Supporting the Industry towards Digital Excellence

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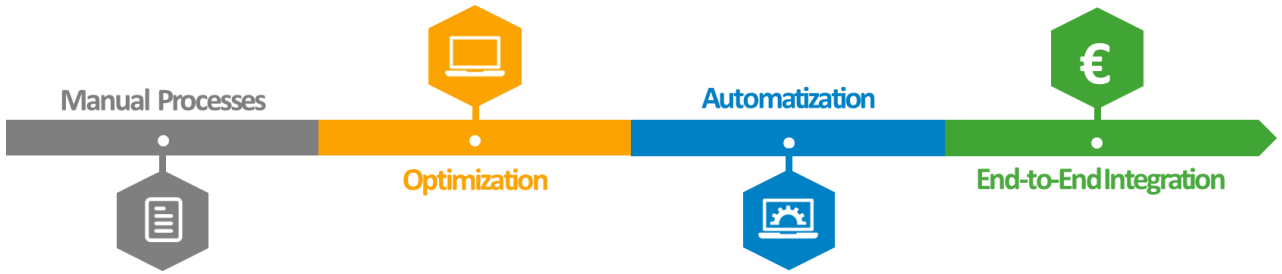
- **Digital Innovation for the Industry**
- What is Decision Science?
- Industrial applications
- Conclusions

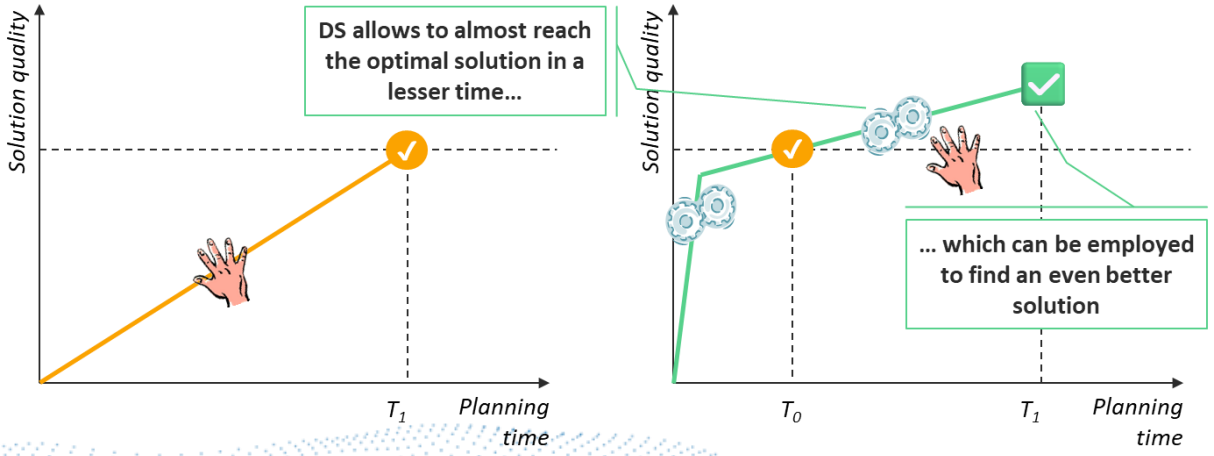
Decision Science as a Digital Innovation enabler

Designing and implementing a **Digital Innovation Roadmap** faces a lot of challenges:

- *… how to properly model the process?*
- *… how to integrate "Smart" Approaches with internal processes and legacy experience?*
- *… to what extent automatization/integration is feasible and/or impactful?*



From manual process … **… to a DS-driven process**



Applying **Decision Science methodologies** allows to:

- **Proven economic benefits**
- **Increased planning speed and accuracy**
- **Improved service quality**
- **Standardized Knowledge**

Optit at a glance

We apply **DECISION SCIENCE** to support our partners in solving complex problems in multiple sectors like **Energy**, **Logistics**, **Waste Management** and **Industry**.

