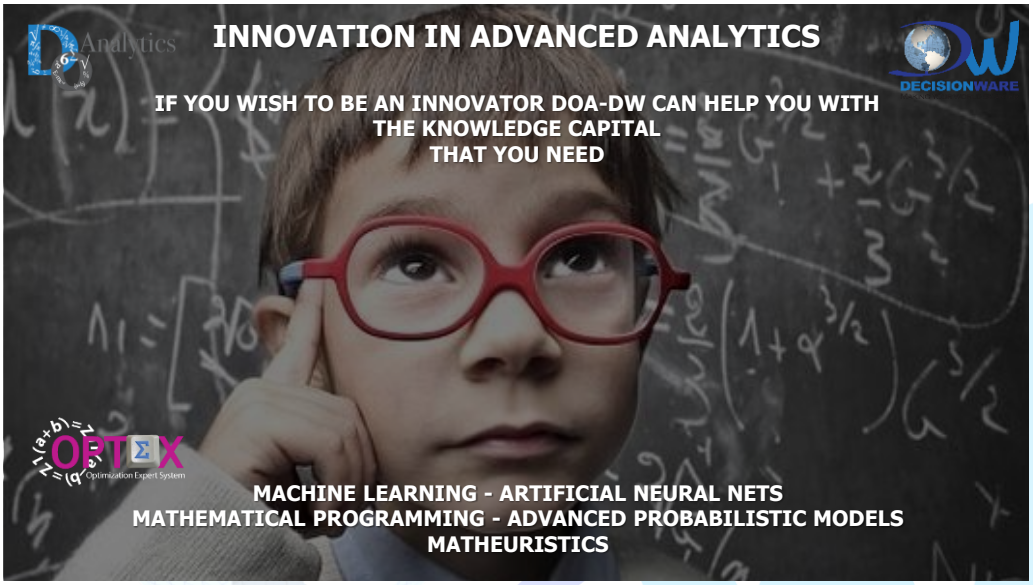
P-CHAIN

OPTIMIZING THE VALUE CHAIN



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DECISIONWARE

MAKING YOUR WORLD SMARTER

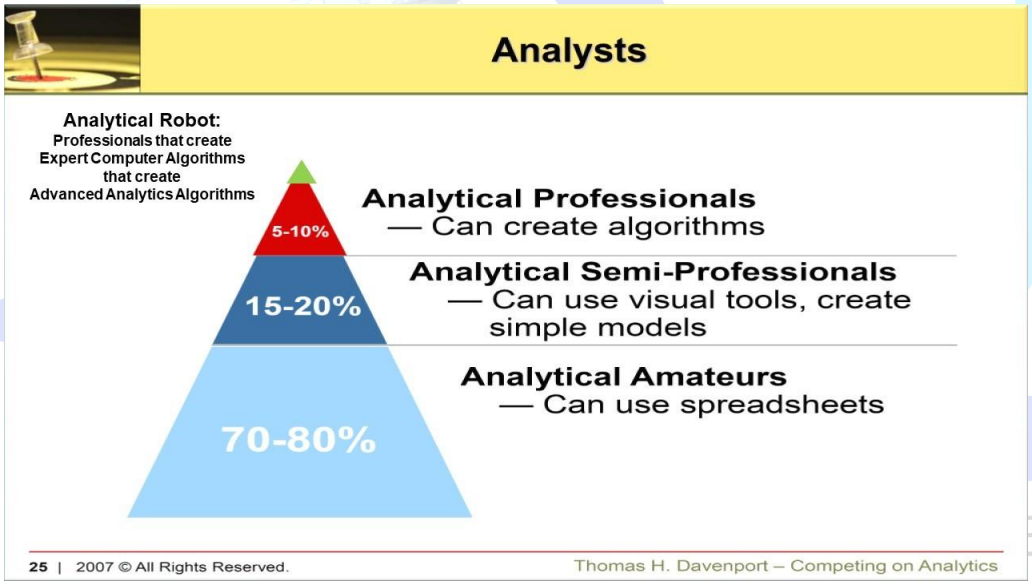
INNOVATION IN ADVANCED ANALYTICS

1. ABOUT DECISIONWARE (DW)

DecisionWare (DW) is company based on information technology, pioneer in Latin America, aimed at specialized consulting and design, implementation and start-up of Decision Support Systems (DSS), that integrate state of the art technologies of Advanced Analytics & Optimization, like: Mathematical Programming, Advanced Probabilistic Modeling, Matheuristics, Machine Learning and Artificial Neural Nets. The knowledge capital that has developed **DW** are:

