



IEMS'2012

3rd Symposium on Industrial Engineering and Management

The Impact of DEGI research on Society

Biblioteca Almeida Garrett
5th January 2012

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Maria Antónia Carravilla

Maria Henriqueta Nóvoa

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Nuno Soares

Organised by:

DEGI – Department of Industrial Engineering and Management

Faculty of Engineering

University of Porto

Welcome

Dear Participant,

On behalf of the Organizing Committee it is my pleasure to welcome you to IEMS'12, the 3rd Industrial Engineering and Management Symposium. This is a joint organization of the Department of Industrial Engineering and Management and of the Doctoral Program in Industrial Engineering and Management of the Faculty of Engineering of the University of Porto (FEUP).

The objectives of this symposium are both internal and external. It aims to be an instrument of team building and of increasing self-awareness of FEUP's research community in the area of Industrial Engineering and Management, and it is also meant to be a showroom of what we are able to do, of our achievements and our skills, not only in scientific terms but also in putting science at the service of society. This is our vocation and the essence of our nature.

In this 3rd edition of the symposium, and after the brave start in 2010, and the clear consolidation that the 2011 symposium has brought (a word of gratitude and praise is due to Bernardo Almada-Lobo for this initiative), it was the moment to assume the lemma "The impact of DEGI research on Society" and to invite actual and potential partners from companies to join us in the symposium. With their presence, that we warmly thank, we expect to have the opportunity to make a balance of past activities and to launch new collaborations, based on new ideas and applied research opportunities, which may be identified and consolidated during the symposium or as its consequence.

The research collaboration with the Department of Industrial Engineering and Management is not limited to the Doctoral Program. Nevertheless, as Director of the PhD program, I would like to state very clearly how much we value the work of our PhD students with concrete problems from companies and truly applied research. I am aware of the ever proclaimed difficulties in the Industry-University cooperation. It is not the moment to analyze why some joint research fails, but it is the moment to state that it is our will to make this collaboration more effective. By working I mean improving the outcomes delivered to companies, both in quality and in readiness, but also improving the conscience of what should be expected from a PhD student working in a company real-world problem.

First of all, a research problem, in opposition to a consultancy task, has components that have never been tried before or that have an unknown solution. Therefore, there is a risk attached to a research project, and in general the risk is higher when we are talking about a PhD project, more speculative by nature. But, in a PhD project, the company will gain with a bright full-time student working on its problem, supervised by an experienced senior researcher from the university. Therefore, with the right level of commitment from the company, the return of the investment will be high. And this is another major distinctive mark of a PhD project: it requires a true involvement and time investment from the company.

Furthermore, as a PhD takes 3 to 4 years to complete, companies may not be able to afford waiting so much time for a deliverable. It is likely that either the problem becomes irrelevant in the due course, and consequently also our answer, or the company needs to address it in a different way. Our methodology is to design efforts and to structure the research project in a way that after an initial phase a possible answer is available. It may be either a first working draft of the solution or the grounded belief that it cannot be solved. Then, the next years should be used to intensify the scientific component of the project, the speculative side of the approach, the risky bets for higher stakes. In the end the company may end up with an improved solution for its problem but meanwhile it has been working with the first solution approach for a couple of years.

In economic terms, times are difficult both for companies and for universities. Nevertheless, it is the moment to invest and to prepare for the period of economic growth that will follow the current crisis. Bright young people find it worthwhile to engage in a tough and demanding training process as PhD students. This is an opportunity for companies and universities to build a true partnership that can turn their effort valuable to society.

José Fernando Oliveira
Director of the Doctoral Program in Industrial Engineering and Management

Information for Participants

Symposium Venue

The symposium takes place at BAG - Biblioteca Almeida Garrett. BAG is located in the gardens of Palácio de Cristal (Pavilhão Rosa Mota), accessible from Rua de D. Manuel II.



Address: Rua de Entre-Quintas, 328, 4050-239 Porto
Tel.: (+351) 226 081 000

BAG is served by public transportation, through STCP lines 200, 201, 207, 302, 303, 501, 601, ZM and Resende lines 104, 119. Nearby public car parks are located at Rua Jorge Viterbo Ferreira and Rua D. Manuel II:



Lunch

A working lunch will be served at Restaurante do Palácio de Cristal. Located in the ground floor of the the building Pavilhão Rosa Mota, the restaurant is accessible through the gardens.

Internet

To use the internet, you should access Eduroam. Do not forget to use your complete institutional email address, not just the username, to login (e.g. username@fe.up.pt).

Guidelines for Speakers

- Arrive at your session at least 5 minutes before it begins and copy your presentation to the laptop available in the room.
- Time your presentation to fit in the allotted time (15 minutes plus Questions & Answers).
- The room is equipped with a video projector and laptop computer.
- Presentation certificates will be available in the end of the symposium.

Guidelines for Voting for the Best Elevator Pitch Award

The elevator pitches are available in this Book of Abstracts, near each extended abstract, and in the IEMS'12 website: <http://www.fe.up.pt/~deig/iems12>. During the breaks, the elevator pitches will also be displayed in the hall of BAG.

The voting process will be on the internet. You may use your own laptop or smartphone to access the website, or the laptop that will be available near the display. All participants in the symposium are entitled to 3 votes.

Program Schedule

Thursday, January 5th

9:00 – 9:30

Reception and Opening Session

(Auditorium BAG)

Chair: José Fernando Oliveira

9:30 – 10:30

Session A

(Auditorium BAG)

Chair: Maria Antónia Carravilla

A.1 – Retail Shelf Space Allocation in a Supermarket Chain

Teresa Bianchi-Aguiar, Maria Antónia Carravilla, José F. Oliveira

A.2 – Enhancing Customer Store Experience in Fashion Retail

João Guichard, B. Almada-Lobo, J. L. Borges, A. Leão Sousa, M. Soares

A.3 – Creating a Model for the Quality of Wine from the Douro Region

António Corte-Real Sousa, José Luís Borges

10:30 – 11:00

Coffee-Break

(Hall BAG)

11:00 – 11:45

Invited Talk

(Auditorium BAG)

Chair: José A. Sarsfield Cabral

I – To be announced

Carlos Brito

11:45 – 12:45

Session B

(Auditorium BAG)

Chair: Alcibiádes Guedes

B.1 – Solving Production Planning Problems when Setups are Sequence-Dependent

Luis Guimarães, Diego Klabjan, Bernardo Almada-Lobo

B.2 – Management Agent-Based Simulation Framework

Carlos Bragança de Oliveira, António Carvalho Brito

B.3 – Influence of Consumer Purchasing Behaviour on the Production Planning of Perishable Food

Pedro Amorim, A.M. Costa, B. Almada-Lobo

12:45 – 14:00

Lunch

(Palácio de Cristal Restaurant)

14:00 – 14:45

Guided Visit to VIARCO's Exhibition

(BAG)

14:45 – 15:45
Session C*(Auditorium BAG)**Chair: João Falcão e Cunha*

C.1 – Designing the Travel Experience: Identification and Incorporation of Passengers' Experience Requirements in New Bus Body Development

Rui Carreira, Lia Patrício, Renato Natal

C.2 – Applied Research on the Automated Generation of Spider Maps

João Mourinho, Teresa Galvão, João Falcão e Cunha

C.3 – How Efficient and Innovative are Portuguese Construction Companies?

Isabel M. Horta, Ana S. Camanho, J. Moreira da Costa

15:45– 16:00
Break*(Hall BAG)*

16:00 – 17:00
Session D*(Auditorium BAG)**Chair: Lia Patrício*

D.1 – Applying Creativity to Research Methods - An Analysis of Innovation Antecedents Using the Business Narrative Modelling Language (BNML)

Manuel Au-Yong Oliveira, João José Pinto Ferreira

D.2 – Service Design for Sustainability: Towards a More Sustainable Home Energy Consumption

Rita Viana, Lia Patrício

D.3 – Optimization Approaches to Staff Scheduling Problems

Marta Rocha, José F. Oliveira, Maria Antónia Carravilla

17:00 – 17:30
Coffee-Break*(Hall BAG)*

17:30 – 18:30
Session E*(Auditorium BAG)**Chair: João Claro*

E.1 – Business Intelligence and Data Mining in Operating Room Scheduling

Carlos Gomes, Arnon Peles, Fabrício Sperandio, António Carvalho Brito, José Borges, Bernardo Almada-Lobo

E.2 – Conceptual Framework for Organizational Model Assessment of Hospital Centers

Ana Simões, Américo Azevedo, Suzete Gonçalves

E.3 – Supporting Cooperative Purchasing Strategies in Health Care Supply Chains

Nazaré Rego, João Claro, Jorge Pinho de Sousa

18:30 – 18:45
Award for the Best Elevator Pitch and Closing Session*(Auditorium BAG)**Chair: Bernardo Almada-Lobo / José A. Sarsfield Cabral*

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A Circle Covering Representation for the Nesting Problem

Pedro Rocha*, Rui Rodrigues*, A. Miguel Gomes*

* INESC Porto, Faculty of Engineering, University of Porto

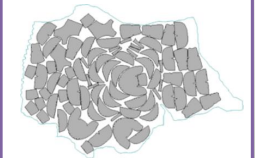
A circle covering representation for the Nesting problem

Pedro Rocha, A. Miguel Gomes
INESC-TEC, Faculdade de Engenharia da Universidade do Porto

Nesting problems deal with the placement of a set of irregular shaped objects in a non-overlapping configuration, inside a container or board.


The Challenge

- Find geometrical representations independent of piece orientation
- Must be functional with complex outlines and allow free rotations

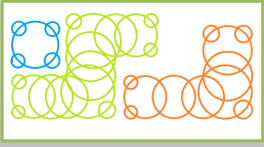


The Methodology

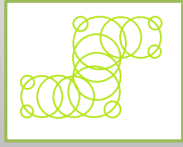
How to avoid overlapping?
Fast overlap detection?
Placement of the circles?



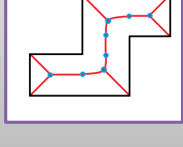
Collision Detection



Circle Cover



Medial Axis



Value to Society

- Less consumption of raw materials and waste reduction
- Better solutions and faster resolution of current related optimization problems

A Fast Greedy Heuristic for the Rectangular Packing Area Minimization Problem

Marisa Oliveira*, Eduarda Pinto Ferreira†, A. Miguel Gomes‡

* School of Engineering, Polytechnic Institute of Porto, † GECAD - Knowledge Engineering and Decision Support Research Center, ‡ INESC Porto, Faculty of Engineering, University of Porto

A Fast Greedy Heuristic to the Rectangular Packing Area Minimization Problem

The Challenge

Pack, **without overlapping**, a set of rectangular pieces while **minimizing the area** of the enclosing rectangle: solving **very large** instances (up to 500 rectangles) in a **small** computational time.

The Methodology

Greedy Heuristic

- Choose and merge pairs of rectangles
- Greedy criteria (area, width, height, perimeter)
- Tree structure with guillotine layouts

Problem Generator

- Identification of the main characteristics (Shape: long, thin, "squareness"; Heterogeneity; Quantity)
- Controlled benchmark instances generator

Statistical Study

- Evaluate the heuristic behavior
- Identifying the best and the worst criteria
- Establish rules for the choice of the criteria depending on the characteristics of the instances

The Value to Society

- Economical and ecological benefits - Reduction of raw materials, energy consumption and more efficient solutions (circuits and layouts)
- Fast design of new large and complex circuits and facilities

Applications

VLSI module placement

Facility Layout

Reception	Raw material	Grinders	Inventory
Planning	Cutting	Final inspection	


IEMS' 2012 (5th January 2012)
 Marisa Oliveira, Eduarda P. Ferreira, A. Miguel Gomes

A Simulation Optimization Enhanced with Data Mining Approach to the Operating Room Planning and Scheduling Problems

Fabrício de Reuter Sperandio, Bernardo Almada-Lobo, José Borges


* Faculty of Engineering, University of Porto

Operating Room Scheduling via Simulation Optimization



Universidade do Porto
FEUP Faculdade de Engenharia


Fabrício Sperandio, Bernardo Almada-Lobo, José Borges
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The Challenge

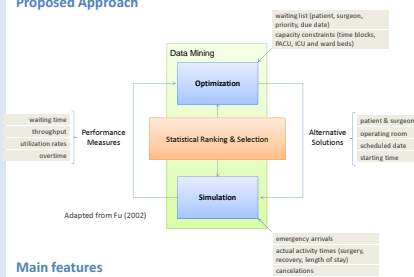
Motivation

Health care costs have been rising for several years due to an increasing demand for surgical services. Additionally, the current financial crisis requires challenging cuts on health care budget. In this context, the managerial aspect of hospitals and especially surgical services are particularly important because they represent the largest share on health care costs. It is imperative to improve operating room efficiency to control surgical waiting lists.



