Durham University Business School

PhD scholarships 2024/25

Centre name

Centre for Strategy, Technological Innovation, and Operations (STIO)

Introduction

The Centre for Strategy, Technological Innovation, and Operations (STIO) is requesting applications for PhD scholarships with students expecting to start the programme in the academic year 2024/2025.

To apply for a scholarship, applicants have two options:

1. They can contact one of the potential supervisors listed in the Section "Potential supervisors" and work towards a research proposal based on mutual interests.
2. They can choose one of the topics listed in the Section "Potential topics", contact the associated supervisor(s), and work towards a research proposal.

Potential supervisors

This is a list of potential supervisors, sorted alphabetically based on the surname of the first supervisor.

Professor Atanu Chaudhuri

- Research interests: Supply chains and business models for digital manufacturing, Supply chain risk management, and Supply chain integration. Contact: atanu.chaudhuri@durham.ac.uk.

Assistant Professor Farzana Chowdhury

- Research interests: Entrepreneurship, Institutions, International Entrepreneurship. Contact: farzana.chowdhury@durham.ac.uk.

Associate Professor Li Ding

- Research interests: Decomposition, Bandit problem, Markov Decision Processes, Supply chain disruption and risk management, Healthcare operations/economics, Behavioural operations management/operations research, and Behavioural economics/finance. Contact: li.ding@durham.ac.uk.

Professor Nalan Gülpinar

- Research interests: Assortment Planning, Healthcare Operations Management. Contact: nalan.gulpinar@durham.ac.uk

Professor Fang Liu

- Research interests: Supply chain resilience, Inventory management, E-commerce and warehouse management, and Corporate social responsibility and sustainability. Contact: fang.liu@durham.ac.uk.

Associate Professor Gar Goei Loke

- Research interests: Decision-making under uncertainty, Robust optimization, and Data-driven optimization. Contact: gar.g.loke@durham.ac.uk.

Associate Professor Stephanie Scott

- Research interests: Innovation Ecosystems, Networks and Agency, Regional Development, Technology Transfer, Open/Collaborative Innovation. Contact: s.a.scott@durham.ac.uk.

Associate Professor Angelo Solarino

- Research interests: Corporate Governance, Innovation, International Business, Research Methods, Strategy. Contact: angelo.solarino@durham.ac.uk.

Associate Professor Zsofia Toth

- Research interests. networks, business relationships, responsible use of AI, service innovation, digital B2B marketing. Contact: zsofia.toth@durham.ac.uk

Professor Lenos Trigeorgis

- Research interests: Real options, corporate finance, corporate strategy, international strategy, Contact: lenos.trigeorgis@durham.ac.uk.

Neil Walton

- Research interests: Applied probability and principally concerns the decentralized minimization of congestion in networks, Contact: neil.walton@durham.ac.uk.

Associate Professor Efpraxia Zamani

- Research interests: Digital poverty and digital inequalities, Making sense of emerging technologies, Information Systems and Technology in the workplace. Contact: efpraxia.zamani@durham.ac.uk

Professor Stavros Zenios

- Research interests: Robust optimization, Linear programming for tail events, Multi-period stochastic optimization, and Asset pricing of political risk. Integrated assessment models for climate change. Contact: stavros.zenios@durham.ac.uk.

Assistant Professor Yanlu Zhao

- Research interests: Data-driven service operations and supply chain management, such as appointment scheduling, vehicle routing problem, online platforms optimization and data analytics in healthcare system. Contact: yanlu.zhao@durham.ac.uk.

Potential topics

This is a list of potential topics, sorted alphabetically based on the surname of the first supervisor.

