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CARLO CATTANEO – LIUC UNIVERSITY

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OLTRE LO STUDIO



Castellanza - Varese



XVI Summer School "Francesco Turco" Impianti Industriali Meccanici
Abano Terme (Padova, Italy) - 14-16 September 2011



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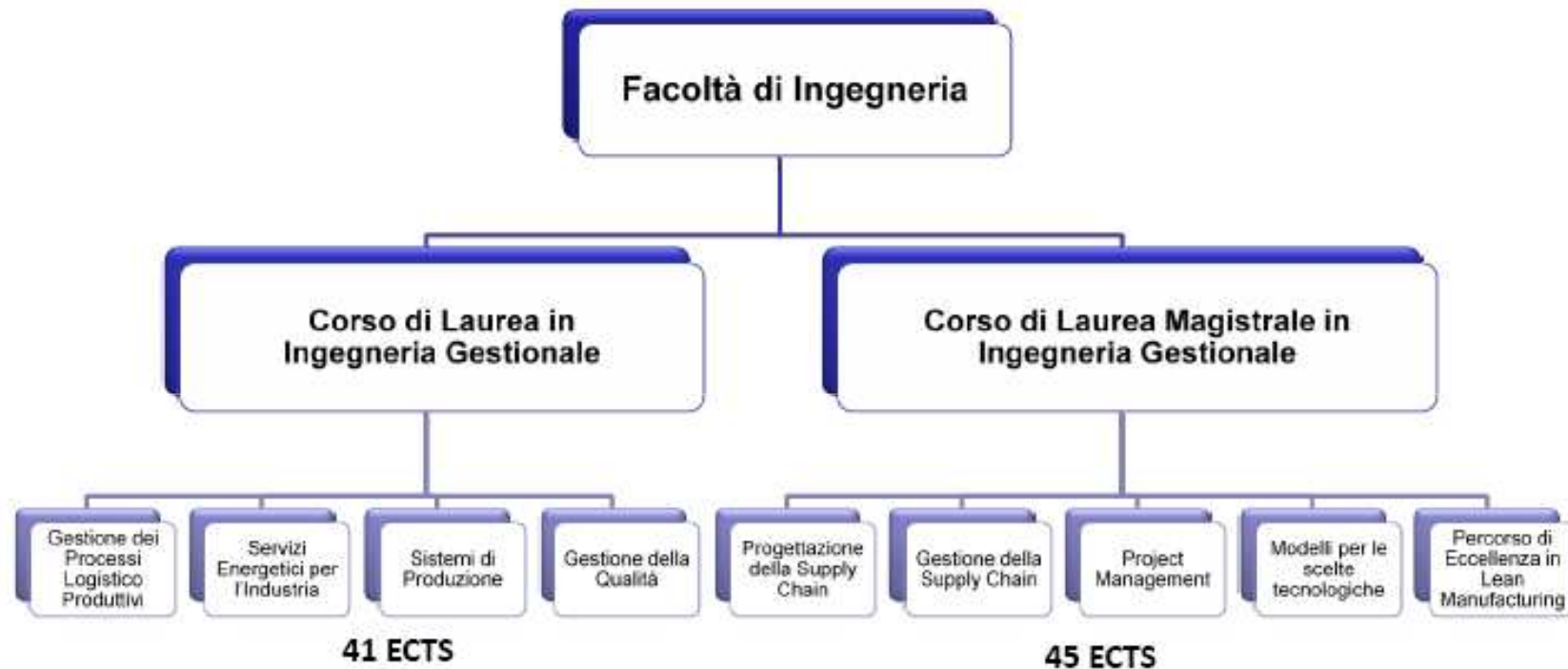
LEAN CLUB

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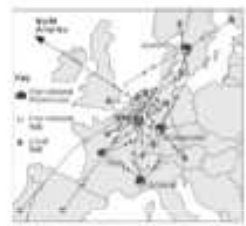