The Methodology

Proposed Approach



Adapted from Fu (2002)

The Value to Society

Expected Results


- To find more **realistic** and **robust** surgical schedules to allow decision makers to **proactively** manage the effects of uncertainty on the performance measures.
- To build an **efficient** simulation optimization solution allowing **quality** solutions to be found on a practical amount of time.
- To increase OR efficiency allowing managers to **reduce costs** while preserving **quality of care**.

Contributions

This project takes **simulation optimization** theory and practice into the operating room management field as never done before. It understands the **stochastic nature** of the system and combines different methods to address the efficiency issue. In doing so it expands the literature on **operating room scheduling** setting up new levels of model detail and respective solution efficiency.

Problem

Surgical services management is a **complex task** due to **strong uncertainty**, **limited resources** and **conflicting objectives**. To manage such complexity researchers split the problem into three decision levels: strategic, tactical and operational. This project focus on the **operational level**. The problem consists on **selecting patients** from the waiting list and **schedule surgeries** over a 1-week planning horizon subject to resource **availability** and **capacity** constraints. The **combinatorial** and **stochastic** nature of the problem makes it **computationally challenging** taking researchers to focus on deterministic approaches.



Our approach takes into account **uncertainty** in patient arrivals and surgical times, downstream **capacity constraints** (PACU, ICU and surgery wards) and **multiple objectives**.

Main features

Optimization: runs a MOEA to search for the set of Pareto optimal solutions. The choice for this algorithm considers the discrete variable and multi-objective characteristics of the problem.

Simulation: features a discrete event simulator based on DEVS formalism for high performance simulation [2]. It uses simulation to both model the problem and assess alternative solutions' performance under uncertainty.

Ranking & Selection: links simulation and optimization modules. MO-OCBA is an effective method to reduce the estimation cost and improve efficiency. It determines the number of simulation replications based on the mean and variance of the alternative solutions being compared [3].

Data Mining: supports simulation and optimization modules on two distinct ways: to model random variables in the simulation and reduce variability; to reduce estimation cost through a metamodel that estimates the performance of the simulation.

References

- [1] Fu, M.C., 2002. Optimization for simulation: Theory vs. practice. *INFORMS Journal on Computing*, 14(1), pp. 192-215.
- [2] Zeigler, B.P., Praehofer, H. & Kim, T.G., 2000. *Theory of Modeling and Simulation*, Academic Press.
- [3] Chen, C.K. & Lee, L.H., 2010. *Stochastic simulation optimization: an optimal computing budget allocation*, World Scientific Pub Co Inc.

Acronyms

MOEA – Multi-objective Evolutionary Algorithm
MO-OCBA – Multi-objective Optimal Computing Budget Allocation
DEVS – Discrete Event System Specifications
PACU – Post Anesthesia Care Unit
ICU – Intensive Care Unit

An Impact Indicator for Researchers


Elizabeth S. Vieira* †, José A. S. Cabral†, José A. N. F. Gomes*

* *REQUIMTE, Department of Chemistry e Biochemistry, Faculty of Sciences, University of Porto,*

† *Faculty of Engineering, University of Porto*

An impact indicator for researchers

Elizabeth S. Vieira, José A. S. Cabral and José A. N. F. Gomes




The assessment of individual researchers using bibliometric indicators is more complex than that of a region, country or university. Hirsch proposed a new indicator, called the *h* index, as a particularly simple and useful way to characterize the scientific output of a researcher. It has the advantage of combining a measure of quantity and impact in a single indicator, but the index is not normalized then:

Pharmacology
h index=17

Chemistry
h index=26

Mathematics
h index=5



Question: Who is the best?
Answer: ???

Solution

To develop an indicator based on the concept of the *h* index and that compensate for the citations culture of different fields - *hnf* index.


In the calculation of the *hnf* index the citations obtained for each document are normalized. The document type, publication year and subject category is considered in the normalization process. Fractional counting is used for documents in order to make difficult to inflate results with co-authorship of documents for reasons other than good scientific performance. Fractional counting is not applied to citations because if we use the number of citations as a proxy of the document quality, the quality is not reduced by having another author in the list!

At the end, an index is obtained that: (1) keeps the same good features of the *h* index; (2) **allows the comparison of researchers working in different fields** and (3) combines several important aspects of the scientific performance of a given researcher.

Pharmacology
hnf index=6.464

Chemistry
hnf index=6.124

Mathematics
hnf index=6.833



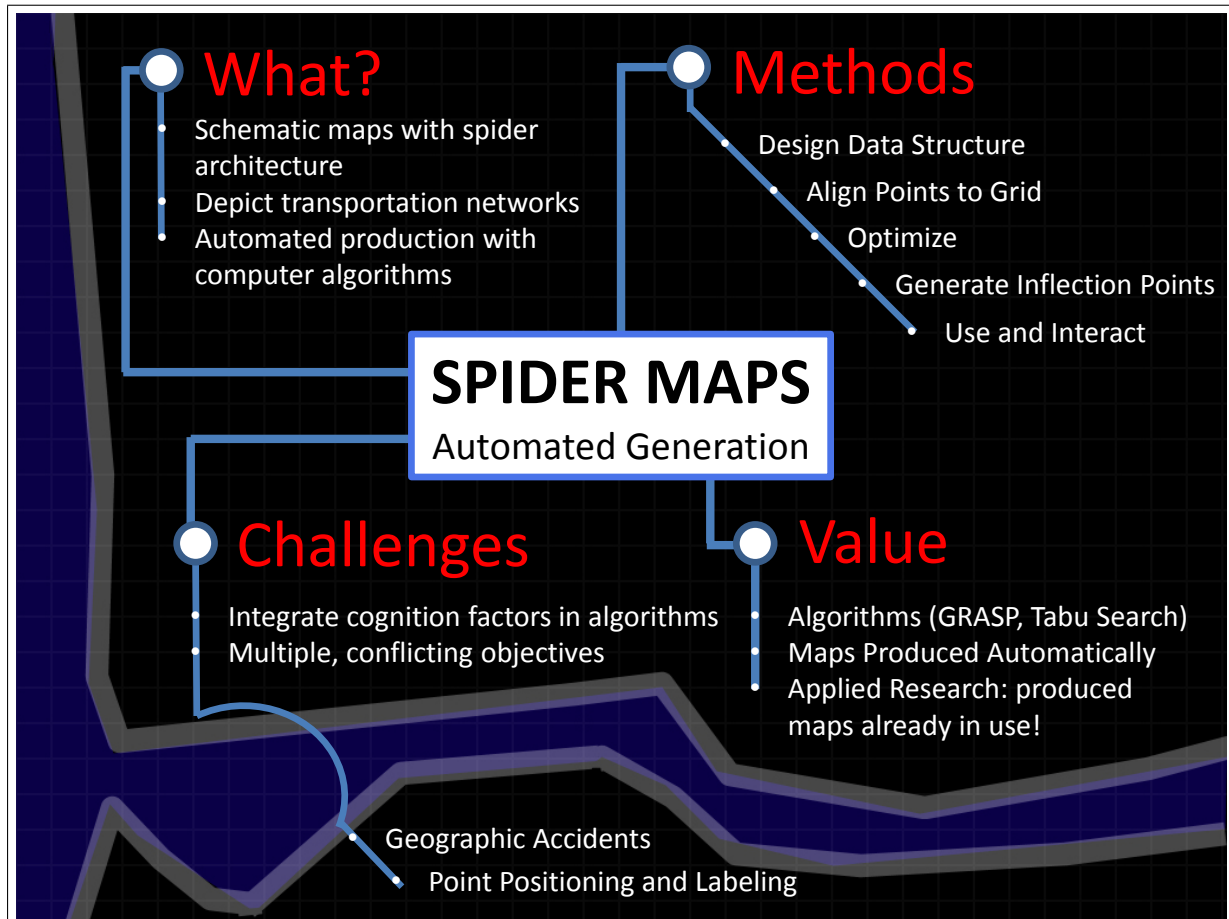
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Applied Research on the Automated Generation of Spider Maps

João Mourinho*, Teresa Galvão*, João Falcão e Cunha*

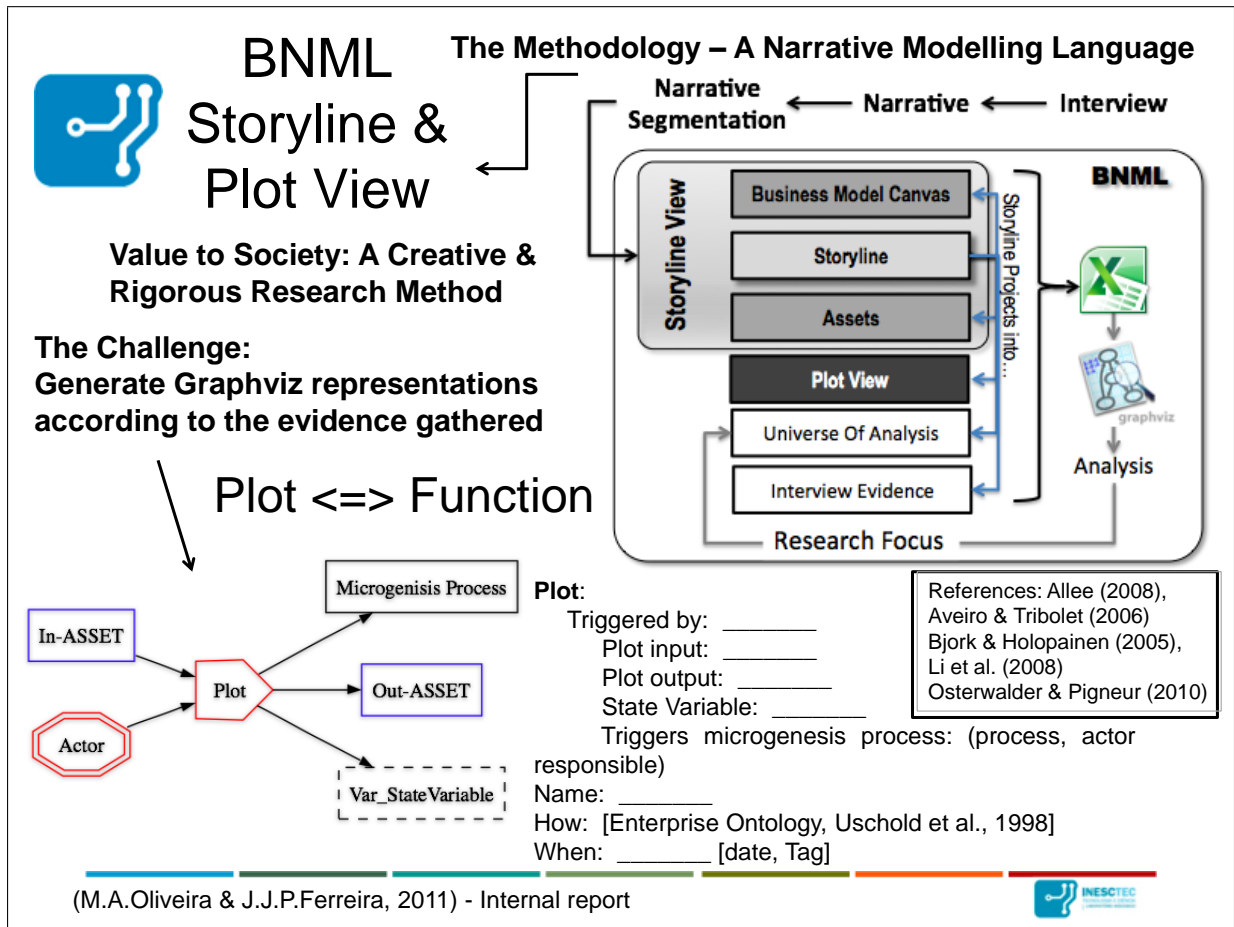
* Faculty of Engineering, University of Porto



Applying Creativity to Research Methods - An Analysis of Innovation Antecedents Using the Business Narrative Modelling Language (BNML)

Manuel Au-Yong Oliveira*, João José Pinto Ferreira*

* Faculty of Engineering, University of Porto



Applying an improved Kernel Density Two-Step Floating Catchment Area method to analyze access to hospital health care in Portugal

Pierre Polzin*, José Luís Borges*, António Coelho*

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Applying an improved Kernel Density Two-Step Floating Catchment Area method to analyze access to hospital health care in Portugal



Universidade do Porto
FEUP Faculdade de Engenharia

Pierre Polzin, José Luís Borges, António Coelho
Faculty of Engineering of the University of Porto

DEIG

1 – The Challenge:

This paper presents an innovative evaluation of access to hospital health care in continental Portugal adopting an improved method based on state of the art methods to analyze access to health care. It is the first application of this kind of method to the context of the hospital health care sector in Portugal.



