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## **RESEARCH PROJECTS**

### **"Urban safety and local government: local authority's orders and new kinds of emergency"**

**Annex code 1**

#### **Department of Law**

Tutor: **Prof. Massimo Andreis**

#### **A.D. IUS/10 – Administrative Law A.R.F.: 12/D1 – Administrative Law**

In the first semester, the researcher will be focused on describing the powers that local authority can use to preserve urban safety. Indeed, the legislator has given them a role already with laws of administrative unification of Italian Kingdom.

In the last few years, however, the legislator intervened in that field always more often, in a fragmentary way with emergency decrees. Constitutional Court engraved heavily on legal system with some considerable decisions.

Legislator used widely forms and models of procedure sometimes experimented in other branches of law (i.e. criminal law) and typical of emergency. Between these, we find the administrative measures called "ordinanza di necessità e urgenza" and prevention or security measures, all with the aim of facing miscellaneous situations. From last, we can mention d.l. n. 92/2008 and d.l. n. 14/2017. These legislative decrees, with unusual instruments, have modified the local authorities' law (d.lgs. n. 267/2000) and redraw some sets of rules, requiring a wide and systematic reflection on dating principles.

Jurists have long reflected on redefining the concept of "emergency" both in public and administrative law, but in the last years also the Courts delivered many rulings on this subject, affirming a set of principles that can change the features of local authority's orders, particularly of the so-called "potere di ordinanza".

For these reasons, the second semester of the research will be dedicated to the analysis of the case law. The aim is to verify whether, and possibly in which way, could work a system based, at the same time, on decisions taken by a monocratic authority and on regulations, that are necessarily adopted by a collegial authority; a system in which these two different types of powers and two antithetical decision-making modes become interchangeable.

In the third semester, the researcher will examine the French jurisprudence and the French judicial system, especially the so-called "arrêtés du maire", that is the mayor who represents the State government in general security matters (art. L2122-27 and the following CGCT I. 21.02.1996, n. 96-142).

In France, the mayor himself has already the power to adopt the administrative police regulation, through a monocratic decision ("l'arrêté") (art. L2122-28, L2212-1 and the following CGCT I. 21.02.1996, n. 96-142).

In regard to this, it can be taken as an example the case in which the Conseil d'Etat judged about the ban on wearing swimwear considered in contrast with the secularism of the French Republic, established by the administrative police regulation (Conseil d'Etat, ord. 26.08.2016, n. 402742 and 402777).

In the final part of the research, the study will focus on the legislative and jurisprudential development in the meantime registered; specifically, on how Judges will interpret the new set of law principles.

The powers studied in this research are characterized by a discretionary nature; for a long time jurists have pointed out that there is a complicated relationship between them and the legality and typicality principles. The forms of procedure and the guarantees of participation in the proceeding at the basis of the exercise of the two powers are very different; they are also different from the general discipline but, according to jurisprudence, capable of a relationship of constant dialogue and heterogeneity with the ordinary paradigm.

What is expected from this research is a systematic description of local authority's orders facing urban safety, in order to give to these powers and orders a unitary placement in the local authorities' law.

Some of these powers have been attributed to local communities since a long time: indeed, the legislation, in its essentials, existed before the Italian Kingdom; however, the legislator decided to renovate, in a deeply and widely manner, the protection of urban safety, introducing new laws.

The effort of this research is to illustrate how the undetermined legal concepts of emergency, decorum and safety are changed in the case law evolution. Due to the work of the legislator, it has been registered not only an increasing use of powers by local authority, but also the creation of new powers (i.d., the so-called “daspo urbano”) whit a huge impact on individual freedom.

The aim of this study is also that to investigate in which way the Courts will solve the contrast between constitutional and European Union principles, on one hand, and the powers for urban security, on the other. This contrast has become frequent and increasingly evident and led to a conspicuous litigation; at the moment, by the way, there is not one single case-law solution to the problem. Lastly, the study is expected to give some cause for reflection about the fact that the administrative law has assumed the purpose of prevention and repression once committed to criminal law; and about the way jurisprudence could use penal principles in the disputes settlement.