Incentive design for community health workers to deliver technology enabled healthcare delivery in disadvantaged regions

- Supervisors: Professor Atanu Chaudhuri, atanu.chaudhuri@durham.ac.uk, potentially with Dr. Ujjal Mukherjee (GIES School of Business, Illinois Urbana-Champaign)
- Description: Healthcare delivery to underserved communities poses multiple challenges due to lack of affordable services, lack of availability of health infrastructure, and lack of awareness about proper healthcare practices and required life-style changes. In recent times, the use of telehealth and innovative mobile health-technologies have been acknowledged to provide low cost and easy access to healthcare services such as remote consultation of doctors, primary health screening, detection of potential health risks, and timely consultation of specialist doctors if necessary (Bettiga et al. 2020). The realization of the potential benefits of mobile and telehealth technologies depends on the adoption and usage of such technologies by Community Healthcare Workers (CHWs) and individual patients (Alonzo and Popescu 2021, Bettiga et al. 2020, Kalkanci et al. 2019). CHWs play key roles in building awareness and in providing education to underserved communities (De Vries et al. 2021). CHWs act as intermediate agents between providers and patient communities, and perform several functions. CHWs are local community members who act as bridges between the individual and the health care system and can help overcome some barriers associated with technology adoption in healthcare delivery. A key issue beleaguering the health outcomes of underserved communities is the lack of awareness resulting in poor adoption of primary care, which, in turn, results in patient level delays in seeking treatment of even the most common and known serious ailments such as cardiac conditions, COPD, diabetes, and cancer. These delays in healthcare seeking behavior can be effectively mitigated by CHWs by engaging with patients and communicating with patients on health-related and other associated social issues. At an operational level the effectiveness of such engagement depends on the frequency and nature of patient encounters and engagements, which in turn depend on financial and non-financial incentives that can motivate CHWs to engage with patients effectively. First, fixed financial incentives may not be sufficient motivation because of the lack of positive reinforcement of actions and performance

of the CHWs, and may fail to motivate to undertake higher levels of action. Variable performance based incentives can help provide the required reinforcements and motivations. Variable incentives can be based on only efforts such as number of contacts made, number of new contacts initiated, and number of hours of service provided, or outcomes such as the number of adoptions, usage or health improvements. Literature on CHWs suggest that variable incentives solely based on performance and actions may undermine the importance of other secondary but important actions such as responding to patients needs and requests. Among the variable incentives, only outcome driven incentives or only effort driven incentives may induce similar biases in the choice of actions. Therefore, the incentive design in the case of CHWs is an important aspect of CHW performance and adoption of telehealth. There is limited understanding how CHWs contribute to technology enabled healthcare delivery in disadvantaged regions. There are multiple operational issues related to the role of CHW involvement, their incentives and training, their use of different technologies , which are needed to improve effectiveness of CHWs in primary healthcare delivery but have received limited attention in literature. Hence, the problem we are trying to address is 1) to design appropriate incentive structures for CHWs to have a positive impact on process outcomes such as frequency and duration of visits to homes of patients, number of new registration and in turn on health outcomes of patients such as blood pressure control, diabetes control and other primary health indicators, while taking into account the role of different types of training (ICT, medical and behavioural) provided to CHWs, prior experience of CHWs and familiarity of CHWs to the local community on their levels of engagement as well as the different types of technological interventions (only teleconsultation and teleconsultation with digital technology enabled primary health data collection and analysis). The objectives of this project are to design appropriate incentive schemes and to assess the effect of training and type of technology intervention and the interaction of those with the type of incentives on process outcomes and health outcomes while controlling for CHW experience and familiarity.

- References:
    - Chaudhuri, A., Prætorius, T., Narayanamurthy, G., Hasle, P. and Pereira, V., 2021. Finding your feet in constrained markets: How bottom of pyramid social enterprises adjust to scale-up-technology-enabled healthcare delivery. Technological Forecasting and Social Change, 173, p.121184.
    - Deserranno, E., 2019. Financial incentives as signals: experimental evidence from the recruitment of village promoters in Uganda. American Economic Journal: Applied Economics, 11(1), pp.277-317
    - Kok, M.C., Dieleman, M., Taegtmeyer, M., Broerse, J.E., Kane, S.S., Ormel, H., Tijm, M.M. and De Koning, K.A., 2015. Which intervention design factors influence performance of community health workers in low-and middle-income countries? A systematic review. Health policy and planning, 30(9),

pp.1207-1227.