2 – The Methodology:

In this paper, a new two-step floating catchment area method is created by introducing nonspatial factors directly in the access index, including the consideration of pendulum movements to characterize people's geographic mobility, and by using a kernel density function typically used to model decaying spatial access to health care to differentiate proximity within catchment areas. It was also adapted to deal with the official catchment areas of the Portuguese public hospitals, which indicate the population that has to be served by each hospital.

3 – The value to society:

This study helps to identify areas with populations facing high, medium or low access to hospital health care and provides the means to identify the hospitals that are responsible for each access level.

The main results obtained indicated that even though the new method calculates lower supply ratios than the basic two-step floating catchment area method and with lower standard deviations for different catchment sizes, the application of the new method identified some regions in Algarve and Alentejo with high access, besides the areas close to Porto, Lisbon and Coimbra.



Business Intelligence and Data Mining in Operating Room Scheduling

Carlos Gomes*, Arnon Peles*, Fabrício Sperandio*, António Carvalho Brito*, José Borges*, Bernardo Almada-Lobo*

* Faculty of Engineering, University of Porto

Bi&DM@OR

Business Intelligence and Data Mining in Operating Room Scheduling

Carlos Gomes, Arnon Peles, Fabrício Sperandio, António Carvalho Brito, José Borges, Bernardo Almada-Lobo

THE PROBLEM?

In Portuguese hospitals, surgeons are responsible for scheduling surgeries and planning their lengths. However, these decisions are often empiric. As such, **problems arise**:

- **Increased uncertainty:** Deviations from planned surgery length.
- **Poor performance:** OR low utilization rate / over-time.

GOAL?

Create a decision support system, placing the necessary infrastructure to give the **hospital personnel** the ability to monitor and analyze their operations in order to correct their scheduling and allocation errors.

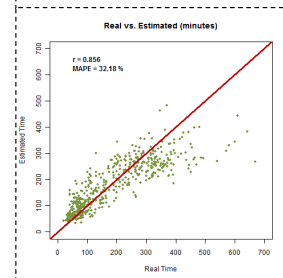
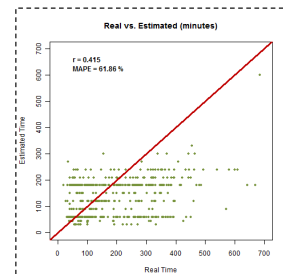
By doing so, **operating room resources** will be used more effectively and efficiently. In a long-term perspective, **more surgeries will be performed** and **less disruptions will occur**.

OUR SOLUTION?

A **business intelligence** module, integrated into a DSS, allowing monitoring and analysis of the OR status. Using a **data mining** solution **improves surgery length estimates**.

This solution not only allows better decision making, but also improves OR overall performance.

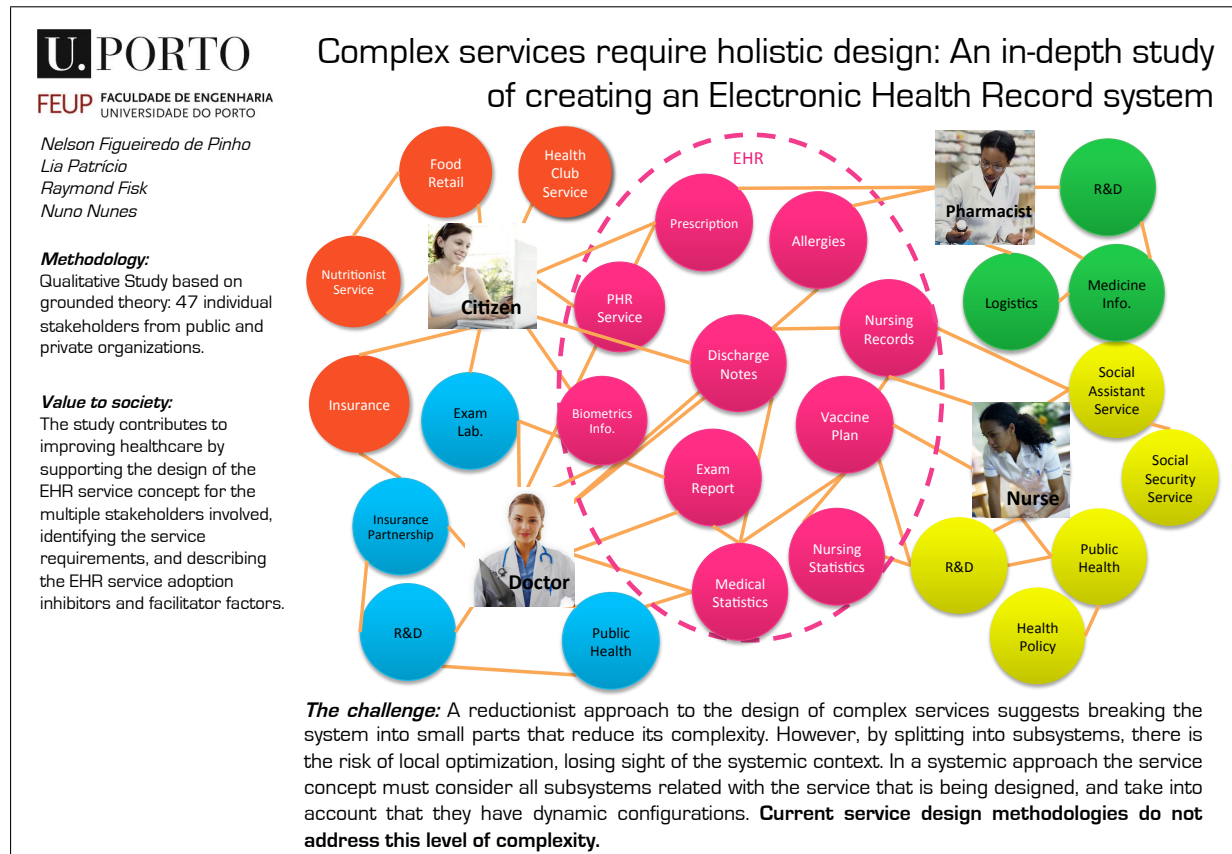
DATA MINING: DURATION ESTIMATION Before and after



Complex Services Require Holistic Design: An In-depth Study of Creating an Electronic Health Record System

Nelson Pinho*, Lia Patrício*, Raymond Fisk†, Nuno Nunes‡

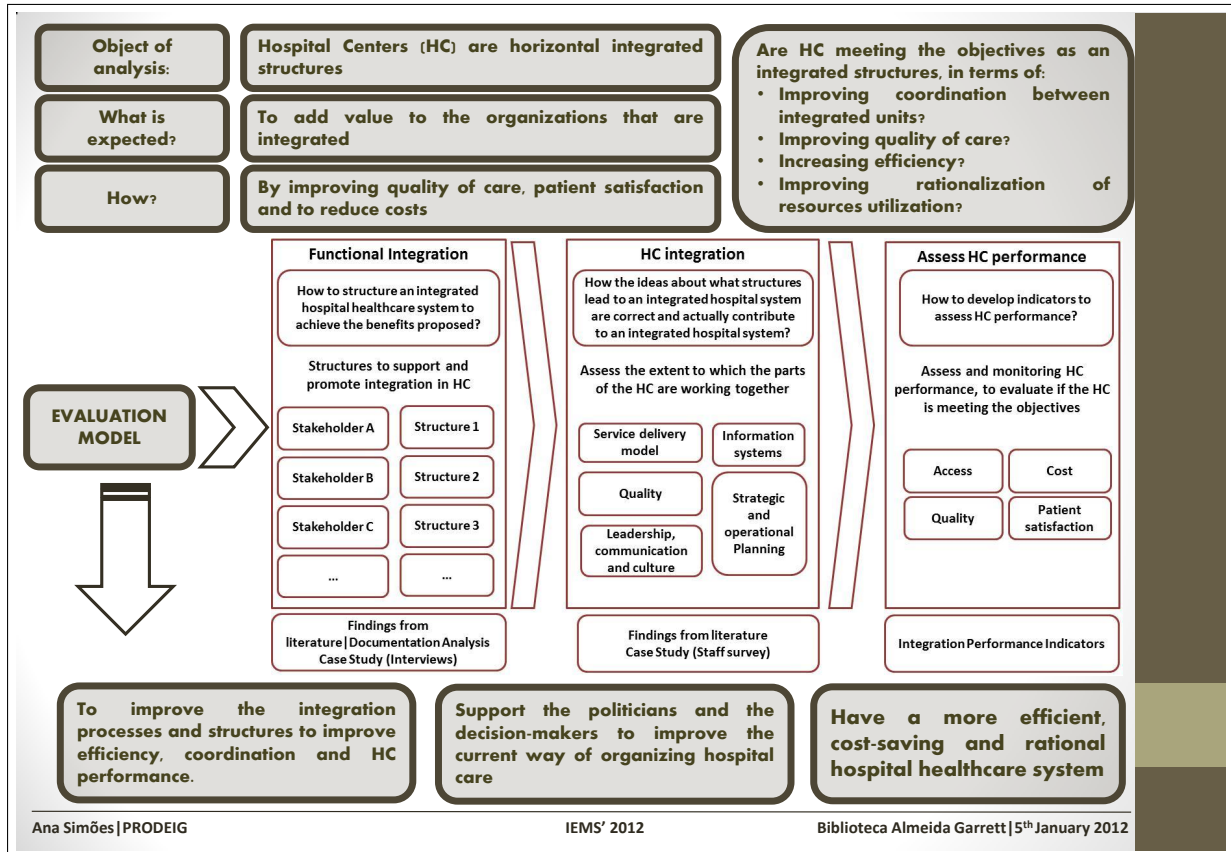
* Faculty of Engineering, University of Porto, † Texas State University - San Marcos, ‡ University of Madeira



Conceptual Framework for Organizational Model Assessment of Hospital Centers

Ana Simões*, Américo Azevedo*, Suzete Gonçalves†

* Faculty of Engineering, University of Porto, † Institute of Social Service of Porto



Conceptual Model for Decomposing the Value for the Customer

Susana Nicola*, Eduarda Pinto Ferreira*, J. J. Pinto Ferreira†

* *GECAD - Knowledge Engineering and Decision Support Research Center, School of Engineering, Polytechnic Institute of Porto*, † *INESC Porto, Faculty of Engineering, University of Porto*

Conceptual Model for Decomposing the Value for the Customer

Student: Susana Nicola

Supervisors: João José Pinto Ferreira & Eduarda Pinto Ferreira

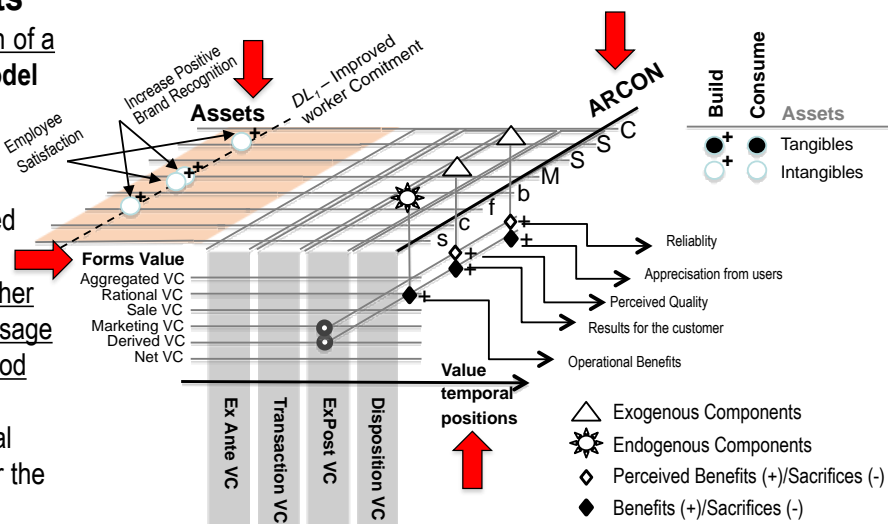
Methodology

Design Science in Information Systems Research proposed by Hevner, A. R., S. T. March, et al. (2004), combined with the **Case Study Approach** as described by Dubé, L. and G. Paré (2003). The actual data collection and processing followed the **BNML** proposed by Oliveira & Ferreira (2011).