86 ECTS overall - 780 hrs lectures

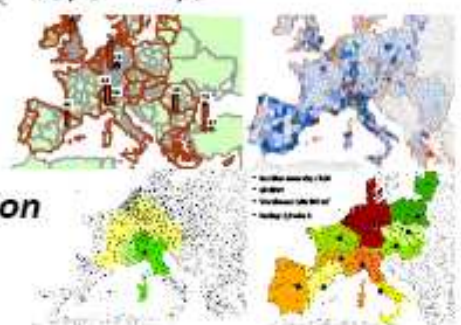


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Global Logistics Networks Design and Distribution Network Optimisation



MILP Models

$$\min \left(\sum_{h=1}^H \sum_{j=1}^J cs_{h,j} \cdot d_{h,j} \cdot k_{h,j} \cdot D_j + \sum_{h=1}^H \sum_{j=1}^J cw_h \cdot k_{h,j} \cdot D_j \right) + \sum_{h=1}^H \sum_{p=1}^P cp_{p,h} \cdot \sum_{j=1}^J p_{p,j} \cdot k_{h,j} \cdot D_j$$


Extensive adoption of GIS Tools

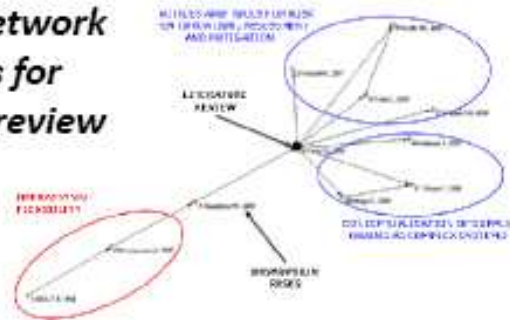
- Network capacity utilization
- Network cost
- Network reliability
- Network flexibility

Global Supply Chain Planning Centralisation Degree study

	L	M	H	L	M	H	all Planning Centralisation
H							Case B
H							Case C
L							Case D
H	Case A			Case E	Case F	Case G	Case I
L	Case D			Case H	Case J		Case J

	L	M	H	L	M	H
all countries	●	●	●	●	●	●
all countries in Europe	●	●	●	●	●	●
all countries in Asia	●	●	●	●	●	●
all countries in North America	●	●	●	●	●	●
all countries in South America	●	●	●	●	●	●
all countries in Africa	●	●	●	●	●	●
all countries in Oceania	●	●	●	●	●	●
all countries in Europe & Asia	●	●	●	●	●	●
all countries in Europe & North America	●	●	●	●	●	●
all countries in Europe & South America	●	●	●	●	●	●
all countries in Europe & Africa	●	●	●	●	●	●
all countries in Europe & Oceania	●	●	●	●	●	●
all countries in Asia & North America	●	●	●	●	●	●
all countries in Asia & South America	●	●	●	●	●	●
all countries in Asia & Africa	●	●	●	●	●	●
all countries in Asia & Oceania	●	●	●	●	●	●
all countries in North America & South America	●	●	●	●	●	●
all countries in North America & Africa	●	●	●	●	●	●
all countries in North America & Oceania	●	●	●	●	●	●
all countries in South America & Africa	●	●	●	●	●	●
all countries in South America & Oceania	●	●	●	●	●	●
all countries in Africa & Oceania	●	●	●	●	●	●

Citation network analysis for literature review

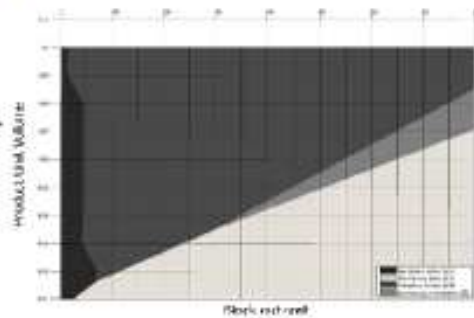
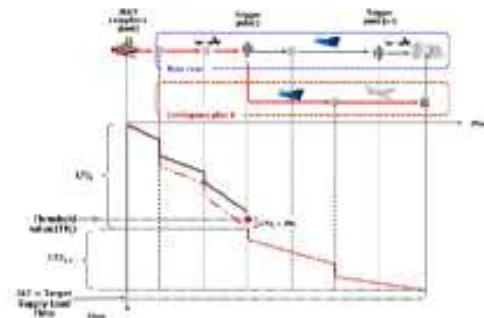


