified by Grubbs (1969), according to whom an outlier is a marked deviation from the remaining values of a data sample. Before deciding what should be done to the outliers, it is important to know the causes that lead to their appearance. In many cases, the reason for their existence determines how they should be handled. The main

causes that lead to the existence of outliers are: measurement errors, execution errors and the variability inherent in population elements (Figueira 2010; Gonçalves et al. 2011).

As a way to ensure that the final results were trustworthy, the outlier definition was used on of the results (WCAG 1.0, WCAG 2.0 and Section 508).

Figure 2 presents a schema of what was applied to the results in this statistical treatment stage.

After this treatment had been performed, we attained a new and more reliable sample of results. By applying some statistical calculations to these results we were able to present a simple and clear perspective of what the results were.

As we can see by analysing Table 1, the average number of errors per website is very high. This situation is common to all the guidelines/regulations used (the objective of all website evaluations is zero errors per website). Not only the average number of web accessibility faults is very high, but also the maximum number of errors that we've achieved is a serious indicator of the poor levels of web accessibility presented by the evaluated websites.

When analysing Fig. 3, it is possible to perceive that approximately half of the evaluated websites present more than 300 WCAG 1.0 priority 1 errors. Furthermore, 86 % have between 60 and over 500 errors. This fact indicates that, according to WCAG 1.0, the majority of the evaluated websites do not have the minimum requirements to be awarded even the lowest web accessibility conformance level (priority 1). We can also see that more than 85 % of the evaluated websites present more than 500 WCAG 1.0 priority 2 errors, which can be considered an extremely high number of errors and an indicator of the lack of web accessibility concerns taken into account during the development of the evaluated websites.

By analysing Fig. 4 its also possible to perceive that the number of WCAG 2.0 errors is extremely high. It is also possible to see that more than 85 % of the evaluated websites present more than 500 WCAG 2.0 level A errors. Although the majority (58 %) of the evaluated websites presents less than 30 WCAG 2.0 level AA errors, an even more significant majority (63 %) presents between 60 and 300 WCAG 2.0 level AAA priority errors.

Given the achieved results and according to WCAG 2.0, though level AAA errors are better than the A and AA categories, we still conclude that the evaluated websites do not present the desired web accessibility conformance levels, which indicates that according to this regulation none of the evaluated websites is accessible to all citizens.

As we can see in Fig. 5, the results of the web accessibility evaluation of the target group websites against the Section 508 regulation was not very different from the previously mentioned results. The majority of the evaluated websites present more than 500 Section 508 regulation errors. This is far more worrisome as the second biggest 'part' of the target group (22 %) still present a number of web accessibility errors between 300 and 500, clearly indicating the inexistence of conditions for those with impairments to access the target group websites and, therefore, not being able to use these resources as those without any disability can.

Although in the course of this study three different sets of standards for the accessibility of web content have been used, we can see that the vast majority of websites do not comply with those standards, not allowing them to be available for Internet users without limitation. This is clearly visible when we see that the results indicate that almost 90 % of the evaluated websites have more than 500 level A errors (WCAG 2.0), which in essence are based on
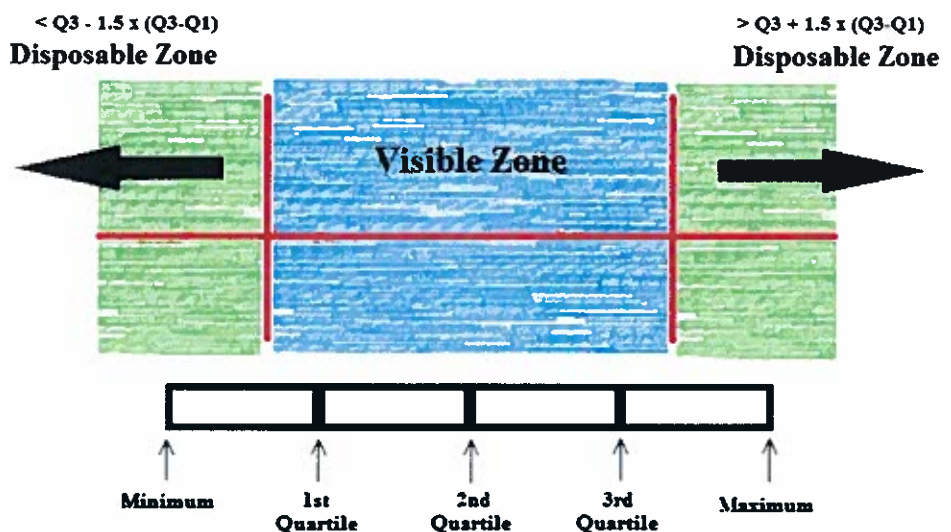
Fig. 2 Outliers' treatment schema

$< Q3 - 1.5 \times (Q3-Q1)$
Disposable Zone

$> Q3 + 1.5 \times (Q3-Q1)$
Disposable Zone

Visible Zone

Minimum   1st Quartile   2nd Quartile   3rd Quartile   Maximum

Table 1 Comparison of statistical data retrieved from the evaluation processes against WCAG 1.0, WCAG 2.0 and the Section 508 regulation