Research Results

Proposal and Validation of a novel “Conceptual Model for Decomposing the Value for the Customer” integrating the illustrated concepts.

This validation was further achieved through the usage of the Fuzzy AHP Method that enabled the development of a formal mathematical model for the CMDVC.



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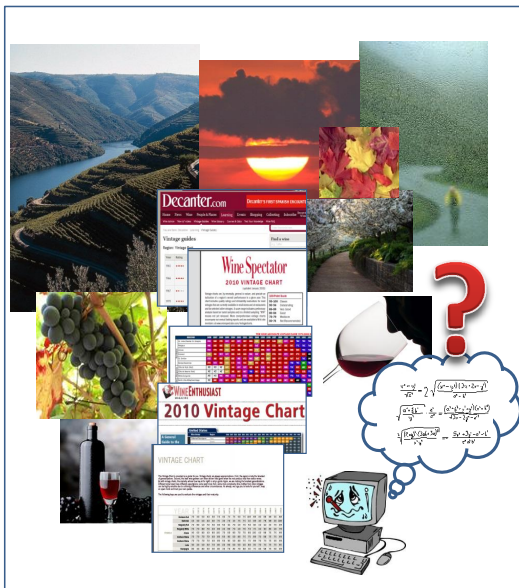
Creating a Model for the Quality of Wine from the Douro Region

António Corte-Real Sousa*, José Luís Borges*

* Faculty of Engineering, University of Porto

Creating a model for the quality of wine from the Douro region

António Corte-Real Sousa
José Luís Borges



The aim of this work is to relate the year's average quality of wines from the Douro region, as perceived by consumers and tasters, to the weather variables, the climate variables and other type of variables that may have influence on it.

Research questions:

- How to define "wine quality"?
- What information can one use to assess the average quality of wine of a vintage?
- How to rank different years by wine quality?
- Which weather variables influence wine quality?
- Will climate change influence wine's quality over time?

Research goal:

To find a mathematical/statistical model able to translate the influence of the variables on the quality of wine.

Research relevance:

A model that helps to understand factors that influence the variability of wine vintages will potentially be invaluable for the economic sustainability of wine regions, helping winegrowers to anticipate actions that may lessen the impact of yearly weather specificities and the impact of climate changes.

Customer Experience Modeling: A Multidisciplinary Method to Improve Experience Understanding and Communication

Jorge Teixeira* †, Lia Patrício*, Leonel Nóbrega†, Larry Constantine†

* Faculty of Engineering, University of Porto, † M-ITI, University of Madeira



Universidade do Porto
FEUP Faculdade de Engenharia

PhD Student: Jorge Grenha Teixeira

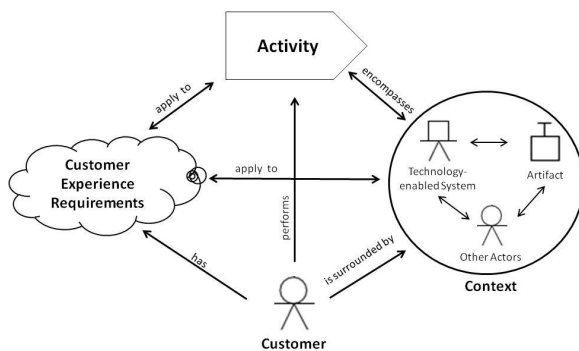
Supervisor: Dr. Lia Patrício

IEMS' 2012

3rd Industrial Engineering
and Management Symposium

Customer Experience Modeling:

A multidisciplinary method to improve experience understanding and communication



Challenge

- Service Design orchestrates the service elements that enable customers to co-create their desired experiences.
- Experiences are, holistically perceived by customers.
- A single ill-designed element can damage the whole experience.
- Current techniques are focused on single elements, not in the rich picture.
- Proliferation of concepts and notations from different research areas damage multidisciplinary team communication.

Methodology

- Design research approach.
- First iteration with seventeen semi-structured interviews, following Grounded Theory precepts.
- Second iteration with contextual inquiry and observations.

Value to Society

- Capture, systematize and evaluate customer experiences.
- Clear set of concepts and notation.
- Adapted to the service mindset.
- Business modeling support.
- Includes Infrastructural and organizational impacts.
- Reduce uncertainty of service design projects

Designing the Travel Experience: Identification and Incorporation of Passengers' Experience Requirements in New Bus Body Development

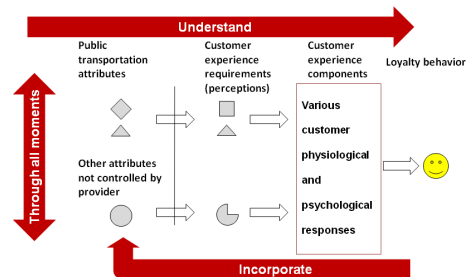
Rui Carreira*, Lia Patrício*, Renato Natal*

* Faculty of Engineering, University of Porto

Designing the travel experience: identification and incorporation of passengers' experience requirements in new bus body development

Rui Carreira (ruicar@fe.up.pt) Advisors: Lia Patrício (lpatric@fe.up.pt), Renato Natal (rnatal@fe.up.pt)

The challenge: Customer experiences are increasingly important. The understanding of customer experience (see top of Figure) and the development of methods for systematically incorporate these requirements (see bottom of Figure) into the combined product and service development process still deserve further attention ([Patrício et al. 2009](#)). Public transportation involves the vehicles, services and even other aspects which may be incongruent to the customers.



The Methodology: A design-science research ([Hevner et al. 2004](#)) approach involved: (1) Observation and interviews to mid-distance bus passengers in order to obtain rich qualitative data ([Neuman 2006](#)) about the travel experience. (2) Development and administration of a questionnaire to perform a scale development approach ([Churchill 1979](#)). (3) Action research ([Harris 2007](#)) was implemented in an extended Kansei engineering methodology to involve passengers, vehicle manufacturers and transport providers.

The value to society: The Travel-Experience scale consists of 28 items aggregated into 7 dimensions. The extended Kansei engineering method enabled the association of three bus interior aesthetic properties to passenger sensorial and emotional assessments.

The work contributes to the (1) identification of several experience requirements, which are combined to specify the Travel-Experience scale, (2) elicitation of customer internal responses, and their antecedents and consequences, and (3) incorporation of experience requirements into new public transportation development.

Dynamic Supply Chains: Models, Organizational Issues and Supporting Technologies

João Bastos*, Américo Azevedo*, Paulo Ávila†

* Faculty of Engineering, University of Porto, † School of Engineering, Polytechnic Institute of Porto

Dynamic Supply Chains: Models, Organizational Issues and Supporting Technologies

Research Objectives

Develop research work in Dynamic Supply Networks, studying and analyzing the different organizational models of supply chain networks and evaluating their performance in case studies

Propose a Dynamic Supply Chain Reference Model to support the companies decision-makers embrace new business models in order to capture the dynamic behavior of people outside and inside the business.

Supply Chain Taxonomy

Demand Flow Types

Supply Chain Types

Flexible	<ul style="list-style-type: none"> Unplannable demand Innovative solutions
Agile	<ul style="list-style-type: none"> Unpredictable demand Quick response
Leagile	<ul style="list-style-type: none"> Hybrid demand Existence of decoupling point
Lean	<ul style="list-style-type: none"> Predictable demand Price sensitive
Continuous Replenishment	<ul style="list-style-type: none"> Very predictable demand Relationship focused

Relationship with Customer (Y-axis: Loose to Tight)

Demand Predictability (X-axis: Low to High)

Research Contributions

Through the proposed dynamic supply chain framework is possible to supply chain managers:

- focus consistently in fulfilling customer requirements;
- improving profit margins through “value-added” supply chain products and services;
- develop new service offerings from continuous innovation across the supply chain.

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INSTITUTO DE ENGENHARIA DE SISTEMAS E COMPUTADORES DO PORTO

João Bastos - Américo Azevedo - Paulo Ávila

Dynamic Vehicle Routing for Demand Responsive Transportation Services

Rui Gomes*, Jorge Pinho de Sousa*, Teresa Galvão*

* Faculty of Engineering, University of Porto




Dynamic Vehicle Routing for Demand Responsive Transportation Services

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{rjgomes,jsousa,tgalvao}@fe.up.pt

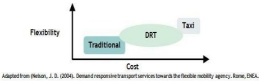
CHALLENGE

- Economic efficiency of public road transportation relies on solid demand levels and well-established mobility patterns
- Public transportation in low, unpredictable, variable demand scenarios such as urban night periods and rural areas, for instance, is expensive, leading to sparse frequencies and low perceived quality



Demand Responsive Transportation (DRT)

- DRT: possible solution with flexible routes and frequencies according to the observed demand

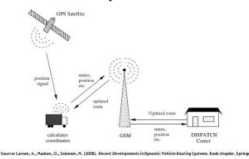


Adaptation (Klein, J. S. (2004). Demand responsive transport services towards the flexible mobility agency. Bonn, DEU.)

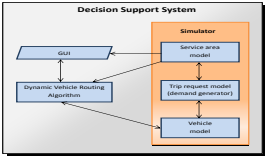
- Routes planned shortly before their start, with better occupancy rates and vehicles with characteristics better suited to users' necessities
- Users specify transportation requests at any time, from anywhere to anywhere, requiring the (re-)design of solutions in real-time