1. **OPTEX Optimization Expert System** a robot (an informatics tool) that capitalize the experience in mathematical modeling and that generate Decision Support Systems in many technological platforms like IBM ILOG, GAMS, AMPL, MOSEL, AIMMS, C. More information in https://www.linkedin.com/pulse/optex-optimization-expert-system-new-approah-make-models-velasquez/

   OPTEX is a state-of-the-art advanced smart algorithm that generates source codes for advanced analytics algorithms, using a normalized methodology to make mathematical models.



2. **Large-Scale Optimization Methodologies**, it is concentrated in to develop variations and enhancements of Benders Theory, it included the creation of **G-SDDP Generalized Stochastic Dual Dynamic Programming** oriented to solve large scale dynamics models. More information in: https://goo.gl/Cfrca9 , https://goo.gl/YryNG3 and
   J. F. Benders Theory & Applications: Past, Present & Future
   https://www.linkedin.com/pulse/j-f-benders-theory-applications-past-present-future-jesus-velasquez/

3. **OPCHAIN (OPtimizing the Value CHAIN)** a collection of specialized solutions, based in mathematical models, for optimize the value chain in: general agroindustry supply chains, transport systems, energy systems (oil, gas, electricity), retail systems, logistics bank systems, financial and risk management, marketing optimization, mines and regional planning. More information in the Catalogue of **OPCHAIN**: https://goo.gl/3EP9j9, it contains "all" models that **DW** has done or design.

   OPCHAIN Mathematical Models that have been developed as result of more than forty years of mathematical modeling. The computer algorithms can be delivered in multiple optimization technologies: **GAMS, IBM OPL, MOSEL, AMPL, AIMMS, PYTHON, R, C** and others. These models can used to create/potentialize specialized optimization companies and/or Advanced Analytics Departments of large industrial/services companies.

2. DOING BUSINESS WITH DW-DOA

2.1. CLIENTS

Customers can access the **DW-DOA** optimization technologies mathematical models in the following forms:

1. **On premise,** in this case the software is installed and runs on the servers indicated by the customer. The software can be sold or leased to the customer.

2. **On demand,** in this case the customer has access to software on a server of **DW** in the cloud (cloud). The software may also be rented by periods (years, months, semesters, weeks). The databases of the customer may be in a customer server.

3. **As a service,** through a professional services contract in which **DW** or **DOA** assumes the responsibility to carry out the agreed work.

4. **Software Factory,** the customer delivers to **DW-DOA** the formulation of the mathematical model and test data and **DW** delivers to the customer a decision-making support system composed of: i) source of the mathematical model in the selected optimization technology (**GAMS, IBM CPLEX, MOSSEL, AMPL, AIMMS**,...), ii) data model of information system and iii) test run to probe the correct functioning of the model.

5. **Joint Ventures,** special projects designed to develop the **Analytical Power** of an organization through a holistic technology transfer process based on the real-life experience of **DW**

2.2. BUSINESS OPPORTUNITIES

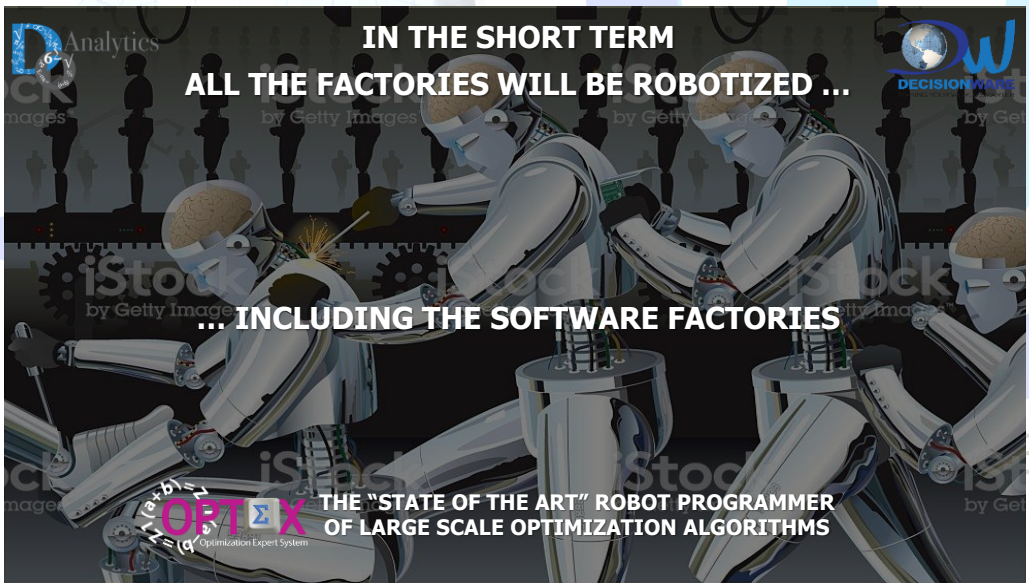
There are many alternatives to create value from the know-how of **DW-DOA**, include the following possibilities:

1. **Producers of Optimization Algorithms: OPTEX** can act as the **IDE** (Integrated Development Environment) for its algorithms in general computer language, like C, PYTHON, R

2. **Producers of High-Level Optimization Technologies:** Can incorporated **OPTEX** characteristics (know how) in its products

3. **Consulting Companies and Producers of Applied Advanced Analytics**: **OPTEX** is agnostic with respect to optimization technologies, this property guarantees the separation of models of computer programs, which ensures: i) the portability of mathematical models and ii) the maintenance and modernization of them in the long-term

4. **Angel Investors: DW-DOA** has create and Expert Computer Algorithm (**OPTEX**) that creates Advanced Analytics Algorithms; this type of artificial intelligence is part of the future: the robotization



5. **Young Entrepreneurs in Advanced Analytics.** To be an innovator in advanced analytics **OPTEX-OPCHAIN** can help the entrepreneurs with the knowledge capital that is required. This decision can accelerate the growth of the start-up company.

6. **Optimization as a Service (OAAS)**: **DW-DOA** can provide the knowledge and the technologies needed to provide services in the cloud. An example is the project **Small & Medium Enterprises - Supply Chain Optimization on the Cloud** oriented to optimizes the **SME** supply chains.

https://www.linkedin.com/pulse/advanced-analytics-decision-support-system-used-demand-velasquez/

3. TECHNICAL DOCUMENTS

Below, a list of technical articles, specialized in the solutions implemented in the **OPCHAIN** Decision Support Systems (**DSS**), is presented. Several of the document are in Spanish; but, at request, a version of the document in English can be sent, as soon it becomes available. To do this send an email to jesus.velasquez@decisionware.net

3.1. ADVANCED ANALYTICS & OPTIMIZATION

General documents in Advanced Analytics & Optimization:

- **The Computer-Based Mathematical Modeling is the Greatest Invention of All Times**
  https://www.linkedin.com/pulse/computer-based-mathematical-modeling-greatest-all-times-velasquez/
- **The Decision-Making Chain**
  https://www.linkedin.com/pulse/decision-making-chain-jesus-velasquez/
- **Multi-Business Supply Chain Optimization Holistic Modeling. A Real-Life Case: The Oil Industry**
  https://www.linkedin.com/pulse/multi-business-supply-chain-optimization-holistic-case-velasquez/
- **J. F. Benders Theory & Applications: Past, Present & Future**
  https://www.linkedin.com/pulse/j-f-benders-theory-applications-past-present-future-jesus-velasquez/
- **Heavy Industry Energy Efficiency**
  https://www.linkedin.com/pulse/heavy-industry-energy-efficiency-optimization-smart-grids-velasquez/
- **Dynamic Machine Learning using a Multi-State Kalman Filter (MS-KF)**
  https://www.linkedin.com/pulse/dynamic-machine-learning-using-multi-state-kalman-filter-velasquez/

3.2. OPCHAIN - DECISION SUPPORT SYSTEM OPCHAIN

3.2.1. OPCHAIN-TSO: Optimization of Complex Transport Systems

The **DSS OPCHAIN-TSO** is integrated by the following mathematical models of optimization:

- **OPCHAIN-TSO-PORT**: port operations, allocation of docks and cranes to ships
- **OPCHAIN-TSO-SEA**: routing of vessels and coordinate industrial activities
- **OPCHAIN-TSO-FISH**: fishing operations
- **OPCHAIN-TSO-RAIL**: time tabling (schedules) on railways
- **OPCHAIN-TSO-WASTE**: solid waste collection
- **OPCHAIN-TSO-CASH**: transport of cash and securities
- **OPCHAIN-TSO-URBANO**: urban collection/distribution processes routing
- **OPCHAIN-TSO-REGIONAL**: regional routing of collection/distribution processes
- **OPCHAIN-TSO-DGO**: distribution of petrol between terminals and service stations

Technical documents:

- **Transport Revenue Management. Case: Less-Than-Truckload (LTL) Transport Networks**

https://www.linkedin.com/pulse/transport-revenue-management-optimal-pricing-case-ltl-jesus-velasquez/

- **Regional Trucks Transport Systems Advanced Optimization**
  https://www.linkedin.com/pulse/regional-transport-systems-optimization-jesus-velasquez/
- **Optimization of Logistics Operations in Ports**
  https://www.linkedin.com/pulse/optimization-logistics-operations-ports-jesus-velasquez/
- **Logistics Operations: Optimization in Ports & Vessels Systems**
  https://www.linkedin.com/pulse/logistics-operations-optimization-ports-ships-systems-jesus-velasquez/

3.2.2. OPCHAIN-OIL: OIL Supply Chain Optimization

OPCHAIN-OIL is composed of the following optimization mathematical models:

- **OPCHAIN-OIL-E&P**: Portfolio optimization in oil exploration & production
- **OPCHAIN-OIL-PRO**: Oil production
- **OPCHAIN-OIL-MWH**: Supply of electricity (smart grids) in oil fields
- **OPCHAIN-OIL-BLEND**: Transport and blending of oil
- **OPCHAIN-OIL-REF**: Refining of petroleum (tactical and strategic planning)
- **OPCHAIN-OIL-REF-ISO**: Oil refining including industrial services
- **OPCHAIN-OIL-PIPES:** Transportation of products by pipelines
  - **OPCHAIN-OIL-PIPES-S&OP:** Sales & operations planning
  - **OPCHAIN-OIL-PIPES-SCH:** Scheduling of batches
  - **OPCHAIN-OIL-PIPES-RT:** Real-Time optimization of pipelines
- **OPCHAIN-OIL-TSO**: Multimodal transportation of oil products
  - **OPCHAIN-OIL-SEA:** Distribution/collection using maritime transport

Descriptive Document:

- **OIL Supply Chain Optimization**
  https://www.linkedin.com/pulse/oil-supply-chain-optimization-jesus-velasquez/

Technical documents:

- **Investments Portfolio Optimization in Oil Exploration & Production**
  https://www.linkedin.com/pulse/investments-portfolio-optimization-oil-exploration-jesus-velasquez/
- **Oil Fields Production Advanced Optimization**
  https://www.linkedin.com/pulse/oil-fields-production-advanced-optimization-jesus-velasquez/
- **Oil Refining Optimization**
  https://www.linkedin.com/pulse/oil-refining-optimization-jesus-velasquez/
- **Oil Transport Systems Optimization**
  https://www.linkedin.com/pulse/oil-transport-systems-optimization-jesus-velasquez/
- **Oil Pipelines Real-Time Optimization**
  https://www.linkedin.com/pulse/oil-pipelines-real-time-optimization-jesus-velasquez/
- **Logistics Operations: Optimization in Ports & Vessels Systems**
  https://www.linkedin.com/pulse/logistics-operations-optimization-ports-ships-systems-jesus-velasquez/

3.2.3. OPCHAIN-E&G: Electricity & Natural Gas - Advanced Supply Chain Optimization

The table presents a resume of the optimization model that integrates **OPCHAIN-ELE**