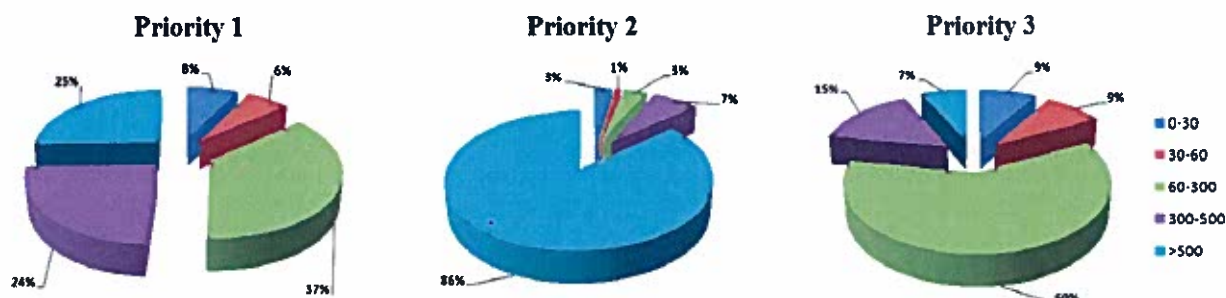|	WCAG 1.0			WCAG 2.0			Section 508
	P1	P2	P3	A	AA	AAA	
Avg.	402	1,909	169	1,351	27	185	550
SD	500	2,347	109	821	29	118	349
Min	0	3	0	2	0	0	2
Max	846	4,104	452	3,472	121	524	1,367

Fig. 3 Number of errors presented by the target group websites when evaluated against WCAG 1.0
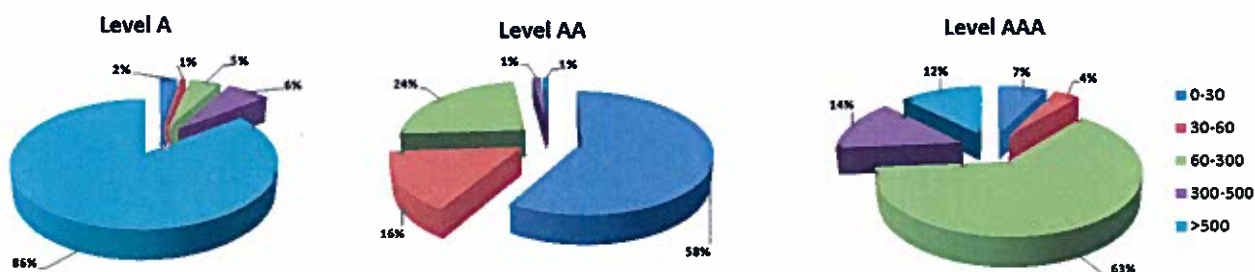

Fig. 4 Number of errors presented by the target group websites when evaluated against WCAG 2.0
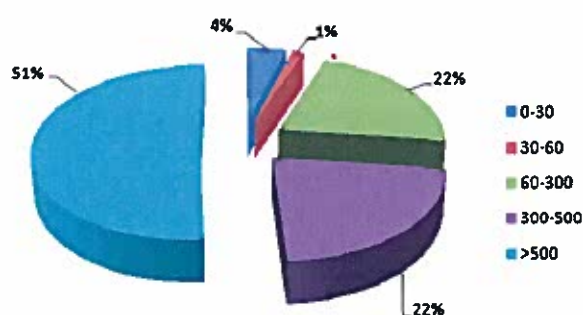

Fig. 5 Number of errors presented by the target group websites when evaluated against the Section 508 regulation

the type of errors that impose barriers to full access of the web content.

One of the basic principles of the Internet is its universality and its capability to connect people and organizations. By limiting access to available Internet and web content, we are denying to a very considerable population of the world the right to enjoy that same content which can be very useful for their day-to-day activities and to their (re) integration into society.

An Analysis of Research Results Using the Business Narrative Modelling Language

The BNML (Oliveira and Ferreira 2011) uses the stories told by relevant actors intervening in a process to create visual representations such as those in Figs. 6 (based on Allee 2008) and 7 (based on Oliveira and Ferreira 2011). Visual representations help achieve a deeper understanding concerning the stories told by individuals (Woodside 2010). BNML also serves as an analytic tool—a thinking technique—'used by analysts to facilitate the coding

process... deriving and developing concepts from data' (Corbin and Strauss 2008, p. 65). The need for BNML arose given that qualitative research efforts are seen to be inferior to more quantitative research efforts (Mason 2002). BNML seeks to provide more standardization across qualitative research efforts as it is based, for example, on the Enterprise Ontology (Uschold et al. 1998) and on predefined game patterns (Bjork and Holopainen 2005).

Figure 6 depicts the accessibility value network (Allee 2008) necessary to overcome web accessibility deficiencies and is the result of a focus-group interaction organized by the authors (Gonçalves et al. 2011). Portraying such value networks of particular areas is the first step of the BNML.