A simulation-based framework for managing global inbound supply risk

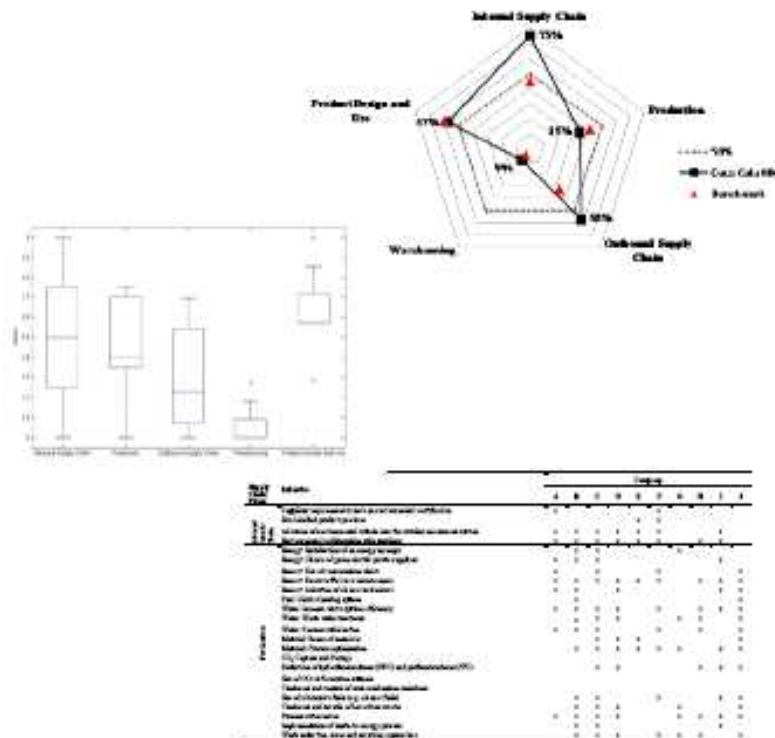


A time-dependent MILP Model for SC robustness

$$\max \left\{ \begin{aligned} & \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^K x_{ijk}(t) \cdot c_{ijk}(t) - \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^K x_{ijk}(t) \cdot c_{ijk}(t) - \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^K x_{ijk}(t) \cdot c_{ijk}(t) \\ & \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^K x_{ijk}(t) \cdot c_{ijk}(t) - \sum_{i=1}^I \sum_{j=1}^J \sum_{k=1}^K x_{ijk}(t) \cdot c_{ijk}(t) \end{aligned} \right\}$$