OPTIT optimal solutions

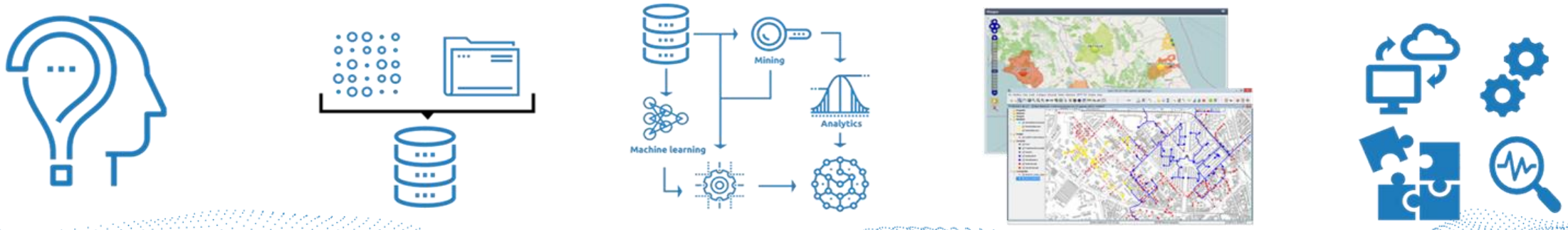
A Team of ≈ 50 of **Mathematical Modelers**, **Algorithm Engineers**, **Computer Scientists**, **Subject Matter Experts**, **Project Managers**

Bologna: HQ

Cesena: Software Factory

New York: US Office

BUSINESS ISSUE → DATA MANAGEMENT → MODELLING, ANALYTICS AND OPTIMIZATION → SOLUTIONS → CONSULTING & SERVICE MANAGEMENT



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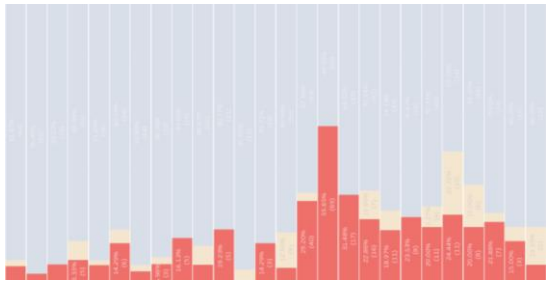
Analytics Landscape

DESCRIPTIVE

“What happened?”
“What is happening?”

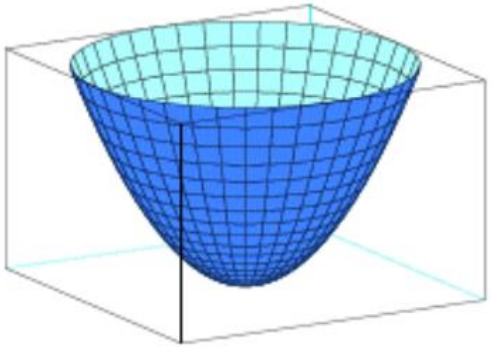


PREDICTIVE

“What will happen (if …)?”

PRESCRIPTIVE

“What should we make happen?”



Planning Levels

Consulting services ⟵ ⟶ *Software with IT systems integrations*

STRATEGIC	TACTICAL	OPERATIONAL	REAL-TIME
Facility location	Fleet sizing	Production / inventory planning	Process monitoring
Network design	Demand forecast, seasonality and trend analysis	Task assignment	Disruption management
Infrastructure maintenance planning	Clustering and districting	Routing and scheduling	Dynamic re-optimization
	Budgeting	Bin packing	
		Energy market trading	