Supply Chain Resilience

- Supervisors: Professor Atanu Chaudhuri, atanu.chaudhuri@durham.ac.uk, Dr Li Ding, li.ding@durham.ac.uk, Professor Stavros Zenios, stavros.zenios@durham.ac.uk
- Description:
    - Risk propagation and stress testing of supply chains: Technological and behavioural perspectives
      One focus area of this theme will be to map the supply chains with their potential risks, develop models for risk propagation, predict the resilience of the supply networks, stress-test the supply chains for various disruptions and to develop resilience enhancing strategies. A socio-technical systems based approach will be followed to ensure that the analytical tools and the digital technologies developed for risk management and for enhancing supply chain resilience can be implemented in practice by taking into account the risk appetite and behavioural traits of the managers. This work will focus on industrial manufacturing (automotive, aerospace, medical device) supply chains.
    - Building resilience in critical raw material supply chains
      This stream of research will focus on critical raw materials for UK and assess the potential for adopting circular economy principles, digital technologies such as Blockchain enabled Digital Material Passports and on-demand manufacturing as resilience enhancing strategies for such critical raw materials. Data availability, data security, digital literacy as well as potential impact of unethical practices will also be explored.
    - Climate change and resilient food supply chains
      The third stream of research will focus on impact of climate change as well as labour shortage and geo-political issues on UK food supply chains and develop a systems view of addressing such risks to build long term resilience.
      Efforts can on also focus on tracking events which can impact global industrial, critical raw materials and food supply chains, identify potential future disruptions, create an early warning system and create some proactive as well as reactive actions to address those events. Such events can be tracked using global secondary data, news feeds etc and by natural language processing to make sense of such data and predict potential disruptions.

Surgical procedures and specific patient characteristics to justify adoption of surgical 3D Printing

- Supervisors: Professor Atanu Chaudhuri, atanu.chaudhuri@durham.ac.uk and Professor Nalan Gulpinar, nalan.gulpinar@durham.ac.uk, potentially along with Professor Deepak Kalaskar from University College, London and Dr Ujjal Mukherjee, GIES School of Business, University of Illinois

- Description: 3D printed anatomical models and customised surgical guides and implants have been used for multiple surgical procedures in many hospitals across the world. There are both clinical and operational benefits associated with surgical 3D Printing. These can be related to reduced post-surgical complications, reduced length of stay, reduced blood loss or reduced anaesthesia usage to reduction in surgery time and reduction in time from diagnosis to surgery etc (Chaudhuri et al., 2021). Hospitals also need to consider multiple other factors such as total demand for surgeries which may require 3D printing, complexity of the surgeries, lead-time criticality of the surgeries i.e how much time is available from diagnosis to surgeries as well as prioritisation of the hospital's own strategic objectives to decide for which surgeries the hospitals need to adopt surgical 3D printing. The adoption can also in varying degree i.e only adopting use of 3D printed anatomical model to adopting 3D printing for customised surgical guides and also implants. If the hospital decides to adopt 3D printing, they also need to decide whether to invest in-house capabilities in segmentation and anatomical modelling or outsourcing such services and also whether they set up point-of care manufacturing facility within the hospital operated by the service provider to design and produce the anatomical models, guides and implants or engage with the 3D printing service providers on a case-to-case basis. While there are research on clinical benefits of surgical 3D printing, limited attention has been paid to model the managerial choices faced by the hospital administrators as mentioned above. This research will address the gap by answering the following research questions

  1a) How do patient characteristics (age, gender, co-morbidity etc) and complexity of the surgery impact the operational and clinical outcomes of surgeries which used 3D printing compared to those which used conventional procedures?

  1b) Which patient characteristics and surgical characteristics will qualify a particular surgical procedure to adopt 3d printed anatomical model, 3d printed anatomical guide in combination with 3d printed surgical guides and implants?

  2) How do volume of surgeries, complexity of surgeries, lead-time criticality of surgeries along with cost of engaging a 3D printing service provider, the investment needed to set-up point-of-care manufacturing capacity and the operational outcomes impact whether hospitals should make investments for in-house capability or engage with a service provider on a case-to-basis or engage with a service provider to set-up point-of-care manufacturing facility

  Questions 1a and b will be answered using empirical data collected about individual surgical procedures while question 2 will be answered by developing suitable analytical models which captures the reality and expert opinion from healthcare 3D printing experts
- Key words: surgical 3D printing, qualifying surgical procedures, technological investment, operational outcomes
- References:

- Chaudhuri, A., Naseraldin, H., Søberg, P.V., Kroll, E. and Librus, M., 2020. Should hospitals invest in customised on-demand 3D printing for surgeries?. International Journal of Operations & Production Management, 41(1), pp.55-62.
- Chaudhuri, A., Naseraldin, H. and Narayanamurthy, G., 2023. Healthcare 3D printing service innovation: Resources and capabilities for value Co-creation. Technovation, 121, p.102596.