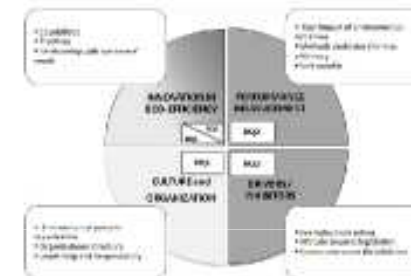


Benchmarking supply chain sustainability



The role of Logistics Service Providers in Eco-efficiency innovation

In collaboration with:
Cranfield
 UNIVERSITY
 School of Management



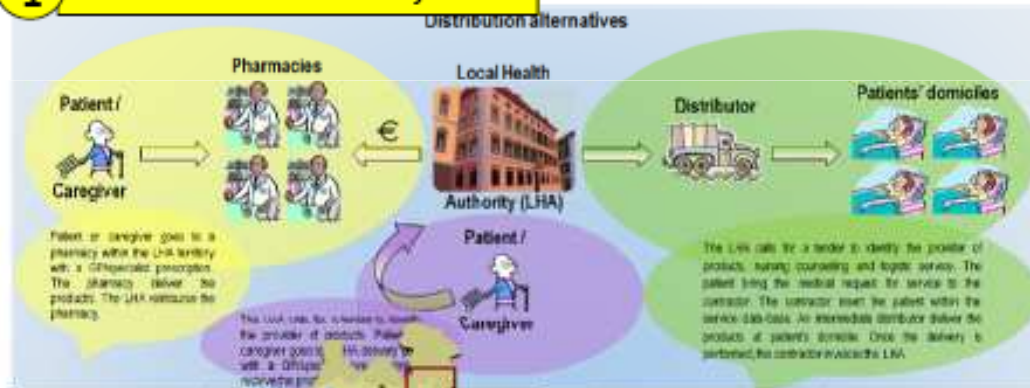
RESEARCH STRATEGY	MAIN TERM	SPECIFIC AFFECT	A	B	C	D	E	F
S01	Collaboration	Environmental policy	Proactive energy	Proactive energy	Proactive energy	High level of awareness	Low level of awareness	Low level of awareness
	Operational innovation	Operational innovation	Top-down	Top-down	Bottom-up	Top-down	Mid-management	Mid-management
	Statistical analysis	Statistical analysis	Statistical	Statistical	Statistical	Statistical	Statistical	Statistical
S02	Operational innovation	Operational innovation	Operational	Operational	Operational	Operational	Operational	Operational
	Statistical analysis	Statistical analysis	Statistical	Statistical	Statistical	Statistical	Statistical	Statistical
	Operational innovation	Operational innovation	Operational	Operational	Operational	Operational	Operational	Operational
S03	Operational innovation	Operational innovation	Operational	Operational	Operational	Operational	Operational	Operational
	Statistical analysis	Statistical analysis	Statistical	Statistical	Statistical	Statistical	Statistical	Statistical
	Operational innovation	Operational innovation	Operational	Operational	Operational	Operational	Operational	Operational



Distribution models for delivering pharmaceuticals and medical equipments at the local level in the Integrated Home Care Services

The shift of the healthcare focus from the hospital towards the local and domicile levels (Integrated Home Care Service) can be mentioned as one of the most relevant evolutionary trends in the world healthcare sector.

1 Distribution models identification



2 LHA cases



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3 Models Assessment

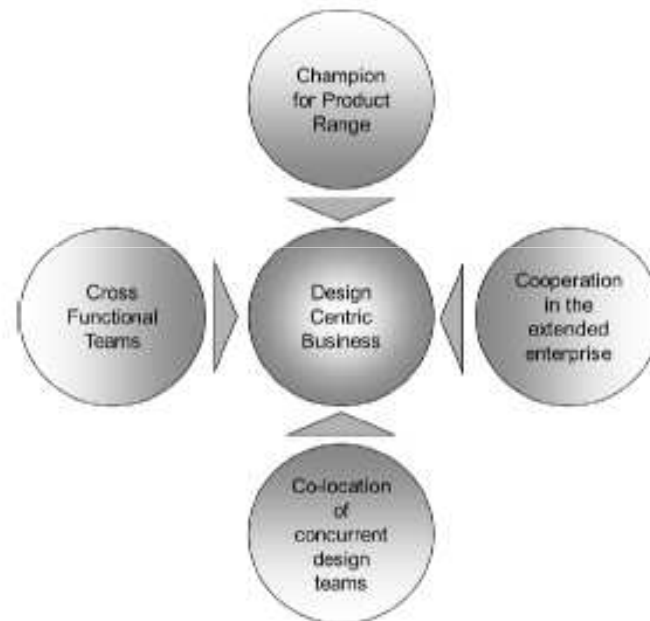
	DISTRIBUTION MODELS		
	pharmacies	LHA district distribution	Patient's domicile distribution
Efficiency	Product unit cost: High (presence of the pharmacy intermediation)	LOW (no intermediation)	LOW (no intermediation)
Delivery service cost	Medium (pharmacies' supplies)	LOW (via districts' supplies)	Optimised (deliveries planned in advance)
Average delivery batch size	Low (actual product's demand)	High (estimated demand between two deliveries)	High (estimated demand between two deliveries)
Inventory level in the network	High (inventory replicated in many network nodes)	Medium (Inventory held at LHA districts - few facilities on the territory)	LOW (centralized inventory at the logistic service provider warehouse)
Efficiency effectiveness	Capitarity and accessibility of the distribution network: High (diffuseness of the territorial pharmacies)	LOW (few facilities on the territory)	High (domicile level)
Product's portfolio choice for the patient	Medium (depending on the pharmacist)	LOW (no patient's choice)	LOW (no patient's choice)
Convenience for the patient	Low (possibility to reach the pharmacy)	Very low (possibility to reach the LHA district)	High (domicile level)
Patient training/consultancy at the time of delivery	High (highly skilled vendor)	Medium (possibility to involve LHA personnel)	LOW (no skilled personnel)