METHODOLOGY

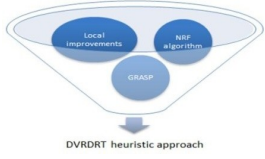
Physical tier



Logic tier



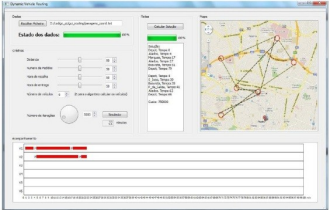
Algorithm



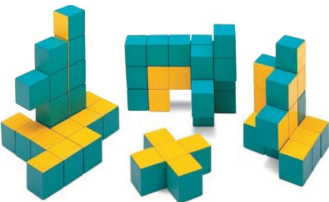
DVRDRT heuristic approach

RESULTS

Decision Support System



DRT design patterns

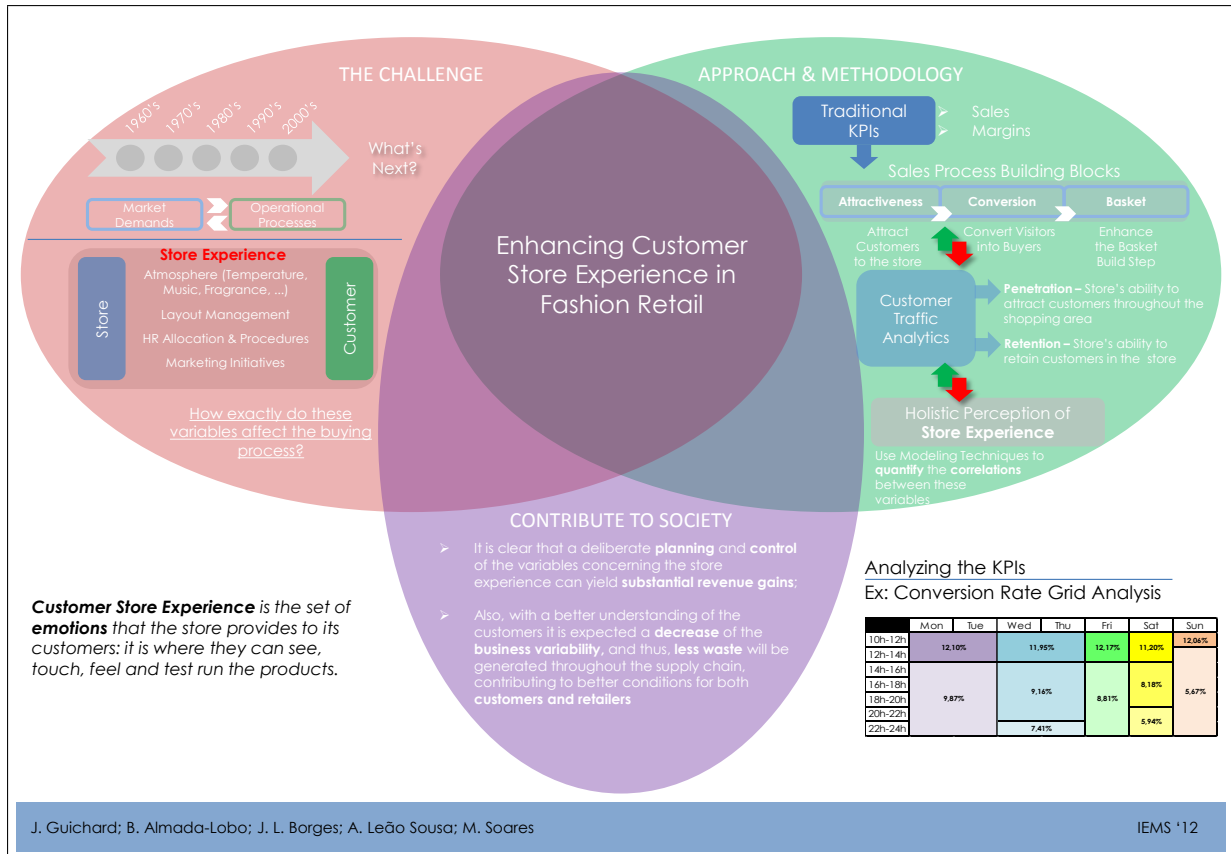


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Enhancing Customer Store Experience in Fashion Retail

J. Guichard*, B. Almada-Lobo* †, J. L. Borges* †, A. Leão Sousa‡, M. Soares‡

* INEGI, † Faculty of Engineering, University of Porto, ‡ INOVRETAIL



Forest Fire Management Systems Analysis and Design

Abílio Pacheco *, João Claro *

* INESC Porto, Faculty of Engineering, University of Porto

The challenge: how to break this vicious cycle?

The Methodology

Adapted from Saveland (1998)

The value to society: contribute to the beginning of a virtuous cycle

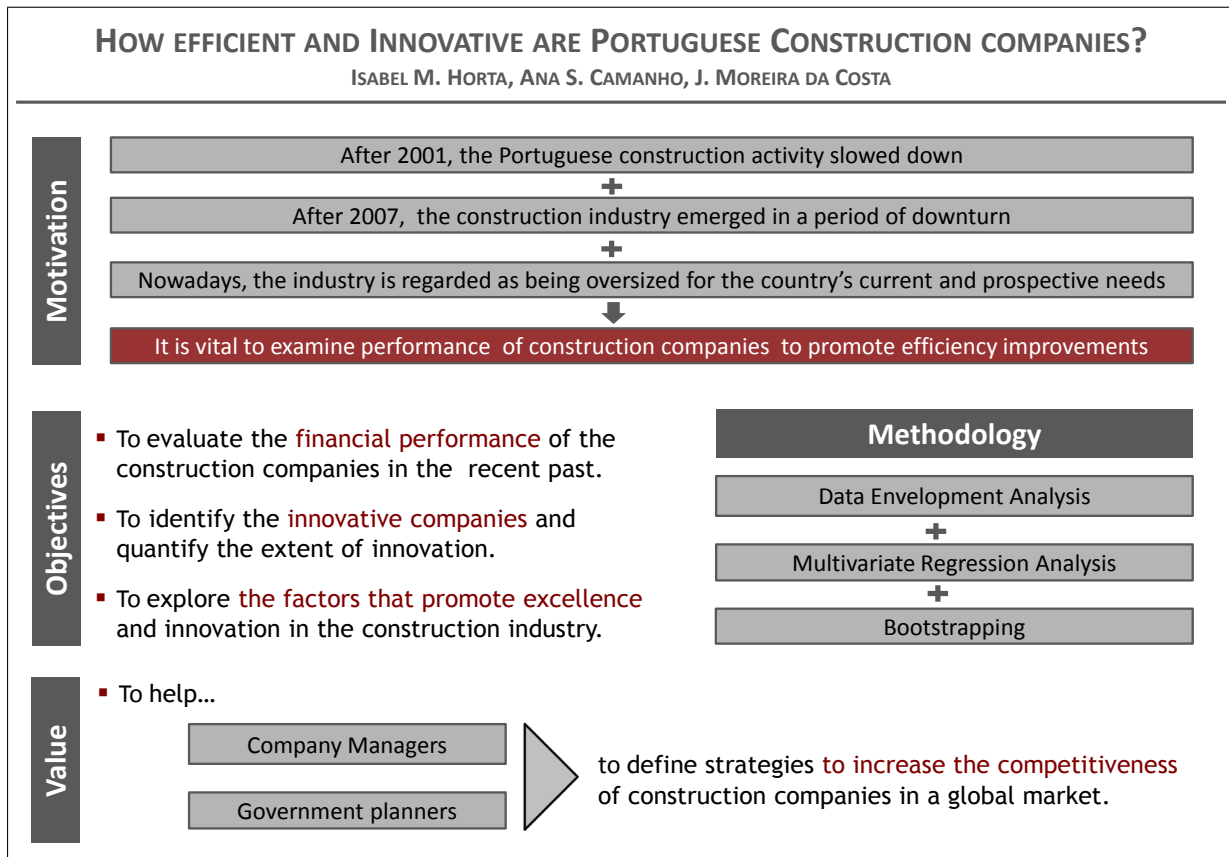
Forest Fire Management Systems Analysis and Design

Abílio Pacheco, João Claro (Supervisor)

How Efficient and Innovative are Portuguese Construction Companies?

Isabel M. Horta*, Ana S. Camanho*, J. Moreira da Costa*

* Faculty of Engineering, University of Porto



Hybrid Algorithms for Production Planning in the Pulp and Paper Industry

Gonalo Figueira* , Bernardo Almada-Lobo*

* Faculty of Engineering, University of Porto

Hybrid Algorithms for Production Planning in the Pulp and Paper Industry

Challenge	Define how to approach the optimization of production planning in the pulp and paper (P&P) industry and other similar process industries.
Methodology	Develop and test optimization models and algorithms based on different...

Optimization tools:	Types of integration:	Planning Horizons:
<ul style="list-style-type: none"> Mixed integer programming Modern heuristics Hybrid approaches 	<ul style="list-style-type: none"> Different production stages with... Distribution and Forecasting 	<ul style="list-style-type: none"> Tactical (e.g. budgeting) Operational (e.g. scheduling, disturbance management)

P&P production process

Synchronization of resources in a production plan

Value to society	Allow companies to produce a wider range of paper and paperboard products with lower costs, improved lead times and reduced environmental impact.
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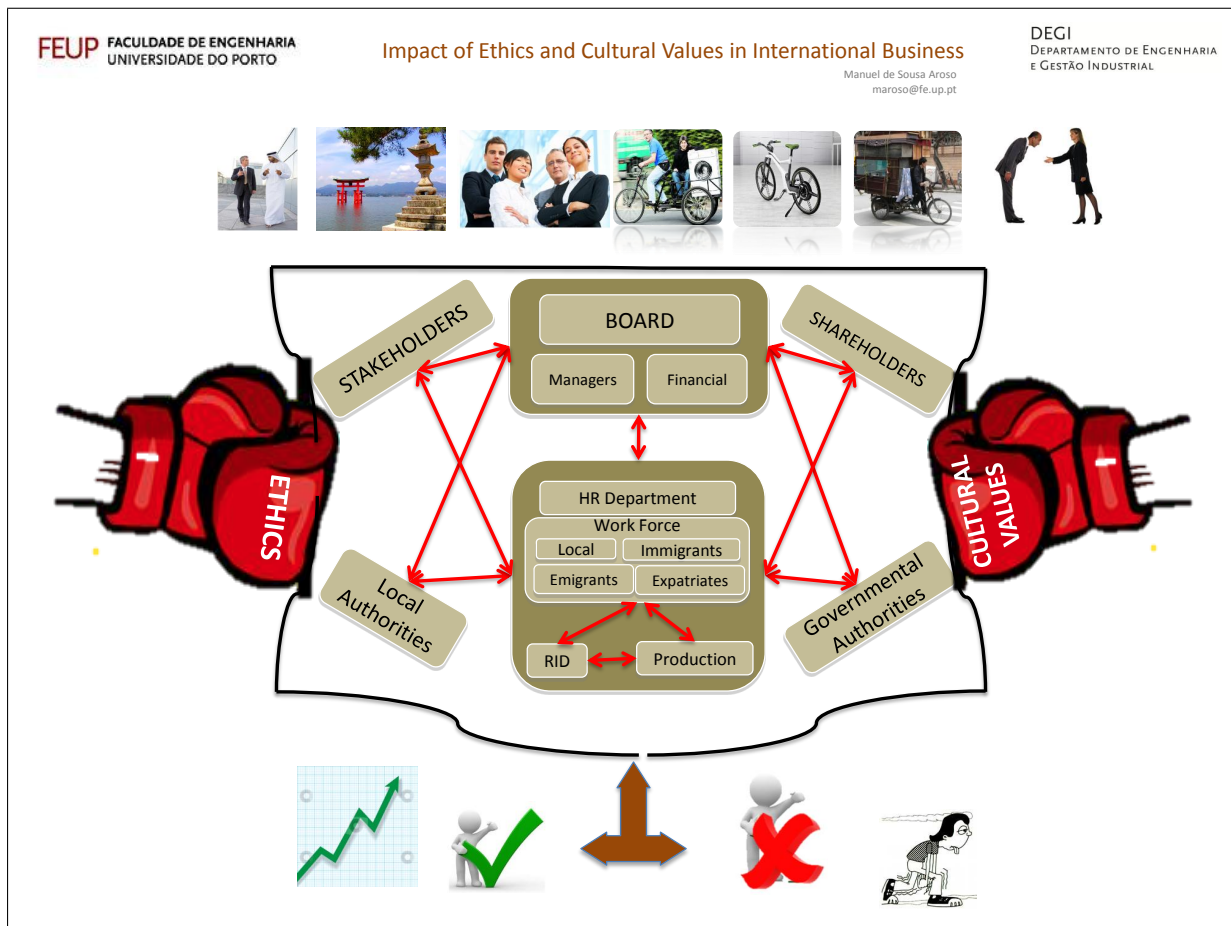
PHD Student: Gonalo Figueira (deg11006@fe.up.pt)
Supervisor: Bernardo Almada-Lobo (almada.lobo@fe.up.pt)

Doctoral Program in Industrial Engineering and Management
Faculty of Engineering of the University of Porto

Impact of Ethics and Cultural Values in International Business of Technological Basis

Manuel de Sousa Aroso*, João José Pinto Ferreira*, Peter Prud'homme


* Faculty of Engineering, University of Porto



Influence of Consumer Purchasing Behaviour on the Production Planning of Perishable Food

P.Amorim* †, A.M.Costa†, B.Almada-Lobo*


* Faculty of Engineering, University of Porto, † ICMC, University of São Paulo, Brazil



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Influence of Consumer Purchasing Behaviour on the Production Planning of Perishable Food

P. Amorim (amorim.pedro@fe.up.pt) , A. M. Costa, B. Almada-Lobo

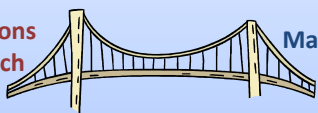


USP
ICMC

The Challenge

*Bridge the gap between **production planning** and **consumer purchasing behaviour** for **perishable food***

Operations Research



Marketing

- Production **Planning**
- Direct Store **Delivery**
- Stochastic **Programming**
- Demand **Uncertainty**
- Demand **Modelling**
- Consumer **Behaviour**