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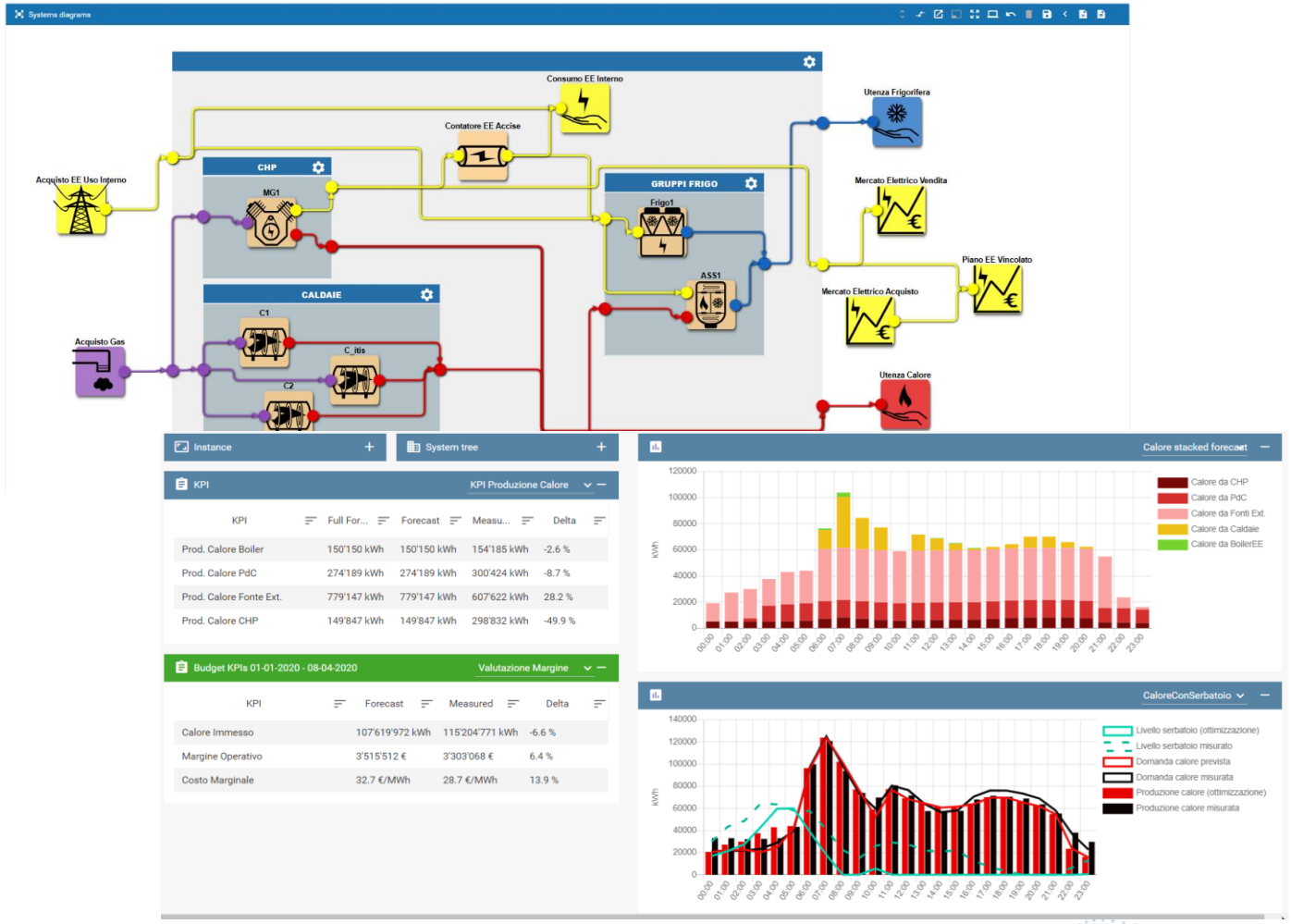
Applications

Energy production

- Optimize the **energy dispatching plan, maximizing the economic function** while providing an actionable solution

- Schedule the **unit commitment** of the energy generation assets, given **operative and topological** constraints, an **economic and regulatory** framework and a **variable time window** (from 1 day to 1 year)

- **Web-based enterprise solution** embedding a Mixed Integer Linear Programming (**MILP**) model solved directly with an exact algorithm by means of a solver