Towards the «Design Centric Business» by means of an improved alignment of Product Design and the Supply Chain for better resilience and responsiveness

In collaboration
with:

Cranfield
UNIVERSITY
School of Management



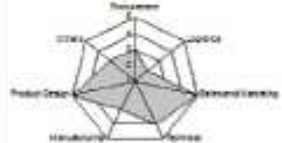
UNIVERSITY OF **Hull**



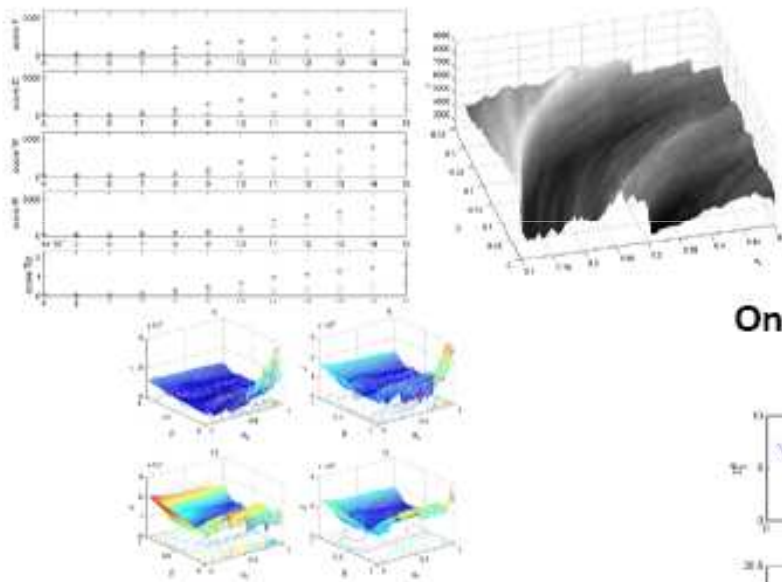
The «4C's» Model



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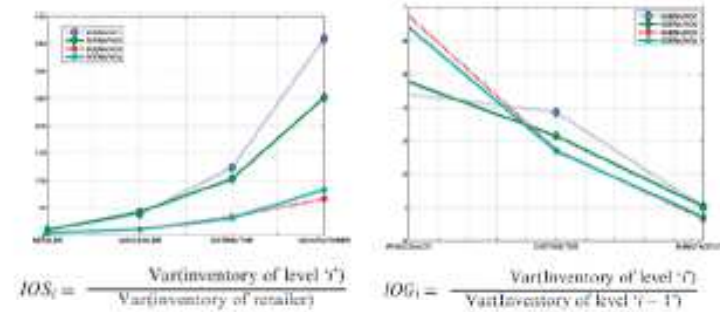
<p>Tilaco</p> <p>Product Design/Supply Chain Interface</p>	<p>Traditionally, product design decisions were made solely by team members and the supply chain was not involved in a concurrent process. Design was not fully aware of logistics and supply chain issues, e.g., design did not take into account transportation, the files are wrong or generated files, what was the design, etc. This has changed since product designers and the customer representatives have been joined together. There is now a greater recognition and understanding of the total sourcing costs that an organization has to bear. A structured process of review and dialogue has been placed between the design and product sourcing departments, with significant feedback from product managers across various suppliers.</p> <p>Suppliers are not integrated in the design process or in the R&D process; they are involved mainly to be consulted for their design in the sampling activity, at final and decisions, but not in the actual development of the product.</p>
	<p>Level of Integration between the Supply Chain Functions</p>  <p>We scored this indicator 5 out of 5 because there was a complete awareness degree of the relationship between functions.</p>