**Department of Engineering and Applied Sciences**

**Tutor: Prof. Francesco Bassi**

**A.D. ING-IND/06 – Fluid dynamics A.R. F.: 09/A1 – Aeronautical and aerospace engineering and naval architecture**

Multiphase flows are commonplace in many technological and industrial processes such as hydrocarbons extraction and transport, naval design, injection in combustion chambers, treatment of pollutants. Physical modeling and numerical simulation of such flows are very complex tasks since the physical phenomena involved, such as the surface tension and the coalescence/division of interfaces between phases, produce flow structures with extremely different time and length scales, where smaller scales have a great influence on the flow behaviour at larger scales.

From a physical point of view, modeling of interfaces between phases is the most critical issue in multiphase flow simulations. Of the two, discontinuous and diffuse, approaches to the modeling of interfaces commonly employed, in this project we will follow the diffuse interface approach. The diffuse interface model describes the phase transition by means of a phase field variable which evolves in time according to an equilibrium equation. This model is attractive because it can be used for 3D problems without any requirement concerning complex geometrical reconstruction of interfaces between phases.

Since diffuse interfaces are actually very concentrated variations of physical properties of the flow, the numerical method applied to this type of modeling must be able to accurately capture and represent very steep gradients in the flow. In this context the Discontinuous Galerkin (DG) method is an optimal choice due to its very high accuracy.

From a practical point of view, a numerical code, based on the DG method coupled with a diffuse interface model and able to exploit High Performance Computing (HPC) resources needed for real life simulations, will be developed within this project. Unlike traditional codes, based on low-accuracy methods, this code will allow an accurate investigation of complex phase interactions also in applications of industrial interest. Application to complex problems will allow to appraise the potential of the diffuse interface approach and to assess the accuracy, efficiency and robustness of the developed code.

**"Optimization of Concentrated Solar Power plants based on tower and Thermal Energy Storage"**

***Annex code 3***

**Department of Engineering and Applied Sciences**

Tutor: **Prof. Giuseppe Franchini**

**A.D. ING-IND/08 – Fluid machinery A.R. F.: 09/C1 – Fluid machinery, energy systems and power generation**

The research project focuses on the modeling and optimization of Concentrated Solar Power plants based on tower and molten salt Thermal Energy Storage. The objective is the development of simulation models for customized plant configurations, whilst most current commercial codes deal with standard solutions. The developed models must predict the performance of each component and of the whole system, for different operating conditions (site location, power load,...). The attention will be mainly oriented to the optimization of the heliostat layout and to the control strategy of the energy storage.

**Department of Engineering and Applied Sciences**

**Tutor: Prof. Silvia Ravelli**

**A.D. ING-IND/09 – Energy systems and power generation A.R. F.: 09/C1 – Fluid machinery, energy systems and power generation**

The current project aims to experimentally investigate new film cooling solutions applied to a first stage turbine vane in a gas turbine engine, i.e. fan-shaped holes for vane cooling and slots for endwall cooling. The main goal is to increase the film cooling effectiveness, combined with minimum coolant consumption and reduced impact on the cascade aerodynamic performance. The research activity will be based on wind tunnel testing at engine-like conditions, according with the following steps:

1. definition and design of a reference geometry G0 of the cooled vane cascade.
2. aerodynamic testing on the G0 geometry to assess aerodynamic losses as a function of injection conditions, by means of a 5-holes aerodynamic probe.
3. thermal testing on the G0 geometry to measure the film cooling effectiveness distribution on vanes and end walls, as a function of injection conditions. Both Thermochromic Liquid Crystals and Pressure Sensitive Paint (PSP) will be used. To replicate engine-like conditions, testing will be performed using CO<sub>2</sub> as coolant flow (to this end, a new CO<sub>2</sub> feeding system will be required in the laboratory).
4. data processing of the G0 performance and definition of the new G1 geometry of the cooled vane cascade.
5. repetition of steps 2 and 3 for G1 geometry.
6. final processing of the measured data and performance evaluation of G1 vane cascade, as compared to G0.