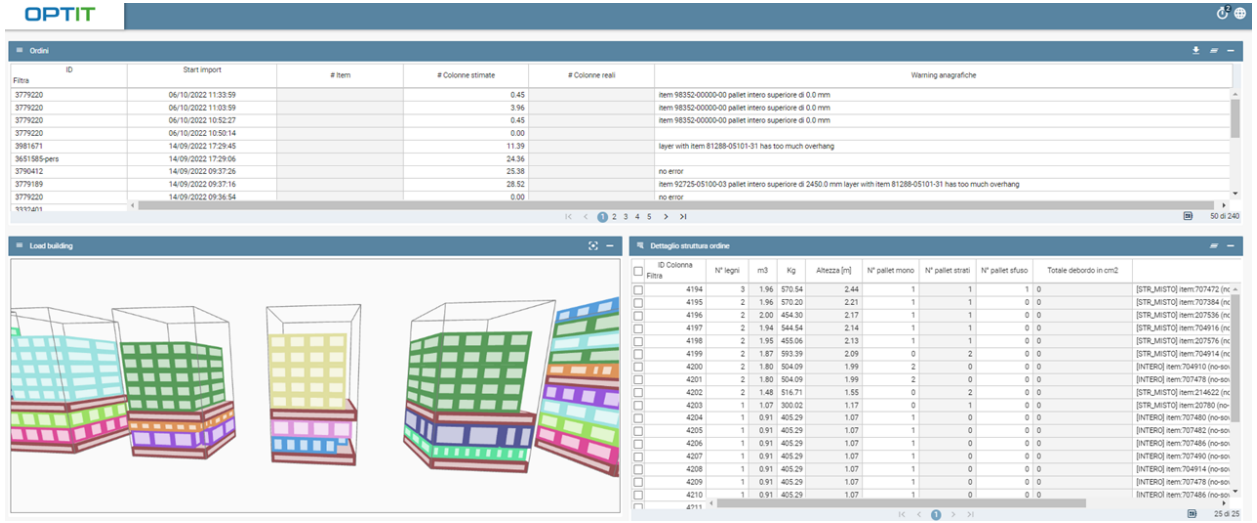


Applications

Energy production

Bin packing

- Given a set of items and a set of containers (bins), **arrange all the items inside the minimum number of bins** (packing problems in transportation logistics)
- **Library of optimization algorithms** and a **web-based visualization tool** to navigate the solutions
- Detailed model of **costs and tariffs**, as well as **operational constraints** (ensuring safety and stability of the cargo)



Applications

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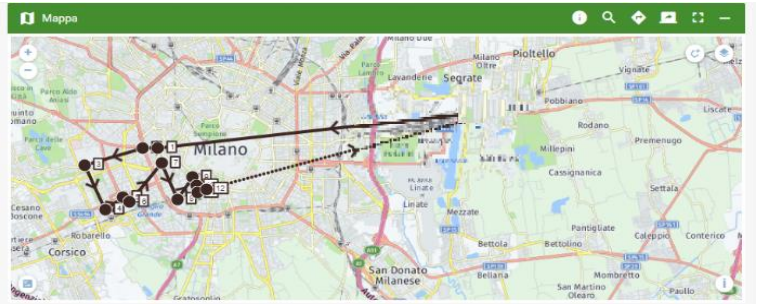
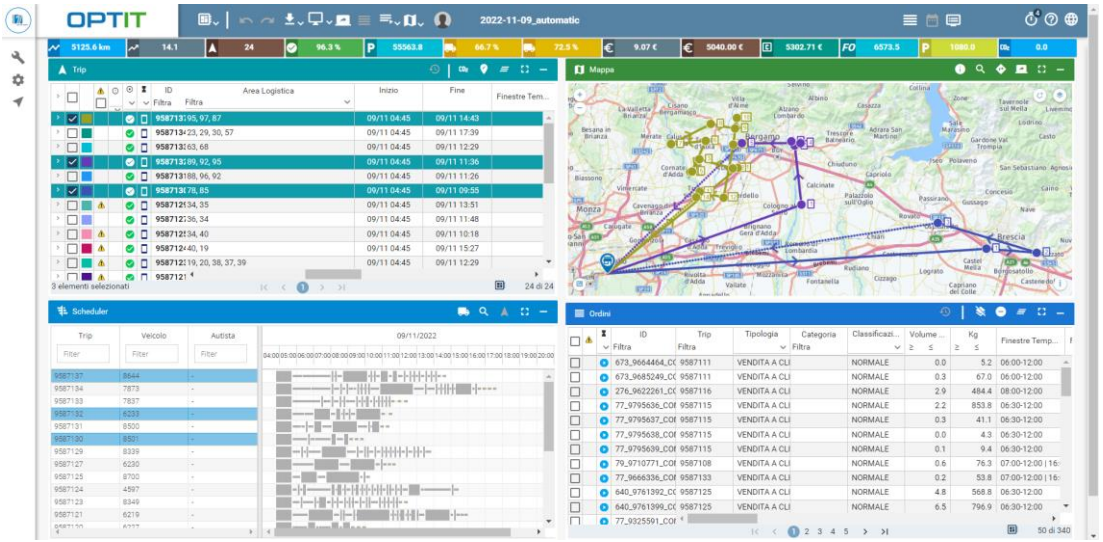
Bin packing