The Methodology

Model Decaying Demand Depending on Age

Model for Deterministic Production Planning

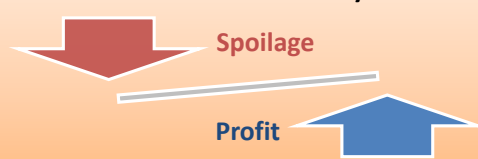
Model for Stochastic Production Planning (Variable Demand)

Extensive Sensitivity Analysis for Key Parameters

Results, Discussion and Conclusions

The Value to Society

- **Spoilage** only occurs in a stochastic scenario
- **Spoilage** in the objective function mitigates significantly its impact



Spoilage

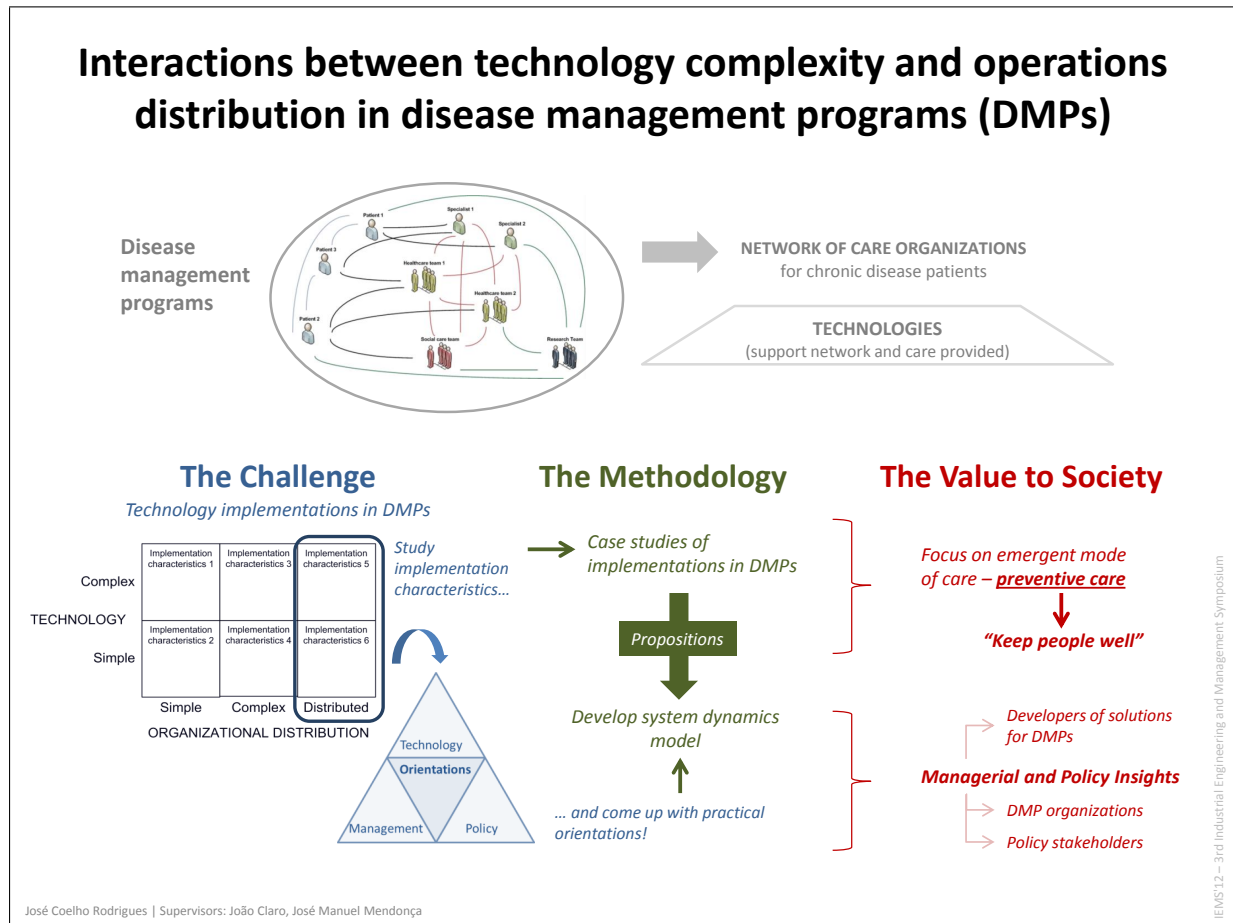
Profit

- **Profit** increases as the correct demand profile is considered
- **Profit** increases for less risky products and less sensitive customers

Interactions Between Technology Complexity and Operations Distribution in Disease Management Programs

José Coelho Rodrigues*, João Claro*, José Manuel Mendonça*

* *INESC Porto, Faculty of Engineering, University of Porto*



IT impact on Portuguese Healthcare Institutions – A Case Study

Miguel Oliveira*, António Carvalho Brito*, Lia Patrício*

* Faculty of Engineering, University of Porto



IT Impact on Portuguese Health Care Institutions – A Case Study

The challenge: Many of the recent electronic health records have failed as they are not well fitted to the health care professionals practices. A deep understanding of the daily routine of health care professionals and the impact of the introduction of Electronic Health Record (EHR) systems is necessary to support the development of EHRs that are well adapted to the organizations' operational processes and are successfully adopted.

Research questions:

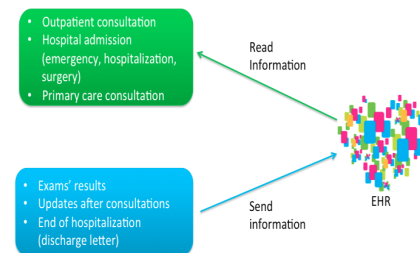
- How do Information Systems impact the daily routine of health care professionals?
- How do inter-institutional IS affect the institutions functioning?
- How will an EHR system impact current organization processes?

Results: The implementation of EHR systems usually require long projects that face many challenges that need to be addressed since the early stages of the projects. These challenges can have different dimensions:

- Technical (e.g. information systems integration)
- Infrastructural (e.g. network broadband, performance)
- Change management (change of current operational processes).

The EHR can be a driver to promote internal and inter-institutional interoperability. Relevant information sharing improves the data quality available for clinical decision-making, thus improving the quality of care.

Institution type	Type of care	Size	
ARS Norte	Public (NHS)	Primary	~10.000 collaborators
ACES Gondomar	Public (NHS)	Primary	~400 collaborators
Hospital da Prelada	Social	Secondary / Hospital	~530 collaborators
Hospital de Vila Nova de Gaia e Espinho	Public (NHS) with private administration	Secondary / Hospital	591 beds

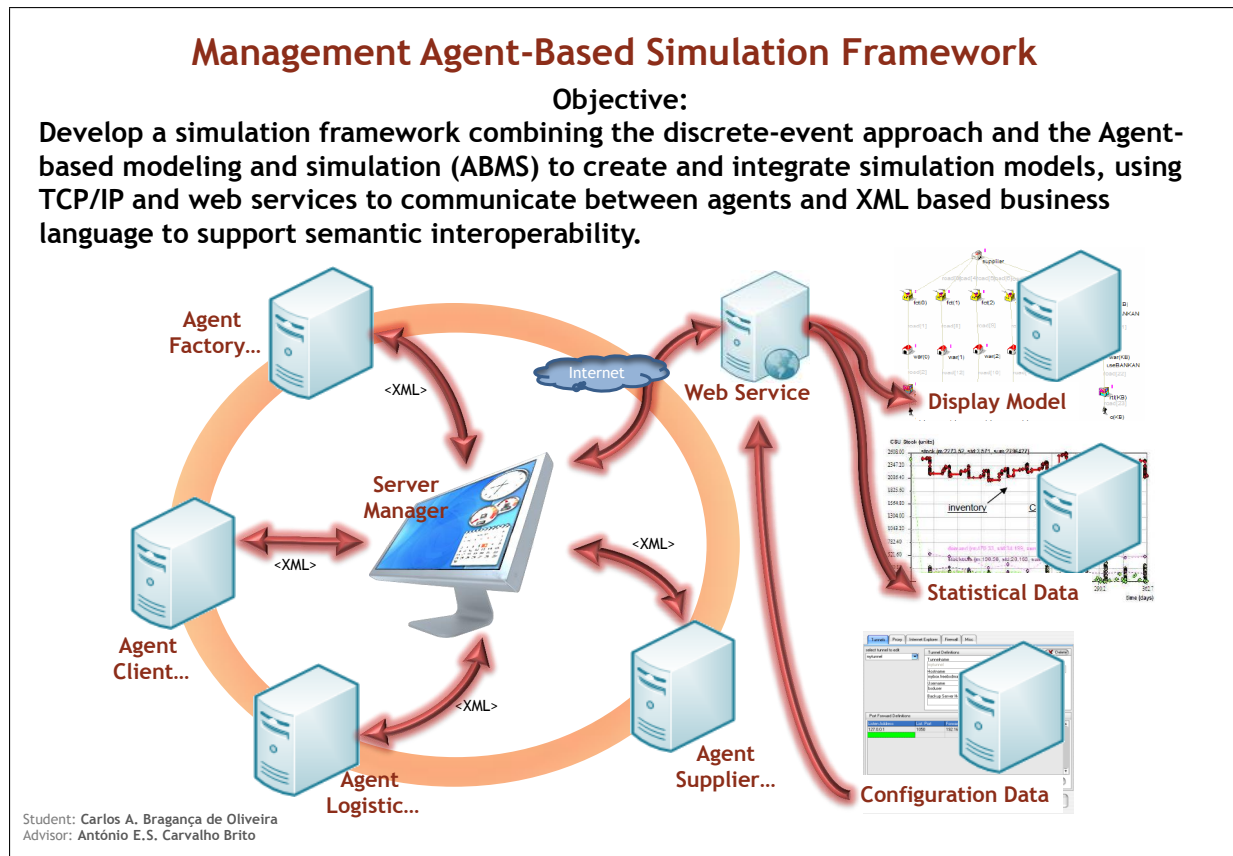


Miguel Oliveira, António Carvalho Brito, Lia Patrício
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Management Agent-Based Simulation Framework

Carlos Bragança de Oliveira*, António Carvalho Brito*

* Faculty of Engineering, University of Porto



Modeling Undesirable Outputs in the Construction of Composite Indicators

Andreia Zanella*, Ana S. Camanho*, Maria Teresa G. Dias*

* Faculty of Engineering, University of Porto

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UNIVERSIDADE DO PORTO

IEMS '12 - 3rd Industrial Engineering and Management Symposium
Andreia Zanella, Ana Camanho and Maria Teresa Galvão Dias

Modeling undesirable outputs in the construction of composite indicators

The challenge
The construction of composite indicators (CIs), based on Data Envelopment Analysis (DEA), assumes that the individual output indicators represent good aspects, so they are measured on a scale in which higher output values correspond to better performance. However, in real-applications, both desirable and undesirable outputs indicators may be present.

The methodology
We developed an enhanced DEA model to estimate composite indicators, that aims to decrease the levels of undesirable outputs and increase the levels of desirable outputs. The model proposed includes a transformation in the measurement scale of the undesirable indicators to accommodate them in a DEA formulation.

The value to society
Aggregating individual indicators into a single measure facilitates the understanding of results and provides an overall picture of performance that can be used by decision makers for planning and control purposes. Besides assigning this summary measure of performance, a CI constructed based on the DEA technique can be used by decision makers for benchmarking purposes.

Example of an environmental CI, which includes both desirable and undesirable output indicators

Individual indicators

- Water quality
- Green space areas
- Habitat protection
- Forest cover
- Solid waste
- Air Pollutants
- Sewage
- Noise

➔

DEA-based
Composite
Indicator

Undesirable outputs

How to accommodate the **undesirable outputs** in a DEA-based CI model?

Multi-Perspective Performance and Risk Estimation for Complex Manufacturing Environments

António Almeida*, Américo Azevedo*

* INESC Porto, Faculty of Engineering, University of Porto

Multi-Perspective Performance and Risk Estimation For Complex Manufacturing Environments

Context

More and more, organizations have been moving towards a business process orientation approach. Through the time, this has led to many success cases due to its capability to:

- Improve cross-functional interactions,
- Follow a customer oriented strategy.