	<p>Adoption of Concurrent Design processes in Product Development</p>  <p>We scored this indicator 1 out of 5 because a sequential Product Design Process is employed.</p>
	<p>Consolidation of the Supply Chain Functions in the Product Design Process</p>  <p>In the Product Design process we have different interrelations among the various Supply Chain Functions:</p> <ul style="list-style-type: none"> • High involvement of Product Design and Sales and Marketing functions, responsible for defining the design of new products and their features. • Medium-high involvement of Technical functions, mostly concerning quality and technical requirements, also in feedback to Product Design. • Medium involvement of Procurement (selection of sources, of supply and other functions such as Costing, assessing profitability, etc.). • Medium-low involvement of Logistics, there is no particular evidence of its involvement in setting guidelines for consistency developing new product.

Beer Game inventory costs applying the same or different order policies

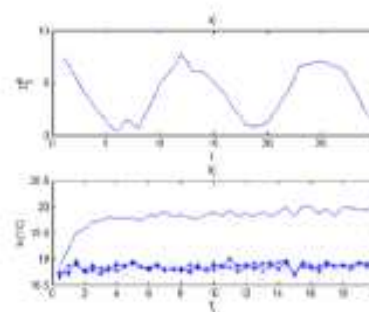


Optimization using GA

Bullwhip based on inventories



On-line order control using divergence operator



$$V_t = \det \begin{bmatrix} O_t - O_{t-\Delta t} & 0 & 0 \\ 0 & NS_t - NS_{t-\Delta t} & 0 \\ 0 & 0 & D_t - D_{t-\Delta t} \end{bmatrix}$$

$$O_t = D_t + \frac{1}{T_i} (k \cdot \sigma_{it} - NS_t)$$

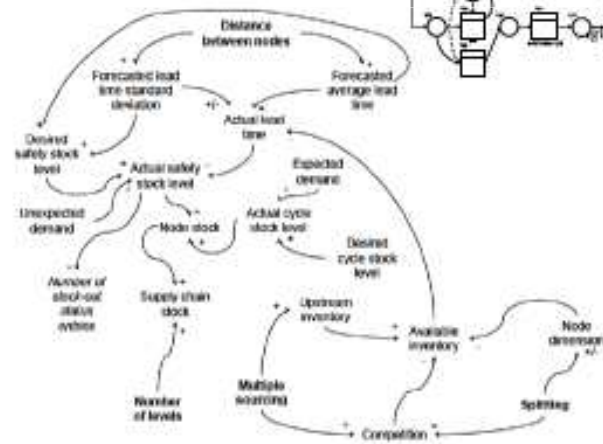
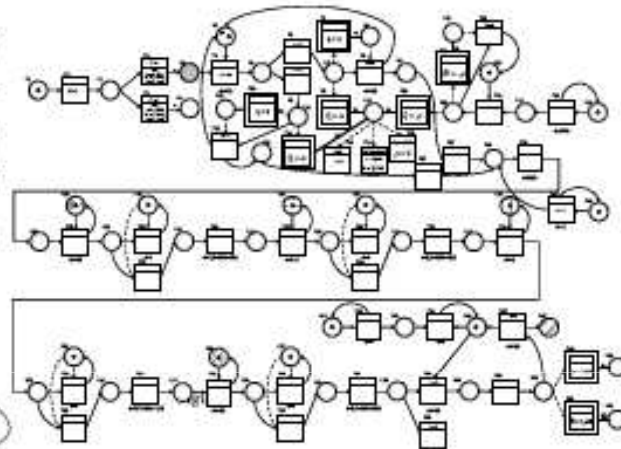
$$NS_t = NS_{t-1} + O_{t-1} - D_{t-1}^R$$