Seven global actors need to interact to improve website accessibility levels: accessibility experts, corporate financial professionals, website construction/correction tool providers, legislators, website builders, website auditors, and designated communication professionals. These actors (or roles) will engage in tangible and intangible transactions involving tangible and intangible deliverables (Fig. 6). Tangible transactions are those entered in the General Ledger ('T' accounts) and involving debit and credit transactions. We predict that initially the transactions will be mostly tangible (i.e. will cost money), as the necessary framework for web accessibility improvement will have to be set down and thus will require an investment by governing bodies. For example, corporate financial professionals will have to be aware of the strategic benefits of website accessibility and this awareness will have to be built up by designated communication professionals;

website builders will have to be up-to-date concerning implementation techniques as well as concerning minimum accessibility requirements and this again will involve some activity by designated communication professionals; and legislators and website auditors will have to be up-to-date on advancements to determine and control the deployment of minimum accessibility requirements. Once an accessibility culture and community (assets visible in Fig. 7) have been built up costs should decrease to lower maintenance-type levels.

Figure 7 (BNML) indeed adds a timeline to Allee's framework and also shows the assets used and built in the accessibility value network. Thus, we can see that a partner network is built all along the sequence of events, as is an accessibility culture amongst the relevant value network players. Technical know-how is initially built and then used throughout the process. An accessibility community is a growing reality as the partner network evolves. Accessibility insights are built and used. An accessibility competence and philosophy are also results of the website accessibility improvement initiative.

The aforementioned assets are built and used along a pattern sequence (Bjork and Holopainen 2005), from alignment and cooperation between accessibility experts, communication professionals and legislators; to improved abilities of website builders. Tangible deliverables are exchanged throughout. Figure 7 is thus a roadmap for the change which needs to occur for website accessibility levels to improve worldwide.
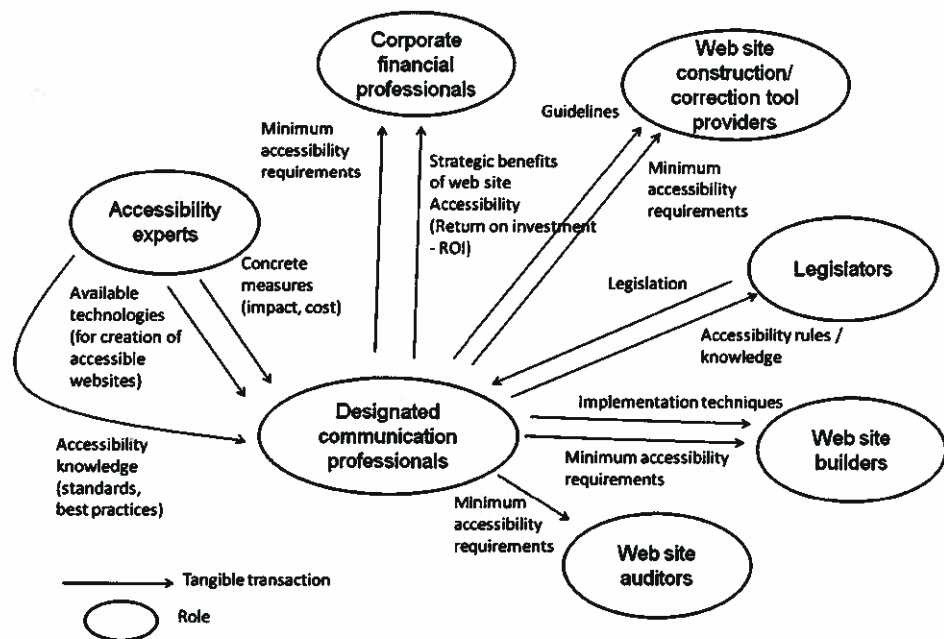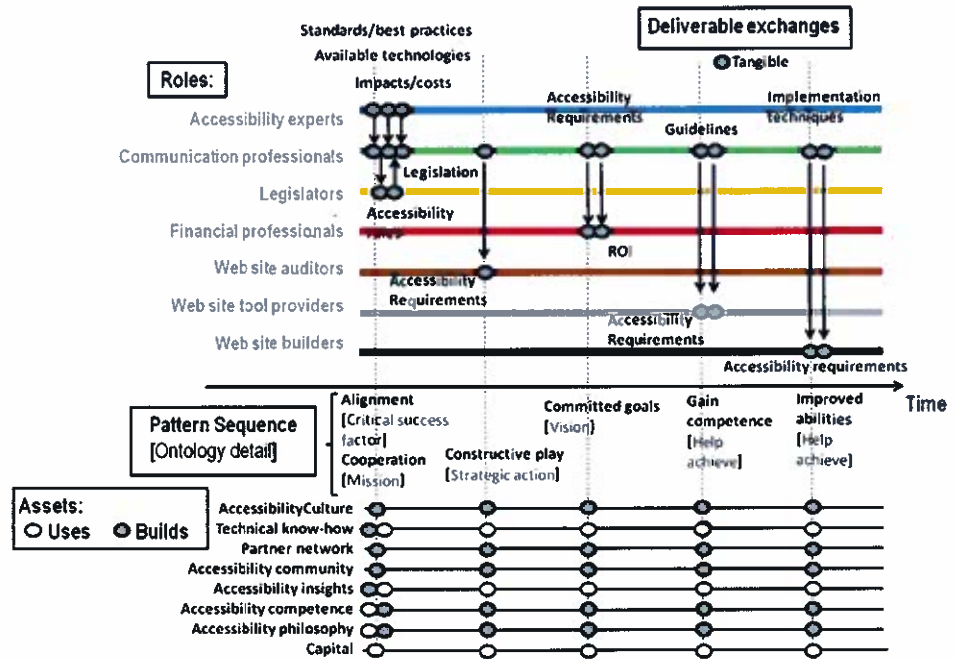