Particularly within complex manufacturing environments, these become competitive capabilities if performance and risk assessment activities are performed seeking to optimize internal and external processes.

Research Goal

Therefore in this research work, it is proposed a business process framework that enhances this business processes orientation, supporting:

- Alignment measurement between business processes execution and the companies' business model;
- Dynamic processes performance management, based on estimation of the system behaviour;
- Selection of the suitable processes according risk analysis and assessment.

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António Almeida (deg10010@fe.up.pt)

Optimization Approaches to Staff Scheduling Problems

Marta Rocha*, José F. Oliveira*, Maria Antónia Carravilla*

* Faculty of Engineering, University of Porto

Optimization approaches to staff scheduling problems

Our challenge...

...is to assign people to the right task at the right time

Our methodology...

- ✓ Automatic scheduling
- ✓ Cyclical scheduling approach
- ✓ Workload balance
- ✓ Flexible modeling of work and rest days patterns
- ✓ Mixed-integer formulation
- ✓ Heuristics

Our value to society...

- ✓ We contribute to cost reduction through the efficient use of human resources
- ✓ We provide fair, stable and predictable schedules
- ✓ We make employees happier and therefore more productive

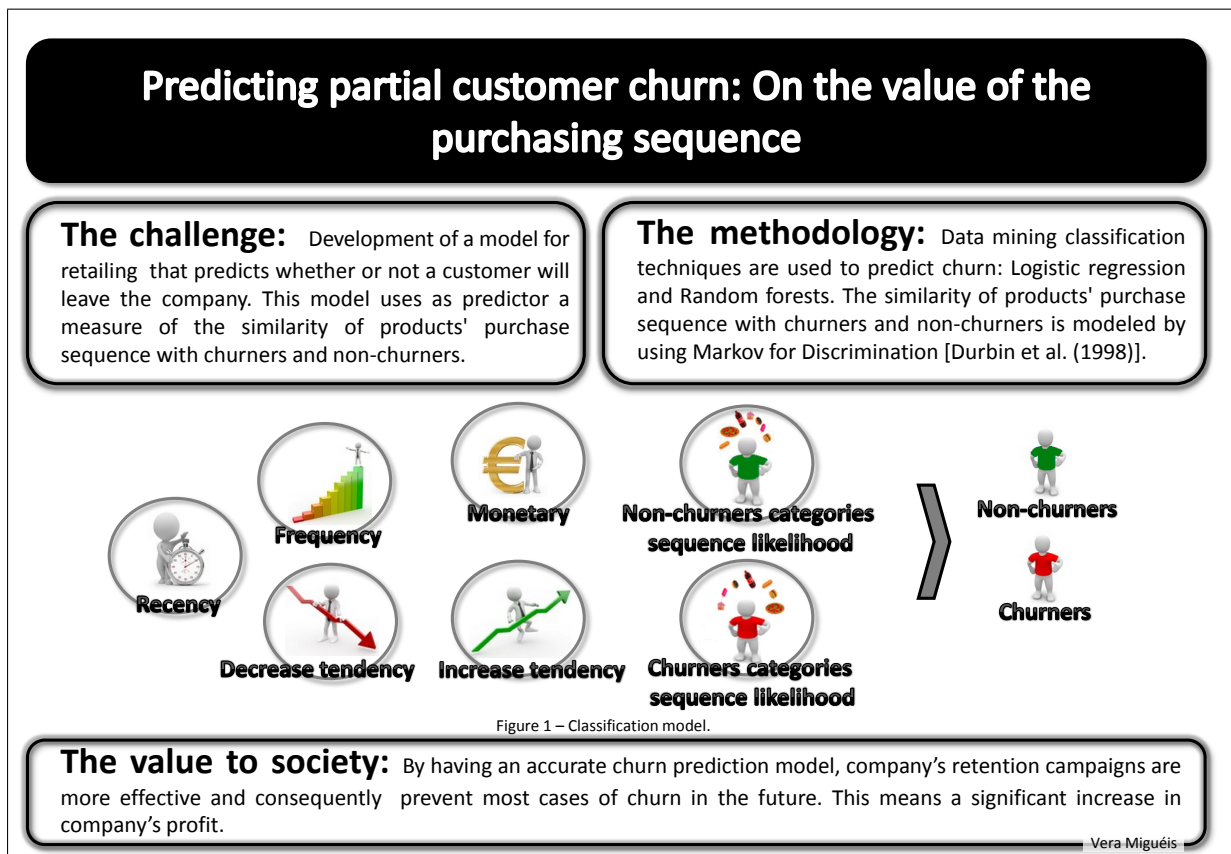
Marta Rocha

IEMS'12 – 05.01.2012

Predicting Partial Customer Churn: On the Value of the Purchasing Sequence

V.L.Miguéis*, Dirk Van den Poel†, A.S. Camanho*, João Falcão e Cunha*

* Faculty of Engineering, University of Porto, † Ghent University, Faculty of Economics and Business Administration



Retail Shelf Space Allocation in a Supermarket Chain

Teresa Bianchi-Aguiar*, Maria Antónia Carravilla*, José F. Oliveira*

* INESC Porto, Faculty of Engineering, University of Porto

Does space arrangement matter while shopping?



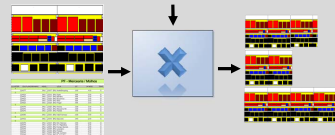
Retail Shelf Space Allocation in a Supermarket Chain

WHAT:

Design of planograms for a given set of fixtures, by deciding **how many** of each product to allocate **where** and **how**, so that sales (or profit) are maximized and allocation constraints are fulfilled.

HOW:

Development of innovative tailor-made optimization techniques combining mathematical programming models and heuristics.



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WHY:

Automate Planogram Generation, Image Standardization, Increase Sales and Profit

WHERE:

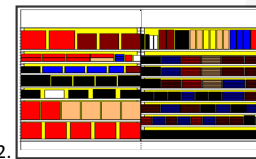
Leading Portuguese Supermarket Chain with over 100 stores

WHO:

Teresa Bianchi-Aguiar,
Maria Antónia Carravilla and
José Fernando Oliveira



3.



2.



1.

Service Design for Sustainability: Towards a More Sustainable Home Energy Consumption

Rita Viana*, Lia Patrício*

* Faculty of Engineering, University of Porto

**IEMS' 2012
FEUP**

Service Design for Sustainability

Towards a more sustainable home energy consumption

Rita Viana and Lia Patrício

???

How can we design transformative services to actively involve customers in the pursuit of sustainability?

→ SD4S
 Service Design for Sustainability

Methodology

To evolve methods for **SD4S**

- 1 **CUSTOMER EXPERIENCE**
Qualitative Study
 Grounded Theory Methodology
- 2 **TO DESIGN THE SERVICE**
Multilevel Service Design
 + GOA notation
 + Customer Journey
 + Greenprinting

Results

●
●
●
●
●

Understanding of **Customer Experience**

METHOD FOR
 Design of the **sustainable Experience**

Experience

Blueprint

Prototype

Envision the **Service to foster sustainable behaviors**

Society

↗

attention to Sustainability

●
●
●
●

Value co-creation
Service Experience
Daily Routines
Consumption Context

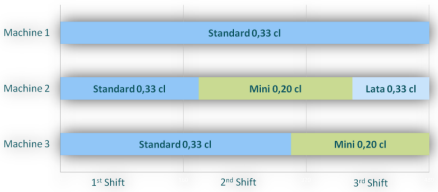
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Sustainable behaviors
Services for Sustainability adoption

Solving Production Planning Problems when Setups are Sequence-Dependent

Luis Guimarães* †, Diego Klabjan†, Bernardo Almada-Lobo*

* Faculty of Engineering, University of Porto, † Department of Industrial Engineering and Management Sciences, Northwestern University, USA

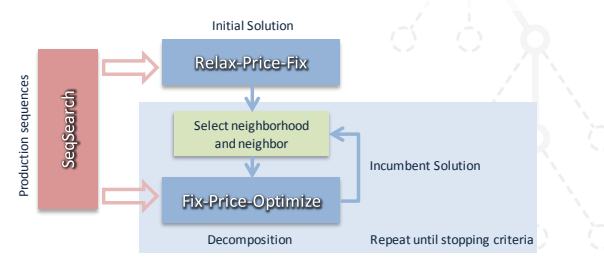


M
Methodology

- New mixed integer model for lotsizing and scheduling problems using a sequence pool
- A pricing heuristic to manage the sequence pool - *column generation and LP-diving*
- Construction and improvement mathematical programming-based heuristics combined with column generation

C
Challenge

- Develop a solution approach to solve lotsizing and scheduling problems with relevant size and realistic features



I
Impact

- Breakthroughs in how to combine mathematical programming-based heuristics and column generation
- Capability of solving real-world tactical and operational production planning problems

Solving production planning problems when setups are sequence-dependent

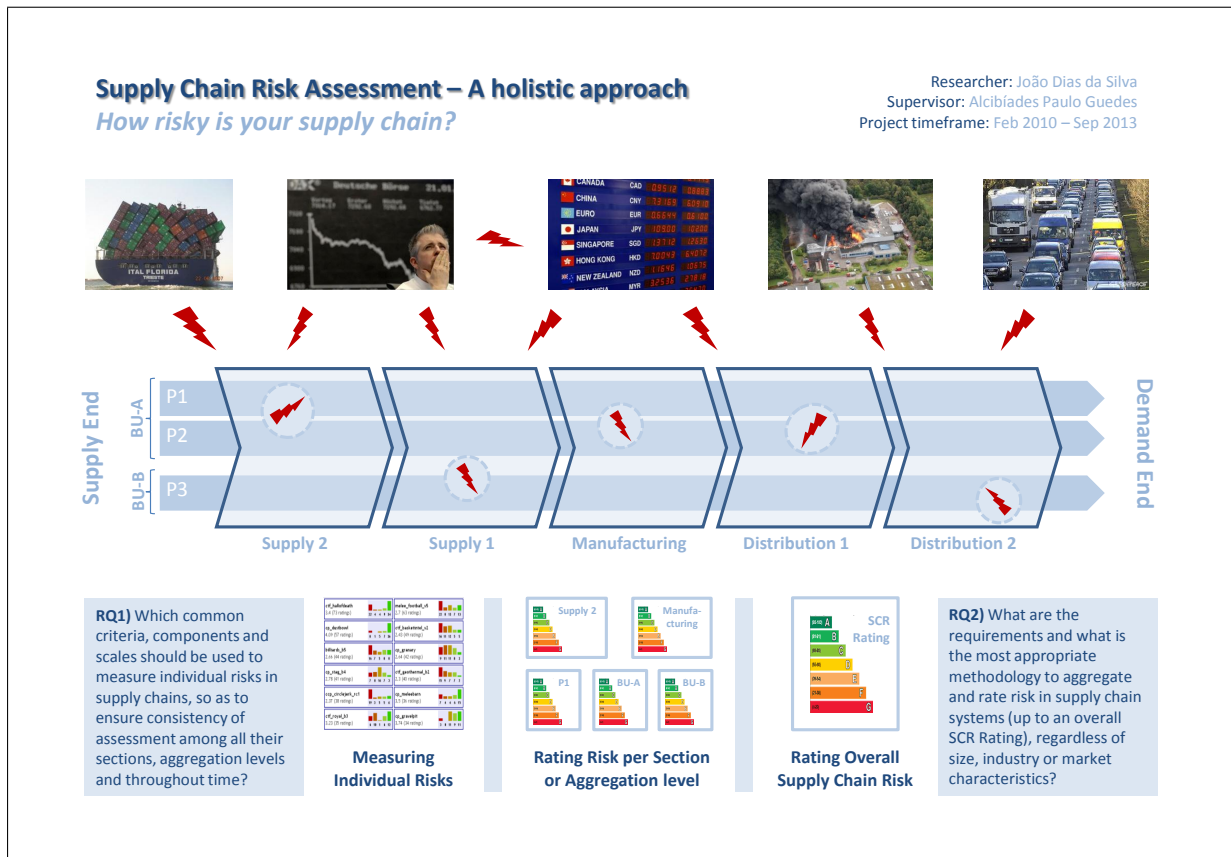
Luis Guimarães
Bernardo Almada Lobo
Diego Klabjan