**Department of Engineering and Applied Sciences**

**Tutor: Prof. Valerio Re**

**A.D. ING-INF/01 – Electronic Engineering A.R. F.: 09/E3 – Electronics**

The projects plans to study a new microelectronic system for the readout of pixel sensors at the Large Hadron Collider (LHC) at CERN.

LHC experiments have yielded excellent results in the field of high energy physics, including the discovery of the Higgs boson. The performance of LHC has improved along its many years of operation in terms of energy and luminosity, and will reach the ultimate limit in the next decade, with the goal of increasing the potential for new discoveries related to crucial scientific problems, such as the nature of dark matter and the existence of supersymmetric particles. These extreme operating conditions require particle detection systems with unprecedented performances in terms of space, time and energy resolution. These performances will be made possible by using the most recent microelectronic technologies for the readout of the signals generated by particles in the detection systems, especially in the silicon pixel sensors that are very close (a few cm) to the region where LHC proton beams collide and generate the physics events of interest.

In the next decade at LHC, pixel readout microelectronic circuits will have to amplify small signals with excellent noise behavior and radiation resistance, and will have to process an extremely large amount of data. Complex electronic functions will be implemented with a very high integrations density, as dictated by the need of acquiring signals from pixel sensors with a pitch of a tens of a  $\mu\text{m}$ . This project has the goal of studying new architectures to process in an intelligent way the information relevant to particle tracks, allowing for an efficient reconstruction of the interesting physics events. First of all, this concerns the front-end analog circuits interfacing with the sensor. Different solutions will be evaluated to provide the most accurate definition of the amplitude threshold that a signal has to overcome in order to be selected as an interesting one. Second, the project aims to study the best way to use the signals acquired from the sensors in the selection of potentially interesting events, so that it is possible to reduce the amount of data to be transmitted to external data processing systems. The project also has the goal of studying architectures that are able to generate in a short time a simplified information relevant to the group of pixels where a particle is detected. These architectures will have to store in a memory all the event information for the time that is necessary to receive an acquisition command, and will have then to send this information off chip with very high speed digital circuits.

The project will be structured in three stages:

- 1) A study will be carried out on the architectures that are presently used in silicon pixel readout systems for very high event rate applications. This study has the goal of defining the limits of these architecture sin view of the design of new particle tracking systems at LHC (6 months).
- 2) The design of analog and digital circuits will be carried out using advanced solutions for signal processing in a pixel and in a region of pixels. This will make it possible to decide if the technology node (65 nm CMOS) currently used in these applications is adequate to implement the new proposed architecture, or if it is necessary to go to a more advanced CMOS generation (such as 28 nm) (9 months).
- 3) A new microelectronic circuit will be designed, integrating the novel analog and digital functions developed in the second stage of the project. The final expected result is the full design of an intelligent system for the readout of pixel detectors at LHC, ready to be integrated in a silicon chip (9 months)

**Department of Foreign Languages, Literatures and Cultures**

**Tutor: Prof. Giuliano Bernini**

**A.D. L-LIN/01 – Historical and general linguistics A.R. F.: 10/G1 – Historical and general linguistics**

**Objective:**

The objective of this project is twofold: a) explore Slavic intercomprehension from the perspectives of theoretical linguistics and language teaching; b) develop a syllabus aimed at providing Italian university students of Russian L2 with skills in Slavic intercomprehension. Taking advantage of the widespread similarities among Slavic languages, intercomprehension training should enable students to simultaneously develop sufficient passive competence in more than one language while only minimally increasing the workload of standard Russian L2 courses.

**Theoretical framework:**

The theoretical framework related to intercomprehension was originally developed with respect to Romance languages. The basic idea is to exploit the widespread similarities among related languages for communicative purposes, thus avoiding the necessity for a lingua franca. Research has initially focussed on contrastive analysis of the relevant languages, on which basis teaching programmes were later developed and sometimes distributed commercially. With only few exceptions, these programmes are aimed at native speakers of one of the languages involved and share the focus on Romance languages and written modality.