Fig. 6 Accessibility value network

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Fig. 7 BNML road map for improving website accessibility levels, worldwide

Our Vision of the Way Forward: Moving Away from Impairments and Towards a Greater Participation in Society by All

The novel BNML is composed of visual representations and by the narrative. By combining these two communication strategies we hope to drive home a deeper message. BNML tells stories, stories about people's lives. All people can be mobile and indeed are mobile in the stories of their lives. It is society that disables people. Figure 8 shows the storyline of disabled people in their role to overcome website accessibility problems. They need in fact to be very active.

Can disabled people be as mobile as virtuous CEOs/leaders? If society were to pay attention to the variety of needs of all members of society, then yes—virtuous CEOs of Forbes 250 companies, for example, would be equally as mobile as disabled people. Both CEOs and disabled people will have to play different but equally vital roles (with corresponding storylines) in the search for a solution to

website accessibility issues, as Fig. 9 shows. In Fig. 9, we can see that disabled people and CEOs will cross paths several times.

Finally, Fig. 10 shows a complete BNML storyline view of our vision and what is needed to move away from impairments and towards a greater participation in society by all. Figure 10 is thus a depiction of the way forward towards greater accessibility. The grey ovals indicate social interaction. Social interaction occurs according to patterns—patterns such as First Person Views, Direct Information, Gain Competence, Constructive Play and Alternative Reality (each taken from Bjork and Holopainen 2005).

In Fig. 10, disabling websites have deliberately been placed at the bottom of the figure. Virtuous leaders will stay away from them, by having an awareness of Section 508 and WCAG 2.0—shown by the Direct Information pattern, an important 'influence factor' [an enterprise ontology term taken from Uschold et al. (1998)]. In sum, the way forwards will require a vision (Uschold et al. 1998)—and that vision needs to be supplied by First Person

Fig. 8 A BNML storyline of disabled people actively working towards a solution to the website accessibility problem
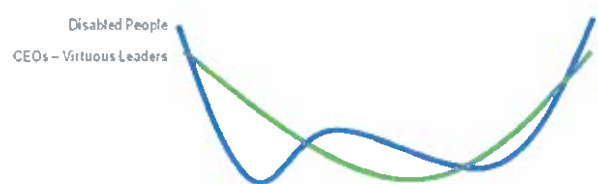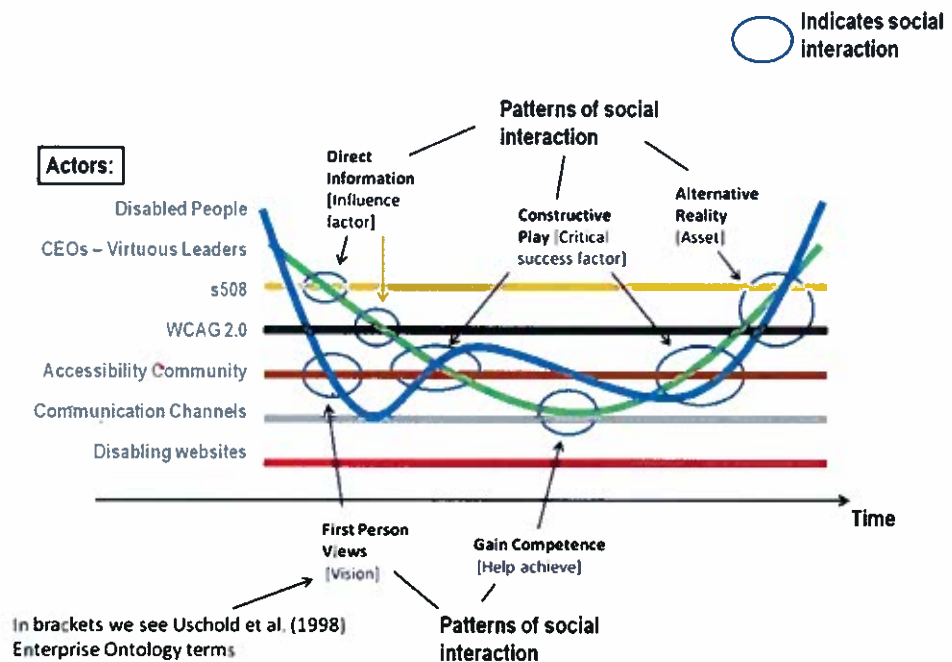

Fig. 9 BNML storylines of both virtuous CEOs and disabled people: both actively taking part in the search for a solution to the website accessibility problem

Fig. 10 A BNML storyline
view of our vision: moving
away from impairments and
towards a greater participation
in society by all

Views, by disabled people, to the accessibility community.
Figure 10 shows how disabled people (represented by the
wavy line coming from the top left hand corner of the figure)
can be very active, if society does not impair them—disabled
people need to keep in close contact with the accessibility
community as well as with other Actors, communicating
their evolving needs (for example, just as WCAG 1.0 was
superseded by WCAG 2.0 we expect that WCAG 2.0 will
also have to evolve in the future). The accessibility com-
munity will have a big contribution to make in the direction
of an Alternative Reality (the last pattern in the figure). The
accessibility community is made up of accessibility experts,
and this community needs to grow in size. The use of the
correct communication channels will be very important for
that to happen. There is a crucial intersection where CEOs,
the accessibility community and people with impairments
will have to meet if we are to be able to solve the global
website accessibility problem. This intersection is made
evident by the two grey clouds indicating Constructive
Play—a pattern of social interaction between these three
actors—which is a 'critical success factor' (Uschold et al.
1998). Furthermore, the proper communication channels
will help CEOs become virtuous leaders by helping them
Gain Website Accessibility Competence (another crucial
pattern at the bottom of Fig. 10).