Distribution planning

- **«Rich Vehicle Routing Problems»**: multiple depots and pickup/delivery time windows, capacity constraints on volumes and weights, compatibility constraints…
- A **flexible and scalable approach** is needed: general **metaheuristic framework** that embeds problem-specific algorithms and operators
- The end users can **interact with the solution** proposed by the algorithm (**manual editing**)



Applications

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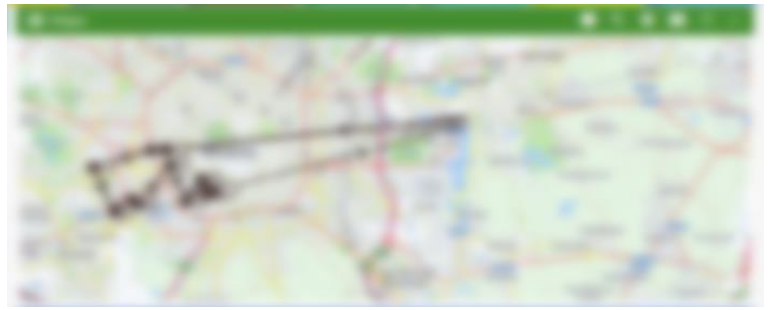
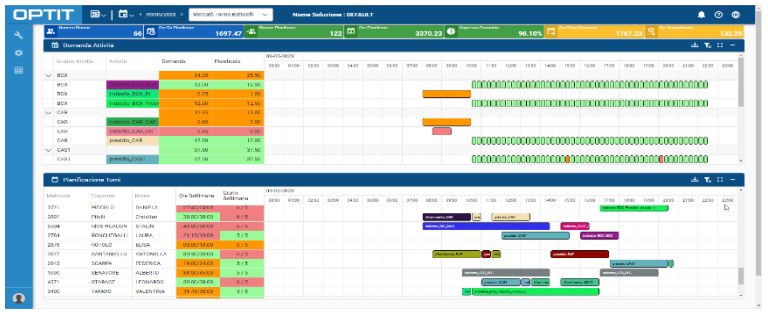


Distribution planning



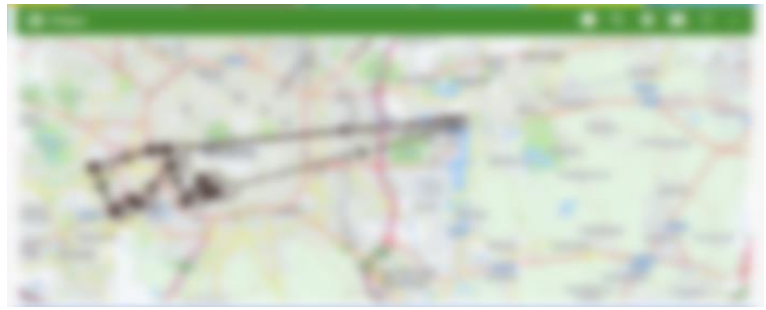
Workforce scheduling

- **Assign tasks** to a staff, within different timeslots
- **Satisfy the required demand**, defined as number of hours devoted to a particular task within a time period
- **Hard constraints**: max number of working hours, days off, compatibility person-task…
- Several **soft constraints**, so need to tune penalties!

Applications

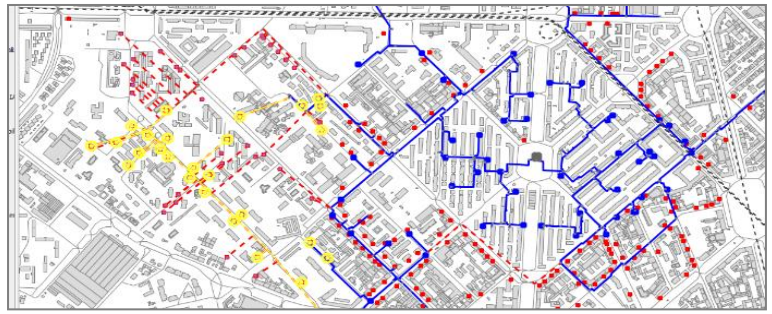
Energy production

Bin packing



Distribution planning

Workforce scheduling



Thermal network development

- Optimize the **strategic development of thermal networks**, maximizing the NPV, while **satisfying physical, economic and urban requirements**
- Ensure feasibility of the proposed design (**pipe sizing and layout**)
- Provide **optimal commercial expansion of existing or brand-new systems**