**Research project description:**

In the first stage of the project, empirical data will be collected in order to evaluate the natural ability of Italian learners of Russian L2 to comprehend other Slavic languages in the absence of specific training.

Students of Russian L2 of various proficiency levels will be asked to translate texts written in different Slavic languages into Italian, but similar in terms of topic and complexity. Data collection should be designed in such way as to highlight the following elements:

- degree of comprehensibility of each language for Italian students of Russian L2;
- differences between oral and written modality;
- lexical and grammatical difficulties;
- unproblematic elements.

On the basis of the data thus collected a teaching syllabus will be prepared. A pilot version will be prepared for advanced students enrolled in the Language Competence Centre of the University. The rationale of this initial programme should be to integrate existing Russian L2 skills with passive competence in other Slavic languages. Later versions will be aimed at beginner students of Russian L2 and should make it possible to simultaneously build an active competence in Russian as well as passive competence in the other Slavic languages. Courses should be designed in such a way as to only minimally increase the Russian L2 course workload.

Finally, the project includes the development of courses in Slavic intercomprehension for external users.

**Time:**

The project spreads over two years articulated as follows:

- 1.data collection and analysis; design of the syllabus and teaching material;
- 2.experimental course for advanced learners; evaluation; design of courses for beginner and external users.

**Expected results:**

The present project should produce a significant contribution to several disciplines, while at the same time providing the University with a source of income and scientific prestige.

First, research in second language acquisition has shown that learners exposed to an unfamiliar L2 draw both on their L1 and on other known languages in order to try and process it. The project should advance knowledge regarding the factors which facilitate or hinder the recognition of common structures and vocabulary.

Second, intercomprehension has long been explored from the perspective of language teaching as well, though both Slavic languages and the aural modality have been somewhat neglected. The present project aims at filling this gap, acknowledging that Slavic languages play a major role in the European society and that the aural dimension has been greatly under-researched.

Moreover, much of the existing research is devoted to intercomprehension among native speakers. In contrast, this project explicitly targets Italian L2 university students not native speakers in any Slavic language. The opportunity to develop some competence in more than one foreign language should positively impact on their communicative competence and on their employment opportunities.

Finally, the project should also result in a syllabus aimed at external users, which will provide the University with a source of income and a prominent role in this scientific area.

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**Department of Foreign Languages, Literatures and Cultures**

Tutor: **Prof. Dorothee Heller**

**A.D. L-LIN/14 – Language and translation - German A.R. F.: 10/M1 - Germanic languages, literatures and cultures**

**Objective:**

The main objective of the project is to give evidence of characteristic features of German which at the time of Galileo had not yet been established as a scientific language but which was going to develop in this direction in the 18th and 19th century, when the first German translation of *Dialogo sopra i due massimi sistemi del mondo* will be published. By comparing the Italian original (1632) and its translation into German (1891), text construction and discursive strategies will be analysed with special regard to lexical, grammatical and stylistic devices. The topics to be explored include in particular connectors, deictic and verbal expressions in which both languages show differences, especially as far as verbal tenses and morphology are concerned (Heller 2012, Lombardi 2008). Other topics of interest regard the use of metaphors (Veronesi 2011), which let emerge cognitive and conceptual aspects of scientific discourse (Graefen 2009). Analogies and differences between Italian and German will be investigated, also by comparing parallel texts.

**Theoretical framework:**

The project aims at giving a contribution to the field of *Wissenschaftssprachkomparatistik* which has recently received important input from studies on scientific and academic argumentation and from Functional Pragmatics (Ehlich 2012, Da Silva 2014, Redder, Thielmann, Heller 2014). The last mentioned linguistic framework, little known outside the German speaking area, is rooted in the linguistic theory of Karl Bühler (1999 [1934]) and offers useful categories also for translation studies.

**Research project description:**

Recent contributions to the debate concerning how the increasing importance assigned to an Anglo-American standard will affect international academic discourse, suggest giving value to the expressive potentials of other scientific languages for multilingual exchange, considering in particular those languages which had an important influence for the evolution of scientific knowledge in the past.