Conclusions

Based on the study undertaken and described above, we
managed to achieve our initial goal which was to deliver

indicators on the actual accessibility levels presented by the
250 (or 236 of these as not all could be evaluated by our
tool) largest enterprises of the year 2009 according to
Forbes.

As the results presented demonstrate, a considerable
number of accessibility errors were detected on all of the
websites belonging to the target group, without exception.
This fact indicates that the accessibility levels presented by
the websites of the [236] largest enterprises of the year
2009, according to Forbes, are indeed decidedly low
according to the W3C WCAG1.0, WCAG2.0 and Sec-
tion 508 standards because, for the majority, they aren't
even conformant with the lower accessibility conformance
level.

Unfortunately, in EU Member States, one finds that
'results from nationally available data are not comparable
across countries due to variable samples and methods
applied' (Cullen et al. 2009). Furthermore, 'in all the
countries covered, there is a considerable variation in terms
of the types of legislative/regulative approaches that are
adopted [including for implementation time-frames] and in
the types of websites that are addressed' (Cullen et al.
2009). We consider this to be a serious shortcoming at the
European level, and thus greater interoperability between
systems and organizations, to make communication
seamless (Mertins et al. 2008), for web accessibility pur-
poses, needs to be a focus in future—so as to ensure the
effort to make websites accessible to all becomes a more
concerted one. By making data across countries compara-
ble, and by taking these data into the public arena, there
will naturally exist added pressure for the lagging Member

States to improve their web accessibility levels. Costs might also be saved by doing this: if companies are convinced of the need to make their websites accessible from the start then retrofitting accessibility into websites, generally seen to be more expensive, would be avoided. If the web accessibility topic persists as a permanent drive, then both investment efficiency and accessibility compliance will be maximized.

In "An Analysis of Research Results Using the Business Narrative Modelling Language" section, we provided an analysis using the BNML based on a focus-group interaction that we organized (Gonçalves et al. 2011). BNML is a visual tool which seeks to reach other audiences, namely practitioners, outside the academic arena. In using BNML, we provided a road map indicating the way forward towards a more solid foundation for enterprise web accessibility levels to be met in the future. A number of actors will have to be involved—from accessibility experts, corporate financial professionals, website construction/correction tool providers, legislators, website builders, website auditors, to designated communication professionals. Both an accessibility culture and an accessibility community are to be major assets in the worldwide effort to improve enterprise accessibility levels (Fig. 7). Figures 8, 9, and 10, in "Our Vision of the Way Forward: Moving Away from Impairments and Towards a Greater Participation in Society by All" section, represent another BNML effort applied herein to convey our vision of the way forward to future desired website accessibility levels. Disabled people will have an active role to play in this process, as can be seen in Figs. 8, 9 and 10 (disabled people are represented by the wavy line moving up and down and coming from the top left hand corner of the figures—the wavy trajectory indicating mobility).

If what authors Dierendonck and Patterson (2010, p. 3) state is true, that 'what accounts for good leadership has changed dramatically. The ideal of a heroic, hierarchical-oriented leader with primacy to shareholders has quickly been replaced by a view on leadership that gives priority to stewardship, ethical behaviour and collaboration through connecting to other people' even so there is still much ground to be covered, as concerns the stance of enterprises towards disabled people in particular. A major contribution of our article is, as our web accessibility results indicate, that an even louder call is needed for virtuous leadership, from various essential global actors, so that followers will not be ignored, but rather embraced, 'as whole individuals... [in] a more caring society' (Dierendonck and Patterson 2010, p. 3).

shape the final manuscript as presented above: a guiding hand which will also, we are sure, lead us to the definition of new research objectives in the quest for website accessibility for all.