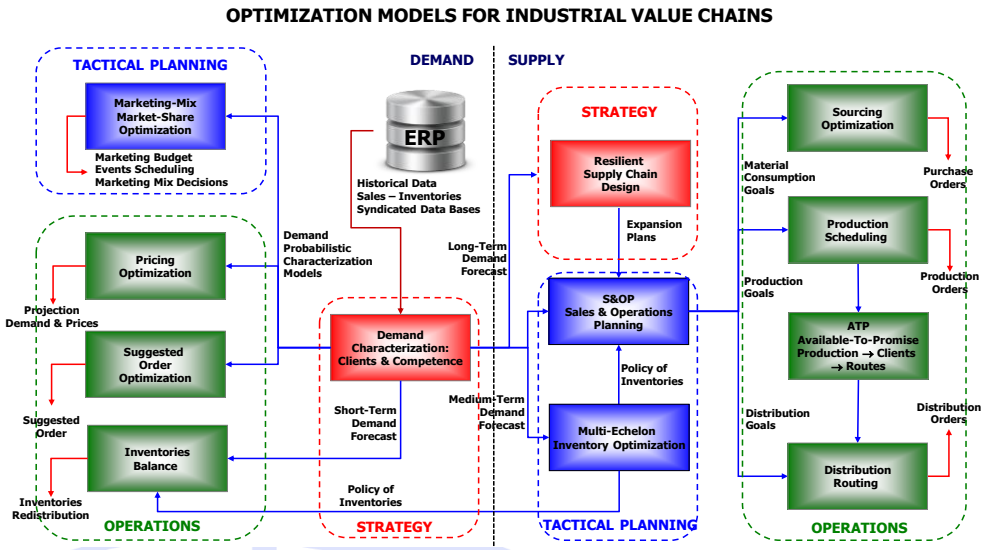
OPCHAIN-ELE MATHEMATICAL MODELS		
Model		**Description**
DISPATCH SIMULATION IN POWER PLANTS		
E&G		The central model **OPCHAIN-E&G** corresponds to the standard integrated representation (equations) of the electricity and gas supply chains; these equations gives rise to variations of the model according to the techno-economic concepts that support a specific modeling. The have at least three type of "similar" models to represent the electricity & gas market in the medium term.
	EDI	Economic Dispatch: Dispatch of plants minimizing the operation cost of the interconnected system, it simulates a perfect electricity market, may be include the gas system.
	ERD	Economic Regulated Dispatch: Dispatch of plants minimizing the operation cost plus the regulated cost of the interconnected system and includes representatives of regulatory aspects of the electricity market being simulated. It may use to simulate a regulated electricity market.
	NCD	Nash-Cournot Equilibrium Dispatch: Dispatch of plants oriented to the simulation of competitive electricity markets with agents that can influence, with their decisions, on transactions occurring in the market. Two type of agents are considered: price makers and prices takers.
	FIN	Integrated simulation of economic/regulated dispatch plus financial modeling (ALM). Oriented to use in valuation of electric assets and/or to analyze the financial health of the agents in a market.
OPTIMIZATION OF AGENTS DECISIONS		
STRATEGIC PLANIFICATION		
SCD		Supply Chain Design, associated with strategic planning (long-term) decisions related to design supply chain, in relation to capacity of reservoir, transfers, power plants and other elements of an electrical system.
TACTICAL PLANIFICATION		
ETRM		Energy Trade and Risk Management, optimal medium/long term decisions related to marketing energy and coverage of financial risks.
MAN		Oriented to optimize the decisions associated to preventive maintenance of multiple central generation plants. It can be applied to all plants in: i) a region, ii) a national grid, or iii) a set of plans that control an agent.
OPERATIVE PLANIFICATION		
UC		Unit Commitment associated with operational planning (short term) decisions related to dispatch plants hourly, or more detailed periods, respecting all non-linear and discrete constraints that are part of the dispatch.
STOCHASTIC PROCESSES MODELS		
HID-SIM		Synthetic generation of water intake based on a model of Fiering-Matalas type.
HID-KAL		Projected short-term hydrological contributions via a DUAL Kalman Filter
HID-ML		Projected short-term hydrological contributions via a Machine Learning Model
PSP		Projected electricity prices short-term competitive markets through **S-ARIMAX-GARCH** models

Technical Document:

- **Electricity & Natural Gas - Advanced Supply Chain Optimization**
  https://www.linkedin.com/pulse/electricity-natural-gas-advanced-supply-chain-jesus-velasquez/

3.2.4. OPCHAIN-SCO: SUPPLY CHAIN OPTIMIZATION

Models that are part of **OPCHAIN-SCO** is present on the right side of the next diagram.