$$D_t = \rho(D_{t-1} - \mu) + \theta(D_{t-1}^E - D_{t-1}) + \varepsilon_t + \mu$$

$$T_i^{t+1} = T_i^t + K_p \cdot (0 - V_{t+1}) + K_d (0 - \Delta V_{t+1})$$

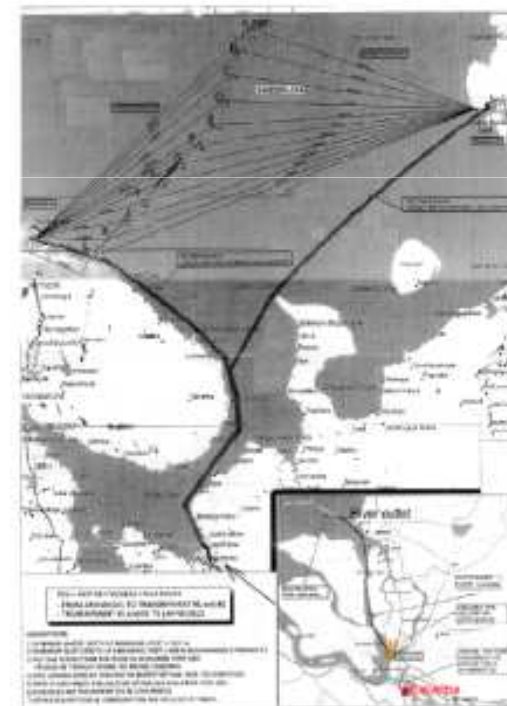


Simulation models and meta-models for representing production plants/ supply chains



Relationships between supply chain design and supply chain performance

Simulation models and meta-models for shaping project logistics systems



Authors	Title	Journal/Conference	Year-Vol-PP	Research Topic
Strozzi, Bosch, Zaldívar	Beer Game Order Policy Optimization under Changing Customer Demand	Decision Support Systems	2007, Vol. 42, pp. 2153-2183	1
Khan, Creazza	Managing the Product Design-Supply Chain Interface: Towards a Roadmap to the 'Design Centric Business'	International Journal of Physical Distribution and Logistics Management	2009, Vol. 39, pp. 301-319	6
Colicchia, Dallari, Melacini	Increasing supply chain resilience in a global sourcing context	Production Planning and Control	2010, Vol.21, pp. 680-694	6
Coppini, Rossignoli, Rossi, Strozzi	Bullwhip effect and inventory oscillations analysis using the beer game model	International Journal of Production Research	2010, Vol. 48, pp. 3943 – 3956	1
Creazza, Dallari, Melacini	Evaluating logistics network configurations for a global supply chain	Supply Chain Management: an International Journal	2010, Vol. 15, pp. 154-164	6
Pero, Rossi, Noè, Sianesi	An exploratory study of the relation between supply chain topological features and supply chain performance	International Journal of Production Economics	2010, Vol. 123, pp. 266-278	6
Cigolini, Pero, Rossi	An object-oriented simulation meta-model to analyse supply chain performance	International Journal of Production Research	2011, in press	6
Colicchia, Melacini, Perotti	Benchmarking supply chain sustainability: Insights from a field study	Benchmarking: an International Journal	2011, in press	6
Creazza, Dallari, Rossi	An integrated model for designing and optimising an international logistics network	International Journal of Production Research	2011, in press	6
Strozzi, Noè, Zaldívar	Stability control in a supply chain: total costs and bullwhip effect reduction	International Journal of Production Research	2011, in press	1

Research Topics – Ing/Ind-17

1	2	3	4	5	6	7
Production system analysis and design	Auxiliary plant analysis and design	Processes and production technologies	Ergonomics and safety of industrial systems	Production system management	Logistics	Production system automation

Design of the «Moving Warehouse» for perishable food products distribution

Since: june 2011

The logistics of the fresh food sector is strongly influenced by the characteristics of the goods and of the structure of their supply chain: this project aims at developing a logistics model using technologies and services for supply chain integration and exploiting the opportunities given by rail intermodality.