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ANNEX B

ABSTRACTS OF PUBLICATIONS RELATED TO THE CANDIDATE'S DOCTORAL STUDIES AND NOT PUBLISHED HEREIN

Complete reference and details	Abstract
Oliveira, M.A., Ferreira, J.J.P. (2012). Applying creativity to research methods – An analysis of innovation antecedents using the Business Narrative Modelling Language (BNML). Article presented at IEMS'2012 – 3rd Symposium on Industrial Engineering and Management – The impact of DEGI research on society. Organized by DEGI, FEUP, Universidade do Porto, at Biblioteca Almeida Garrett, 5th Jan. An elevator pitch of the research was published on the symposium website. An extended abstract was also published in the book of extended abstracts, pp.28-30. Key words: Research methods, innovation, interoperability, BNML Editor: DEGI, FEUP, Universidade do Porto	This article summarizes the candidate's PhD research which focused on innovation and in particular on innovation antecedents. The relationship between interoperability and innovation was determined (the former being an antecedent of the latter) as companies are coming under increased pressure to innovate in order to survive in free market economies. Interoperability and free flowing communication are seen to lead to increased innovation output. Eight case studies were performed as well as two surveys. A major output of the research project was the novel Business Narrative Modelling Language (BNML) – a new research method which we developed and which was used to analyse the interview and survey data. BNML – based on the narrative, on visual representations and on several ontologies – decreased the time necessary to perform the qualitative research. BNML also made evident certain relationships between the data as it adds the representation of time to other tools such as Verna Allee's value network representations.
Gonçalves, R., Martins, J., Pereira, J., Oliveira, M.A., Ferreira, J.J.P. (2011). Accessibility levels of Portuguese Enterprise websites: Equal opportunities for all? Published online 18th May (iFirst), *Behaviour & Information Technology*, DOI:10.1080/0144929X.2011.563802, pp.1-19 (Online ISSN 1362-3001; Print ISSN 0144-929X;; ISI INDEXED JOURNAL; IMPACT FACTOR 0.835). Key words: Accessibility, comparative study, web sites Editor: Taylor & Francis Group	This article in *Behaviour & Information Technology* (BIT) laid down the foundation for the follow-up article which used BNML and which was published in the *Journal of Business Ethics* (please see Annex A). For example, the focus group described in this BIT article (Gonçalves et al., 2011) was again taken up in the *Journal of Business Ethics* article (Gonçalves et al., 2012 – Annex A) with a further BNML analysis. Both journal articles sought to determine web site accessibility levels. The sample used in the BIT article was made up of Portuguese companies whereas the sample used in the *Journal of Business Ethics* article was made up from the well-known and more international Forbes listing of 2009.
Oliveira, M.A., Ferreira, J.J.P. (2011). Innovativeness and its link to interoperability: An investigation using a novel Business Narrative Modelling	This article summarized the candidate's doctoral research to date. Multiple case studies were the objective in order to develop a theoretical model concerning the

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Language (BNML). Article presented orally at IEMS'2011 – 2nd Symposium on Industrial Engineering and Management; organized by DEGI, FEUP, Universidade do Porto, at Museum Soares dos Reis, 6th Jan., and published in the book of extended abstracts, pp.11-13.

Key words: Innovativeness, interoperability, BNML, research method

Editor: DEGI, FEUP, Universidade do Porto

URI: http://hdl.handle.net/10773/7664

contemporary phenomenon of organizational innovativeness and its link to interoperability. We were interested in particular in interoperability as pertaining to people and organizations able to operate in conjunction (together) to produce innovation. Interoperability can be defined as "the ability of a system or an organization to work seamless[ly] with other systems or organization[s] without any special effort" (Mertins et al., 2008, p.v) and Gasser and Palfrey (2007, p.ii) state that "One of the reasons why we tend to like interoperability is that we believe it leads to innovation". However, they continue, "the relationship between interoperability and innovation, while it likely exists in most cases, is extremely hard to prove" (Gasser and Palfrey, 2007, p.ii). In so doing we are to test a business narrative modelling language (BNML) that we have developed. BNML is a research method that uses representations combining storylines, roles, ontologies, patterns, assets and value exchanges. We intend to apply our BNML as a main doctoral research effort to map out the creation of value and innovation in organizations. The need for BNML arose given a growing dissatisfaction with qualitative research approaches and also due to the need to bring entrepreneurs, especially those with little training in management theory, closer to the academic (as well as practitioner) discussion of innovation and strategy for value creation. Such studies, which may bring to the fore rich detailed descriptions for example of how collective mind is achieved, are lacking in the literature (Camarinha-Matos, 2008).

Oliveira, M.A., Ferreira, J.J.P. (2010). Strategic change communication using a novel Business narrative modelling language. 3rd International Conference of Education, Research and Innovation - ICERI2010 (IATED). Madrid, Spain, 15-17 November. Virtual presentaiton and article published in the conference proceedings, pp.5911-5920 (abstracts CD ISBN: 978-84-614-2438-2; articles CD / proceedings ISBN: 978-84-614-2439-9).

Key words: Strategic change communication, modelling language, narrative, storytelling, the language of film, value creation

This conceptual paper was developed in the realm of strategic change communication. The purpose of this paper was to present our Business Narrative Modelling Language (BNML) as a tool for discussing strategy using real life cases. Following data collection using a qualitative methodology and an analysis of the "As-Is" situation we proceeded to construct a representation of the future desired ("To-Be") situation, in both situations using BNML. We started by defining the organizational actors relevant to value creation, and we then mapped out their interactions in the organizational context, and studied how relevant deliverables were exchanged, both tangible and intangible, along various storylines, one per actor. The social interaction