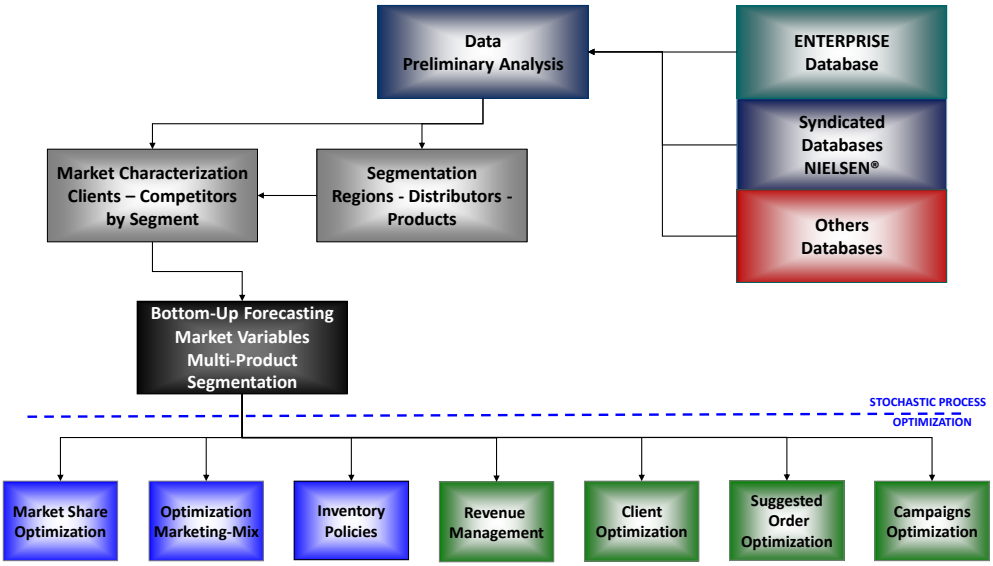


Technical Documents:

- **Advanced Supply Chain Optimization. Traditional & State-of-The-Art Models**
  https://www.linkedin.com/pulse/supply-chain-optimization-jesus-velasquez/
- **An Advanced Analytics Decision Support System to Be Used on Demand in the Cloud**
  https://www.linkedin.com/pulse/advanced-analytics-decision-support-system-used-demand-velasquez/

3.2.5. OPCHAIN-DCO: DEMAND CHAIN OPTIMIZATION

Models that are part of **OPCHAIN-SCO** is present on the down side of the next diagram.



Technical Documents:

- **Scientific Marketing: Advanced Demand Chain Optimization**
  https://www.linkedin.com/pulse/scientific-marketing-advanced-demand-chain-jesus-velasquez/
- **Market Modeling Via Syndicated Databases - A Real-Life Case of Scientific Marketing Using Nielsen Database**
  https://www.linkedin.com/pulse/market-modeling-via-syndicated-databases-case-jesus-velasquez/
- **Transport Revenue Management. Case: Less-Than-Truckload (LTL) Transport Networks using Machine Learning and Optimization**
  https://www.linkedin.com/pulse/transport-revenue-management-optimal-pricing-case-ltl-jesus-velasquez/
- **An Advanced Analytics Decision Support System to Be Used on Demand in the Cloud**
  https://www.linkedin.com/pulse/advanced-analytics-decision-support-system-used-demand-velasquez/

3.2.6. OPCHAIN-RPO: INTEGRATED REGIONAL

Technical Documents:
- **Integrated Regional Planning Cities & Regions: Smart, Analytical, & Sustainable**
  https://www.linkedin.com/pulse/integrated-regional-planning-cities-regions-smart-jesus-velasquez/

3.2.7. OPCHAIN-MINES: MINES OPTIMIZATION

Technical Documents:
- **Mathematical Programming Applied to Mining & Metallurgical Industries**
  https://www.linkedin.com/pulse/mathematical-programming-applied-mining-metallurgical-jesus-velasquez/
- **Advanced Optimization Applied to Cement Plants**
  https://www.linkedin.com/pulse/advanced-optimization-applied-cement-plants-jesus-velasquez/

3.2.8. OPCHAIN-EDO: Educational System Optimization

Technical Documents:
- **Advanced Analytics Applied to Academic Systems**
  To be published in the short term

3.2.9. OPCHAIN-BANK: Optimization Applied in Financial Enterprises

Technical Documents:
- **Optimization Applied in Financial Enterprises**
  To be published in the short term

3.2.10. OPCHAIN-HR: Human Resource Analytics

Technical Documents:
- **Human Resource Analytics**
  To be published in the short term