IEMS' 12 – 3rd Industrial Engineering and Management Symposium

Supply Chain Risk Assessment: A Holistic Approach

João Dias da Silva*, Alcibiades Paulo Guedes*

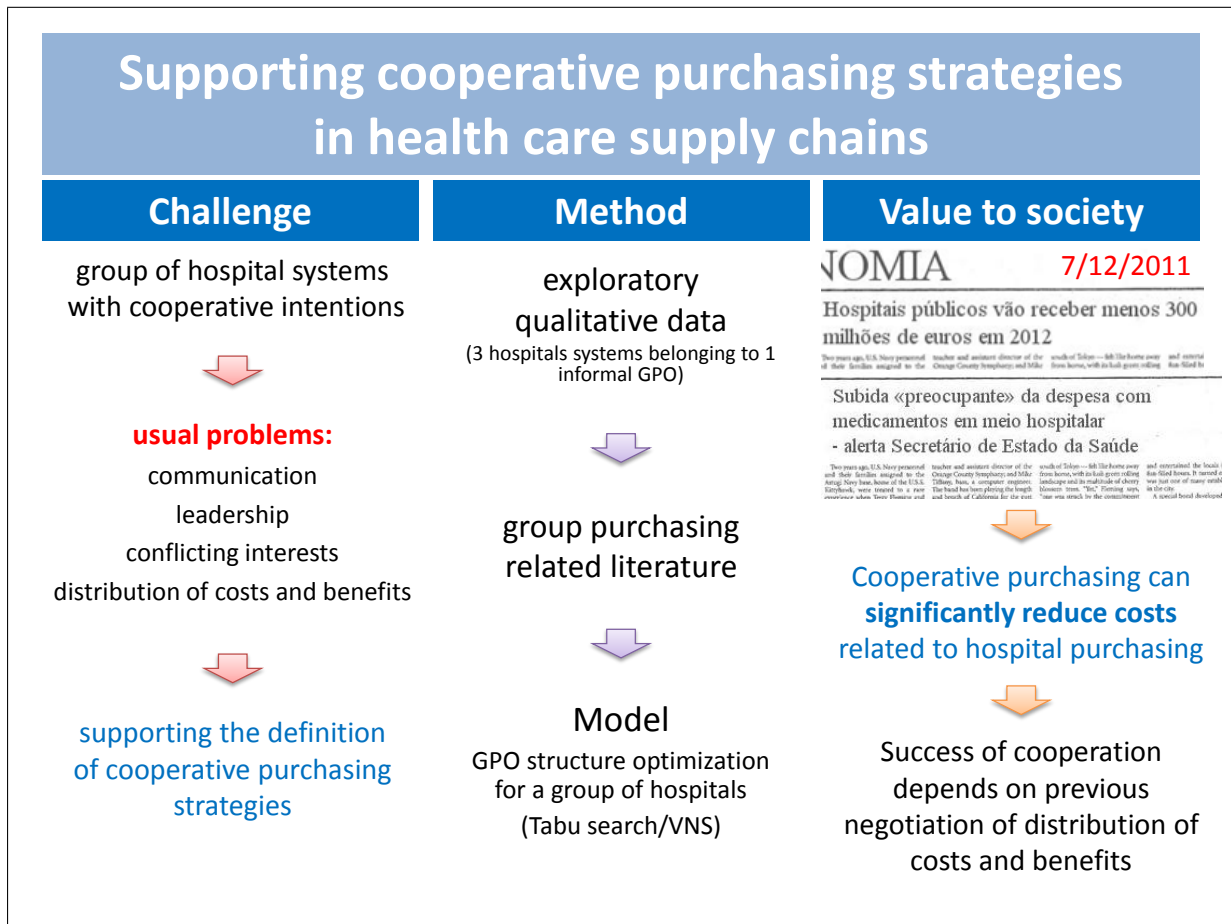
* Faculty of Engineering, University of Porto



Supporting Cooperative Purchasing Strategies in Health Care Supply Chains

Nazaré Rego[†], João Claro^{*}, Jorge Pinho de Sousa^{*}

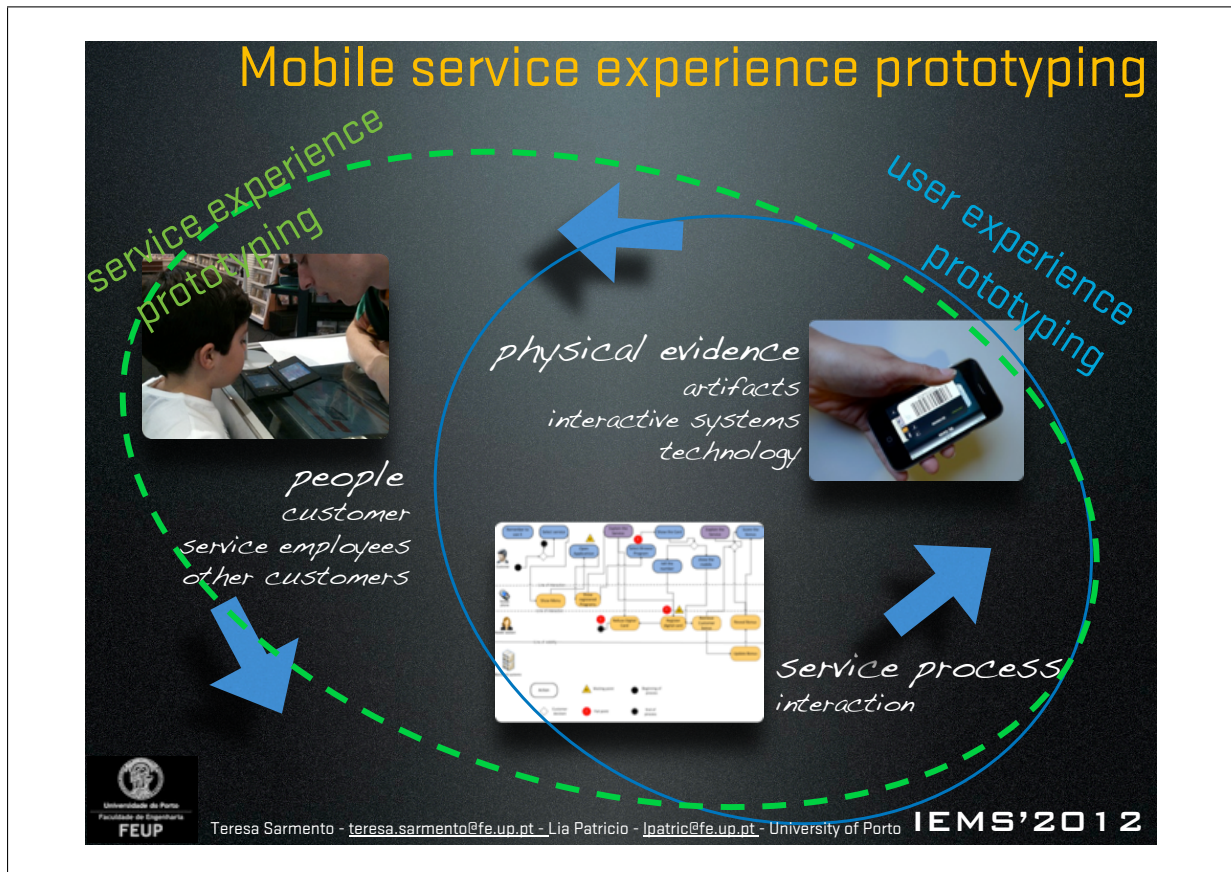
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Understanding Mobile Service Experience Factors: from Exploratory Research to a Quantitative Study

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Understanding Participation in Company Social Networks Online: Drivers of Membership and Factors of Satisfaction

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Understanding participation in company social networks online: drivers of membership and factors of satisfaction

2. METHODOLOGY

Approach : Qualitative study / Grounded Theory Method
Data collection : Focus Groups and Interviews
 > Motives to become part of a Company Social Network
 > Factors of satisfaction with Company Social Networks
Data analysis: content analysis using NVivo

3. VALUE FOR SOCIETY

1. THE CHALLENGE

>>Social Web
 >>>Social Network Sites
 >>>>>Company Social Networks (online)

Need for a better understanding on how companies can create value through Company Social Networks.

The question of participation...

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INFORMATION
ENJOYMENT
REWARDS
IDENTITY VALUE
COMPLIANCE
ALTRUISM

PARTICIPATION

CONTENT
SOCIAL IMAGE
ACTIVITY
COMMUNICATION
SOCIAL CONCERN
THEMATIC CONSISTENCY

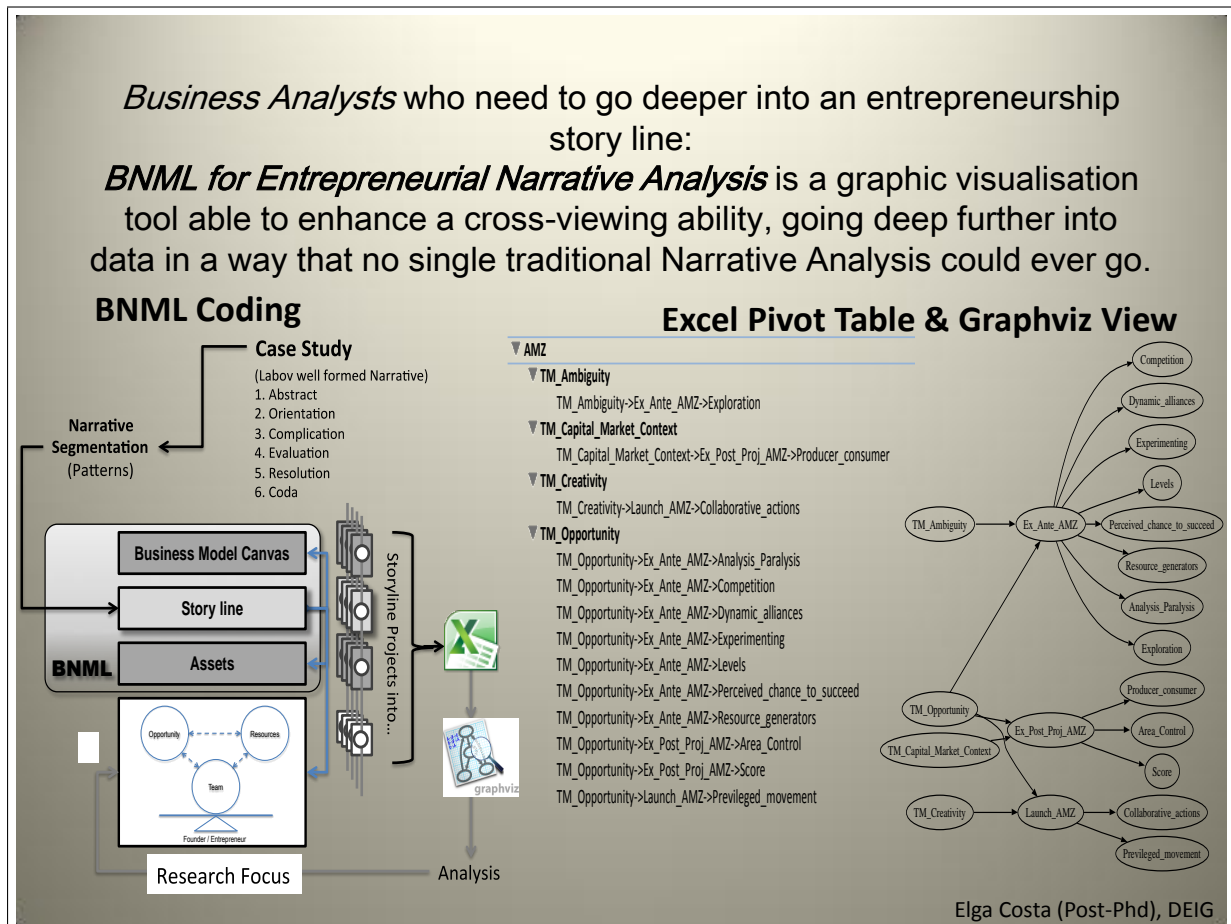
SATISFACTION

>> Implications for the design and management of company social networks online.
 >> Development of a conceptual framework to support the creation of a survey to access company social network quality.

Using Business Narrative Modelling Language (BNML) for Entrepreneurial Narrative Analysis

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