The project, which is connected to the above mentioned debate, aims at analysing typical features of Italian and German academic discourse in a comparative and historical perspective. Special attention is given to the German translation of Galileo Galilei's writings, and in particular of his dialogues. In consideration of the crucial role that translation of scientific texts has for dissemination of knowledge and cultural enrichment, the project refers to the topics of Horizon 2020 (pillar Societal Challenges, Europe in a changing world) in relation to the objective to “carry out research on the history, literature, art, philosophy and religion of European countries and regions, and how these have originated the diversity of today”.

The input of Galileo for a new concept of science becomes evident in his *Discorsi and Dialoghi* which are characterized by arguments for a scientific culture which overcomes former doctrine and goes hand in hand with the rise of empirical sciences (Thielmann 2003). The impact of Galileo's prose has to be considered also in the light of the evolution of scientific Italian. It is a prose characterized by an eristic dimension which requires linguistic and discursive features closely connected to the so called *alltägliche Wissenschaftssprache* (Ehlich 1999) and might create remarkable challenges for translation.

**Time:**

- bibliographic survey (2 months)
- data collection based on analysis of source texts and translations (8 months)
- interpretation and discussion of data within the framework outlined above (8 months)
- presentation of results in conferences and papers to be published in periodicals and volumes (6 months)

**Expected results:**

While some features of Galileo's writing have been partly studied, such as syntax (Altieri Biagi 1990), textual and pragmatic strategies (Heller 2012, Thielmann 2003), the field of translation into German is largely unexplored.

The research to be conducted will give evidence of the complexity of cross-language transposition of Italian scientific prose of the seventeenth century and scientific German of the late nineteenth century, paying attention to the evolution of both languages. This double perspective (comparative analysis German-Italian in a historic perspective) can be considered a particularly original aspect of the project. It will give insights into the challenges of translation in case of large gaps between source text and target text and the choices to be taken by the translator in terms of modernisation.

Furthermore, the project will give a contribution to the recommended valorisation of national languages in terms of cultural vehicles and dissemination of scientific knowledge, a topic of increasing interest in the area of humanities. It has to be underlined, however, that the translation of a scientific text goes beyond the function of diffusion of research results. During the process of cross-language transposition the translator has to cope with challenges due to the expressive potential of the single languages and their specific use in academic discourse.

For this reason, the comparison of source and target text has to be considered a precious resource for linguistic analysis, able to give a valuable contribution to comparative linguistics in academia. An advancement of knowledge will emerge also from the linguistic comparison of features in which the languages under comparison show differences such as in the case of deictic structures, verbal morphology and the organization of tenses. On the basis of these results, it will be possible to open further research perspectives on Galileo's translations in other languages, for example of the Slavic speaking area.

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**Department of Management, Information and Production Engineering**

**Tutor: Prof. Matteo Kalchschmidt**

**A.D. ING-IND/35 – Business and management engineering A.R. F.: 09/B3 – Business and management engineering**

Multinational manufacturing companies produce different types of products using international production networks. These networks can have a vertical structure (production is divided according to the production process) or an horizontal structure (divided according to the market to be served). In addition, the diversity of products, for example, products with a high or low technological content, can be reflected in the way these networks are managed.

Compared to these different management methods, in 2016 Vereecke, Ferdows and De Meyer introduced the concept of sub-network, i. e. a grouping of production units characterized by a certain type of product/process. The result of this study shows how sub-networks that produce low-tech products are more subject to structural reviews (footloose sub-network).

Although the concept of sub-network may simplify the management activity of the entire network, the ways in which these sub-networks are managed have not yet been studied in depth.

The project therefore aims to study these sub-networks and the related management practices, such as the organisational structure, control and coordination mechanisms, the level of expertise required, operational integration practices and knowledge exchange.

Given the complexity and novelty of the theme, the research methodology chosen is that of case studies. In particular, a number of companies will be analysed at European level and the related foreign production plants within the sub-networks.

The project will therefore be divided into 3 phases for a total duration of 24 months.

Phase 1 - Systematic review of literature (4 months). In this phase, the most relevant articles will be collected for the identification of the different management variables of a sub-network. Where necessary, systematic literature review techniques will be applied, including a systematic search for articles, analysis of the citation network and main topics.