The Logistics Atlas

Since: september 2010

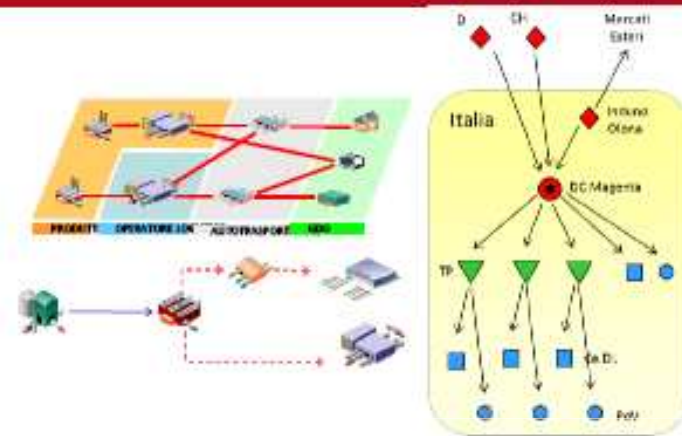
By means of an extensive survey we are analysing the warehouses and distribution centres run by third party logistics across the whole Italian territory also in order to understand the features of the logistics flows.



FMCG logistics flows analysis and mapping

Since: may 2010

In collaboration with ECR Italy, we are studying the specific features, the map and the overall scope of the Fast Moving Consumer Goods logistics flows in Italy from the factory warehouse down to the point of sale.



PRIN 2008: Logistics management of health technologies for the home care services

Since: january 2010

The objective of this research is to identify the features of the various distribution models available for the health technologies (with particular reference to medical equipments and pharmaceuticals) and to unfold their strengths and weaknesses



AUTOMA: Automobile Logistics Management

Since: may 2009

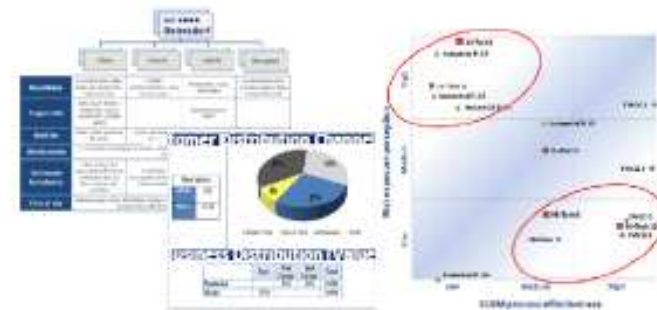
We developed an innovative application for the tracking activity in the *vehicle logistics* sector by means of the RfId technology. We specifically developed the full project for the compound operations in the automotive port terminal at Gioia Tauro port.



Supply Chain Risk Management in Italy

Since: april 2009

The project, developed in collaboration with Assologistica and Trueconomy, analyses the strategies adopted for managing the risk in the supply chain of different industries, highlighting the degree of maturity, the approaches and the practical actions implemented for mitigating supply chain risk.



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Characterisation of the Logistics flows in the Milan Logistics Region

Since: march 2009

C-log supported the CCIAA of Milan in developing a research project aimed at measuring the «value generated by the Milanese Logistics» by the companies operating on the territory as international logistics flows «orchestrators».



Manmade project: diagnosing vulnerability, emergent phenomena, and volatility in manmade networks

Since: january 2007

Granted by the European Community, it concerns the compound networks that comprise Europe's critical infrastructure, primarily on energy supply, emergency response systems and key infrastructures. Aim was to develop and apply mathematical methods to analyse large, man-made multi-element infrastructure systems.



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