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Editor: IATED URI: http://hdl.handle.net/10773/7673	which led to value creation happened according to a pattern sequence (using patterns taken from Bjork and Holopainen, 2005, which are intuitively comprehensible) and was instantiated according to an Enterprise Ontology (Uschold et al., 1998). By combining various sensemaking strategies such as the narrative, visual mapping and quantification our BNML scores high on accuracy, simplicity and generality (Langley, 1999) thus providing an attractive alternative to other techniques available to researchers and consultants and used to "connect and organize dispersed organizational knowledge" (Huff and Jenkins, 2002, p.14).
Oliveira, M. A., Ferreira, J.J.P. (2010). Modelling change using a novel business narrative modelling language. Article presented at the 5th Workshop on Organizational Change and Development: Core Competences in a Changing World; Vienna, Austria, between 23 - 24 September. Paper published on the workshop website. Key words: Strategic change communication, modelling language, narrative, storytelling, the language of film, value creation Editor: EIASM – The European Institute for Advanced Studies in Management URI: http://hdl.handle.net/10773/7684	The purpose of this conceptual paper was to present our Business Narrative Modelling Language (BNML) as a tool for facilitating change. This paper drew on the experience of the authors and on a literature review of other modelling techniques which were seen to be mainstream alternatives to our BNML. Several case studies (involving action research as well as other research methods) were performed using BNML and inspired the text. We found that as concerns the management of strategic change most important of all is to be able to change the mindset of entrepreneurs, senior managers and other key leaders in organizations. In one case in particular, this involved moving from desperation to the possession of a positive vision for the future – BNML helped provide a new vision in a down-to-earth way, comprehensible across the organization, at all levels. Research implications – The potentially negative attitude towards the narrative and storytelling and pictorial representations needs to be overcome and it is necessary to devise new methods to inspire change at all levels in organizations. It is our conviction that the importance of communication, and how it aids change initiatives, should be duly appreciated. We hope to show in our future research efforts that BNML can help to achieve change objectives. This paper contributed to change management theory building on Eriksen (2008) – change is of a personal nature – and on Quinn et al. (2000) – change must occur in the mind. Neurologist Damásio (2000) has shown that the feeling of what happens is like a "film in our brain" which we tried to reproduce and reinforce with our BNML. BNML proposes an innovative modelling

	language and business narrative, using them as a communication tool in a dialogue for change.
Oliveira, M.A., Ferreira, J.J.P. (2010). Inspiring disruptive change: A novel approach to modelling the value creation process. A full paper presented at the international conference IADIS e-Society 2010 – held between 18 - 21 March at the Hotel Meliã Gaia Porto. Article published in the conference proceedings, pp.203-212 (book with ISBN 978-972-8939-07-6). Key words: Narratives, Game Patterns, Value Network, Innovation Editor: IADIS URI: http://hdl.handle.net/10773/7670	This methodology paper brings forth a novel process with which to portray the value network and enterprise asset creation. Real cases which involved field research by the authors are used to present and better illustrate certain concepts. Organizations involve intense human interaction and require novel ways which make evident variations in performance, a central aspect of management today and in the near future. Our contribution is in combining the use of the narrative / storylines, game design patterns, value network analysis and the dynamic capabilities paradigm to reduce the complexity of the strategy debate. Our modelling tool is also pictorial and so simple to grasp. The primary value of graphical notations lies in their communication and understanding possibilities (Fowler, 2004). The importance of the dynamic capabilities paradigm (Teece et al., 1997) is emphasized in which information and communication technologies (ICT) play a central and strategic role (Pavlou, 2004) in the creation of value and consequently of enterprise assets. Geertz (2000) brought attention to the fact that research is performed in order to clarify or usefully revise our own or someone else's ideas and we see this clarification and revision as being necessary given a heightened need to motivate and inspire people to carry out actions of disruptive change (Denning, 2004).
Oliveira, M.A., Barandas, H., Ferreira, J.J.P. (2009). O Método Lead User para o desenvolvimento de produtos. *Executive Digest* (April), N°37 (II Series), pp.53-55 (ISSN 0874-0526). Key words: Innovation, lead user method, product development Editor: Multipublicações URI: http://hdl.handle.net/10773/7108	This article focuses on a more democratic form of innovation – the lead user method. The democratizing of innovation means that there are product and service users (companies as well as individual consumers) who are ever more capable of innovating for themselves. This growing tendency changes the nature of existing commercial relationships in the marketplace, where traditionally it was the manufacturers who owned the product development and innovation processes. This fact is particularly evident in "Information Products / Services" where users have the possibility to conceive a significant part or totality of a product or service without needing to resort to a manufacturer. Examples of this are the well-known Open Software initiatives (Linux, Apache, etc.) where a community of users developed a product capable of