Phase 2 - Data collection (12 months). In this phase, the interview protocol will be defined and the companies to be contacted will be selected following the best methodological practices in the analysis of case studies. Firms will be interviewed in person or by telephone and all the information collected will be triangulated with information from secondary sources (reports, balance sheet data, presentations, etc.). If further data need to be collected, companies will be contacted for follow-up meetings.

Phase 3 - Analysis of results (10 months). The collected data will be coded in order to identify the differences and similarities between the cases and the different types of sub-network analysed. In this phase, best practices in the management of these networks will also be studied, with particular emphasis on the difference between footloose networks and other types of networks.

The project will also be supported by a dissemination phase of the duration of the entire project.

The aim is to produce at least 2 articles to be presented at the conference and then sent to international journals. A report will also be written for the participating companies. Finally, the results of the project will be disseminated through social networks and specialised websites.

All phases of this study will be conducted according to the principles of the highest scientific rigour to ensure results that advance the state of the art of knowledge.

**Department of Management, Information and Production Engineering**

**Tutor: Prof. Roberto Leporini**

**A.D. MAT/01 – Mathematical logic A.R. F.: 01/A1 – Mathematical logic, mathematics education and history of mathematics**

While voice BCI systems work well using the motor imagery paradigm, for BCI silent speech systems the problem of the path classification is much more complicated. Recent studies show the presence of analogies between spoken speech language and the silent one, reviving the interest in the use of new logical-semantic interpretation paradigms and, at the same time, towards optimized classification techniques. In the present project we plan: 1) the realization of a recursive neural network for the recognition of phonemes, and subsequently words with meaning accomplished; 2) to identify particular structures common to the two activities of language, with the advantage of achieving a reduction in computational complexity, by analyzing and comparing the results obtained; 3) the creation of an innovative embedded BCI system capable of classifying silent speech neurological activities, and hence to interpret the pronounced verbal language on which, unlike voice language, the research has not yet reached of satisfactory results. The project will allow to build a BCI system that is able to work effectively both in voice and in speech silent, and that it can be achieved by means of devices normally in the market. However, the ultimate goal remains to allow end users to use a sophisticated BCI system for sophisticated motor functionality, regardless of the use of specialized technical personnel.

**Department of Management, Information and Production Engineering**

**Tutor: Prof. Gianmaria Martini**

**A.D. SECS-P/06 – Applied Economics A.R. F.: 13/A4 – Applied Economics**

The aim of the research project is to define a method of estimating efficiency boundaries based on the stochastic method with four random components elaborated by Colombi et al. (Journal of Productivity Analysis, 2014). The model allows to estimate a theoretical frontier of benchmarks, and to compare firms' performance. It is expected to estimate a cost limit - to identify cost-effectiveness - and a production boundary - to identify total factor productivity. Efficiency is studied thanks to the properties of the Colombi et al. (2014) through 4 dimensions:

1. short-term or temporary efficiency
2. Long-term or persistent efficiency
3. The typical effect of the firm due to the influence of latent variables that can not be observed
4. the presence of random shocks not subject to management control.

Short-term and long-term efficiency allows management to identify how enterprise performance can be improved as a result of actions on variable and flexible factors (eg work) and changes with longer time horizons. It is also of utmost importance for defining the regulatory mechanisms and reducing the impact of information asymmetry and therefore of adverse selection and moral hazard phenomena (Dormont and Milcent, 2005). It is essential to be included in the project a good knowledge of R.

**Department of Management, Information and Production Engineering**

**Tutor: Prof. Roberto Pinto**

**A.D. ING-IND/17 – Industrial mechanical systems engineering A.R. F.: 09/B2 – Industrial mechanical systems engineering**

Distribution logistics is an increasingly pervasive process. Especially in the retail sector, where consumer purchasing habits have undergone a considerable evolution and transformation over the last few years (i.e. e-commerce), logistics has increased its relevance as a competitive factor. The market demands more flexibility and efficiency for modern production and distribution chains (supply chains).