Applications

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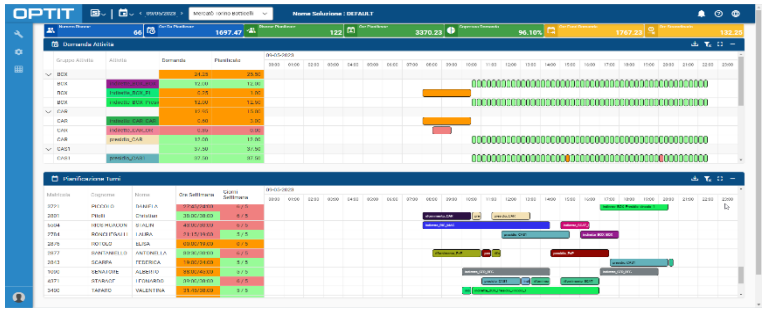
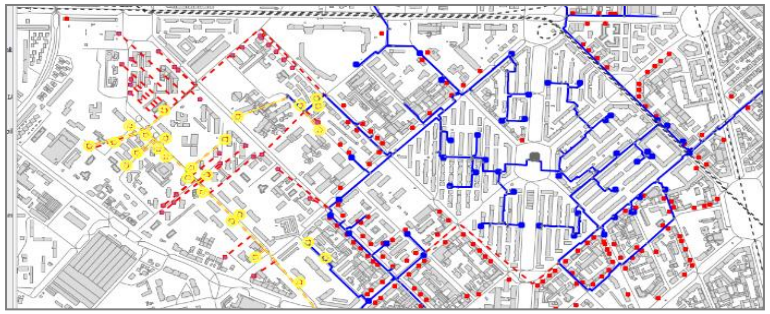


Workforce scheduling



Thermal network development

...

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Key mantras

- …keep calm and relax… that constraint
- …think twice, code once
- …one small step for you, a giant leap for your customer
- …one objective, many skills
- …never stop learning

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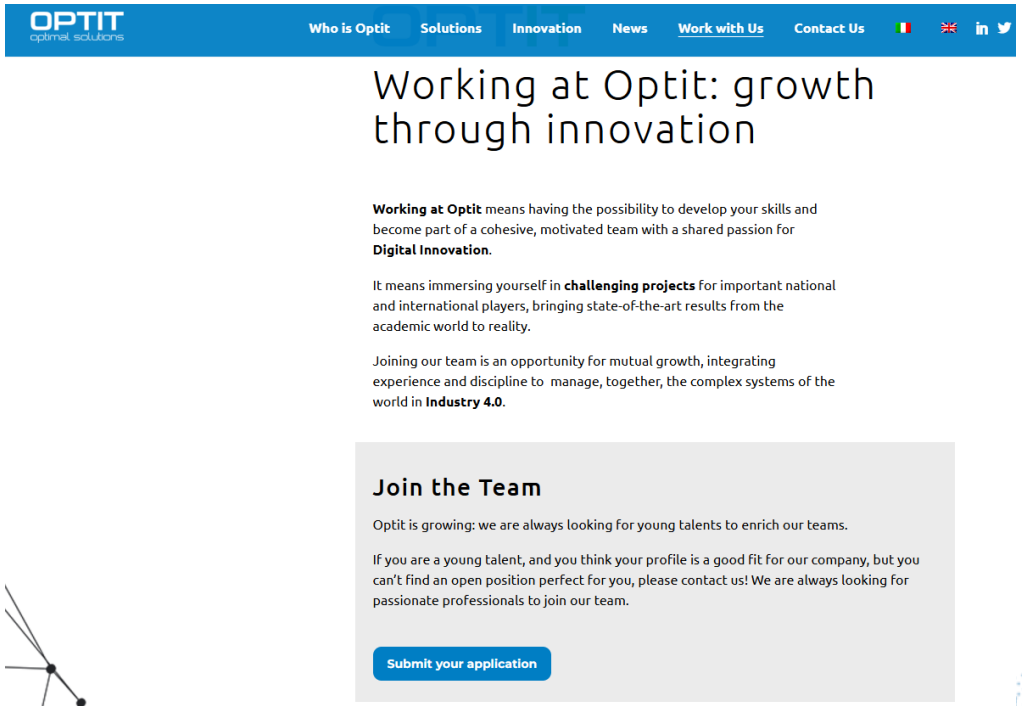

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