	competing with products entirely developed by manufacturers.
Oliveira, M.A., Gonçalves, R., Oliveira, J.M., Aroso, M., Barbosa, M., Santos, R., Ferreira, J.J.P. (2009). Social Entrepreneurship and the Role of Universities - A rationale for guiding social entrepreneur coaching along the social business development process. An article presented at the international conference Employability and Entrepreneurship: Tuning Universities and Enterprises. Held at Universidade Católica Portuguesa (campus da Foz, Porto) between 1 - 2 July. Published in the e-proceedings (e-Book ISBN: 978-989-95577-9-6) in November, pp.65-76. Key words: Social entrepreneurship, postgraduate students, role of universities, business development process Editor: Universidade Católica Portuguesa URI: http://hdl.handle.net/10773/7661	Entrepreneurship is often linked to innovation and taking advantage of entrepreneurial talent is seen to be of paramount importance for economic development all over the World. Research involving students at various levels of education and in various courses has been performed by academics worldwide. Empirical studies however have been mostly concentrated on undergraduate students' intents. Postgraduate student analyses are rare but needed given the widespread fears of unemployment and increasing dissatisfaction with employment at this level. Social entrepreneurship in particular is an area of inquiry which is still in its infancy. Based upon Weerawardena and Mort's (2006) multidimensional model of social entrepreneurship: SVC = f (I, P, RM) subject to S, SM, E; where SVC: social value creation; I: innovativeness; P: proactiveness; RM: risk management; S: Sustainability; SM – social mission; E: environment; we provide a rationale for guiding social entrepreneur coaching along the social business development process at the postgraduate level.
Oliveira, M.A., Ferreira, J.J.P., Barandas, H. (2008). Innovation and entrepreneurship: What professors from leading universities say? A full paper presented at BASYS 2008 – 8th IFIP International Conference on Information Technology for Balanced Automation Systems – Hotel Ipanema, Porto – between 23 - 25 June. Article published in the conference proceedings (digital version). Article published also in IFIP International Federation for Information Processing, Volume 266, Chapter 38, *Innovation in Manufacturing Networks;* ed. A. Azevedo; (Boston: Springer), pp. 353–362. (ISBN-10: 0387094911; ISBN-13: 978-0387094915)). Listed in Thomson Reuters – Science – *Journal Citation Reports.* Key words: Innovation, entrepreneurship, teaching practices Editor: Springer	As innovation is essential for the competitiveness of enterprises and economic development there is a question which has been raised with some insistence: Do teaching practices make a difference to innovation and entrepreneurship in the work place? Experts were contacted for their views. They say yes, as long as the teaching method is adequate. So, in the USA, a naturally innovative society, a new concept of integrated teaching was developed - "hands-on" to increase innovation ever more in North America. This concept proved also to be successful in a non-innovative society as is demonstrated by the case of MIETE (a partnership between FEUP and FEP, University of Porto) in Portugal.

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URI: http://hdl.handle.net/10773/7687	
Oliveira, M.A. (2008). Teaching innovation – a comparison between courses in Europe and in the USA. Paper presented at the 18th Luso-Spanish Conference on Management, Faculdade de Economia, Universidade do Porto (FEP, UP) – between 7 - 8 February. Research Seminar article published in the conference proceedings (ISBN: 978-989-20-1009-0). Key words: Teaching, innovation, Europe, USA Editor: Faculdade de Economia, Universidade do Porto URI: http://hdl.handle.net/10773/7716	What role does the formal teaching of innovation management play? Courses in Europe and the USA are reviewed, especially two courses, MIETE, taught at the University of Porto, in Portugal, and the Stanford University and Michigan University model from the USA. As these flagship courses have resulted in real innovations being introduced into the market formal teaching may well play a decisive role in the larger scenario of real innovation management. A literature review was performed and these two aforementioned cases studied in depth – MIETE via repeated contact with its Director and through the analysis of other publicly available information; while the Stanford University and Michigan University model was analysed by way of a comprehensive publication. A model for innovation and entrepreneurship is put forward whereby personal characteristics, the environment, and career experience and formal teaching will all play a part in the output of innovation and entrepreneurship in society.
Oliveira, M.A., Barandas, H., Barros, A. (2007). What do innovators do to succeed? A case study of Sage plc. Article presented at the 14th International Product Development Management Conference, EIASM – The European Institute for Advanced Studies in Management - Faculdade de Engenharia do Porto, Universidade do Porto (FEUP, UP) – between 10 - 12 June. Published in the conference proceedings, part 2 of 3, pp.1007-1018. Key words: Innovation, Sage, case study, management strategy, culture Editor: EIASM – The European Institute for Advanced Studies in Management URI: http://hdl.handle.net/10773/7669	What do innovators do in their efforts to succeed? Successful innovation is embedded and leveraged by the management strategy. Sage plc, the third largest management software company in the world, is analysed. Various factors are seen to foster an innovation culture at Sage: an open organizational culture, a responsive market orientation coupled with a proactive market orientation, an international expansion strategy according to a multi-domestic orientation, and a horizontal internal communication policy. Sage Portugal was visited and its CEO interviewed, several times, in-depth. Sage Portugal N°2 was also interviewed. Company documents, reports, newsletters, Internet site and Intranet were also analysed.
Barros, A., Oliveira, M.A., Barandas, H. (2006). The cultural determinants of international business loyalty: a case study of Japanese and Portuguese firms. Poster paper article presented at the 32nd international conference of EIBA - European International Business Academy -	In business-to-business (B2B) markets customer loyalty is critical to success, although its building process may be different from in consumer markets (B2C). Not only do we propose to investigate B2B loyalty but also how this construct occurs across cultures, i.e., is B2B loyalty affected by culture? Preliminary research results indicate that Japanese

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Fribourg, Switzerland, between 7 - 9 December. Published in the conference proceedings (CD).

companies will change foreign supplier more easily than Portuguese companies as Japanese society is very competitive and has higher levels of ethnocentrism. Based on preliminary interviews and a literature review we propose that masculinity, ethnocentrism and suppliers' cultural interaction capabilities are antecedents of cross-cultural customer loyalty.

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