The distribution of goods must be aligned with the company's value proposition to a customer who can access the purchase processes through different, interconnected, physical and virtual channels. A misalignment between these channels, between the "promise" of availability and delivery, and the actual performance, can entail very high costs in terms of lost sale and customer dissatisfaction.

The research project aims to investigate the role of new technologies that characterize the "IV Industrial Revolution" (or Industry 4.0) within the retail supply chain. Despite the discussion on Industry 4.0 being strongly focused on the manufacturing sector, some of the enabling technologies that characterize this new paradigm offer opportunities even outside the industrial scope. Manufacturing and commercial companies need to reconsider and transform their distribution chains in the light of the possibilities offered by new digital technologies and in accordance with changing market needs. The right combination of understanding needs, automation, and digitization of processes leads to the realization of the digital supply chain.

The research project is articulated into the following macro-phases:

1. Identification and definition of the distribution logistics main elements in modern economic and industrial systems.  
Objective: to define the state of the art of distribution logistics by the light of new commercial dynamics and technological evolutions, with particular reference to the use of digital technologies in the retail sector (6 months).
  2. Identification and analysis of industry-enabled Industry 4.0 paradigm technologies for distribution logistics.  
Objective: analysis of possible technology applications - and their impacts - in the logistics-distribution domain for the implementation of the digital supply chain. Particular attention will be given to the following technologies: big data & analytics, cyber-physical systems, internet of things, cloud computing, automatic identification (Rfid and beacon), simulation, augmented reality (8 months in partial overlap with Phase 1).
  3. Identification of the key decision-making processes in the distribution logistics sector.  
Objective: Identify the key decision-making processes that can be enabled or supported by the implementation of one or more of the technologies identified in phase 2. Particular attention will be given to the design of decision support systems based on - or enabled by - technologies, with particular regard to the use of data for decision-making. Attention will also be given to aspects of collaboration, coordination and visibility in the supply chain (10 months).
  4. Definition of a reference model for the development of the digital supply chain in the retail sector.  
Objective: Definition of a descriptive reference model for the adoption of innovative technologies for the realization of the digital supply chain (6 months in partial overlap with phase 3).
- Starting from the month 6, these phases can be complemented, up to the completion of the project, with a dissemination phase (both popular and scientific).

**Department of Management, Information and Production Engineering**

**Tutor: Prof. Andrea Remuzzi**

**A.D. ING-IND/34 – Industrial bioengineering A.R. F.: 09/G2 – Bioengineering**

The limits of renal replacement therapies, and their costs, require that new strategies are urgently studied to find more effective treatment. The main cause of these pathologies is the loss of permeability of the kidney filtering membrane to plasma water. The functions of this membrane depend on endothelial cells and podocytes, and the progression of the disease is caused by the loss of podocytes that detach from the membrane and are lost in the urine. The drugs available today are able to only partially slow down the disease. Studies so far have failed to take account of the mechanical stresses induced on these cells by the passage of filtered fluid through the membrane. Direct observations of these phenomena are not possible because of the very small size (in the order of nanometers) of these structures and the difficulty of conducting studies in living organisms such as experimental animals. The aim of the project is to develop an innovative system based on organ-on-chip technology to grow endothelial and podocytes cells adhering to a semi-permeable elastic membrane and expose them to controlled flow and pressure conditions. The microfluidic system will have to reproduce the structure and function of the glomerular filtration wall to study the effect of filtration on the cell biology that compose it. The system will also be able to test in vitro new molecules that may favor the mechanical strength of these cells under conditions that simulate pathological ones. The system will also allow us to study in vitro the behavior of kidney-derived kidney cells. In fact, the differentiation of induced pluripotent cells (iPS, obtained from patients with chronic nephropathy) in endothelial cells and podocytes, can be used to better understand the mechanisms responsible for these pathologies and to study the response to pharmacological treatments at the individual patient level.

**Department of Management, Economics and Quantitative Methods**

**Tutor: Prof. Mariafrancesca Sicilia**

**A.D. SECS-P/07 – Business administration and accounting studies A.R. F.: 13/B1 – Business administration and accounting studies**

Increasing demand for services, squeezed budgets, emerging complex and uncertain social problems, the progressive decline of citizenship and the sense of "moi commun" has prompted scholars and practitioners to look for new public service delivery mechanisms that reinvigorate the role of citizens in their communities beyond simply voter and customer.

The literature has used the term co-production to generically refer to 'the involvement of both users and public sector professionals in the delivery of public services' (Nabatchi et al. 2016). However, this definition has not been used consistently and there is no agreement on the meaning of the concept of co-production. On the one hand, this has led to a difficulty in measuring the results of existing research in this topic, on the other hand, this has not allowed to systematically investigate the differences among the diverse typologies of coproduction.

To allow a clearer understanding of the phenomena, Nabatchi et al. 2017 have proposed a typology for coproduction in order to better clarify the meaning of both the components of the term "co-production".

On the "co" side of coproduction, they specified three levels of coproduction, i.e. individual, group, and collective co-production. In the first two cases, a state actor works directly with a client or customer, or with a number of clients or customers; in the third case, a state actor involves citizens to generate social benefits. With reference to the "production" word, Nabatchi et al. (2017) considers four phases of the public service cycle, i.e. commissioning, design, delivery, and assessment. This project aims to study the different types of co-production identified above, by adopting the perspective of both clients/citizens and the public sector. The final aim is to investigate the underlying cognitive processes and the variables that may explain clients/citizens' and the professionals' willingness to coproduce. The theoretical framework will be developed by combining the psychological literature (e.g., framing of information, priming, prior beliefs, negativity bias) and public management literature (e.g., representative bureaucracy, citizen engagement, collaborative advantage, public sector accountability).

As such, the project responds to recent calls that have emphasized the advantages of contamination among different disciplines to advance knowledge of current phenomena characterizing the public sector (e.g., Gimmelikhuijsen et al. 2017). From a methodological point of view, the research will be conducted through experiments in order to overcome endogeneity problems that often affect social science research (Morton and Williams 2010). The use of this methodology allows to isolate the effect generated by one variable on another, by identifying causal relationships and thus contributing to the development of theories (Bouwman e Gimmelikhuijsen 2016). This research will require at least 2 years of work. In particular, the following steps can be identified: • Step 1: Analysis of the literature and identification of the relevant theories for developing the theoretical research framework (6 months). • Step 2: Operationalization of the variables to be test, design of the experiments, creation of a sample and the mailing list of addresses to which the experiments will be administered (5 months). • Step 3: Pre-test of each experiment and following refinement (3 months). • Step 4: administering of experiments (3 months). • Step 5: Data analysis and elaboration of the research outputs, presentation of the outputs to International conferences (IRSPM, PMRA, EGPA; 5 months).

The project is innovative for research for the following reasons: - extant studies have not paid much attention on co-production, and they have predominantly used single case studies; - public debate on co-production is currently driven more by ideological considerations on the role of government and the civil society, rather than on empirical comprehension of this phenomena (this is the objective of the proposed research); - the study will use experiments, which provide the advantage of showing cause-effects relationships contributing, thus, to the development of theory; - the project aims to extend the approach defined as "Behavioral Public Administration", by using theories that have been developed in the psychological field. Under a managerial perspective, the project provides indications for the design and the implementation of future experiences of co-production and on the ways to enhance the propensity to coproduce of both citizens/clients and the professionals who work in the public sector. Furthermore, the project is of particular importance in the international arena. Indeed, the work programme Horizon 2020 considers as strategic the topics linked to how to strengthen PA's governance capacity, the involvement of civil society and citizens, to innovative ways to improve the design and impacts of public policies. The proposed project will also help to highlight



under what conditions and to what extent coproduction practices can promote greater social inclusion (including the contribution of digital tools and their impact in terms of accountability). Finally, The project will allow to activate and enhance collaborations with other researches through the “IIAS Study Group on Co-production of Public Services” network, hosted by the University of Bergamo in 2014 and co-chaired by Trui Steen (Leuven University), Tina Nabatchi (Syracuse University) e Dirk Brand (Stellenbosch University).