Personalised Assortment Planning

- Supervisors: Professor Nalan Gulpinar, nalan.gulpinar@durham.ac.uk.
- Description: Balancing supply and demand uncertainties is a mission impossible for any supply chain. Especially for retailers using an online shopping channel, offering the most preferable products at acceptable price for individual customers is a challenging problem and this requires a real-time decision-making process with novel and efficient solution approaches. Most importantly, changing customer choices and expected future demand within different market conditions need to be taken into account when making decisions.

  This project aims to develop real-time decision-making approaches for retail revenue management and dynamic pricing problems under uncertain customer demand. Machine learning approaches will be used for the assortment planning of personalised products by taking into account customer preferences. Due to dynamic and stochastic nature of the underlying real-life problem, stochastic dynamic programming models will be developed and distributionally robust optimisation will be considered to model the underlying demand uncertainty. It is crucial to determine pricing strategies efficiently given in a real-life setting. However, the existing solution approaches are not applicable due to curse of dimensionality. Novel solution approaches based on approximate dynamic programming and decomposition methods need to be developed.

  The PhD project will focus on i) development of novel models for joint assortment optimisation and dynamic pricing problem using stochastic dynamic programming, ii) design of solution approach based on approximate methods, iii) implementation and evaluation of the proposed methods using real data (collected from an online shopping platform) and comparison with traditional approaches.

  The modelling and solution framework proposed in this PhD will be developed in collaboration with industrial partners (e-commerce company/retailer). A recommendation system will be designed, and the optimal strategies will be evaluated under various customer acceptance rules.

  Working codes for the underlying retail optimisation and customer choice models and research papers presenting numerical results obtained by a real data set.

  Students are required to have programming skills and desire to work on real life decision-making problems.

- References:
    - Aydin, G., & Ziya, S. (2009). Personalized Dynamic Pricing of Limited Inventories. Operations Research, 57(6), 1523–1531. https://doi.org/10.1287/opre.1090.0701
    - Bhatia, N., Gulpinar, N. and Aydin, N., Dynamic Production-Pricing Strategies for Multi-generation Products under Uncertainty, International Journal of Production Economics, 2020, Vol: 230,107851
    - Gulpinar, N., Strauss, A., Zheng, Y., Dynamic Pricing of Flexible Timeslots for Attended Home Delivery, European Journal of Operational Research, 2021, 294, 3, 1022-1041
    - Miao, S., and Chao, X., Dynamic Joint Assortment and Pricing Optimization with Demand Learning, Manufacturing & Service Operations Management, 2020, 23(2), 525-545.

Integrated Planning for Healthcare Operation Management

- Supervisors: Professor Nalan Gulpinar, nalan.gulpinar@durham.ac.uk
- Description: Increasing data availability and streamlining of inpatient care have demonstrated the need and possibility to successfully link decisions on different resources (Rachuba et al. 2022). This leads to an integrated approach that allows joining complex decision-making processes efficiently. A joint decision-making provides benefits in comparison to decision-making in isolation; especially capacity decisions made in isolation may not be feasible for the integrated whole system. As far as the hospital management is concerned, the optimal, yet non-integrated, decisions do not guarantee a good utilization of immediately related resources such as shared hospital wards, personalized rooms and multi-skilled nursing staff.
  This project aims to develop novel modelling and solving approaches for integrated decision-making problems that the hospital management faces. Synchronising those independent operational activities as part of a holistic approach is a challenging task, but crucial for the efficient utilisation of hospital resources.
  The modelling and solution framework proposed in this PhD will be developed in collaboration with industrial partners (such as NHS Trust).
  Working codes for the underlying integrated healthcare operations management and research papers presenting numerical results obtained by a real data set.
  Students are required to have programming skills and desire to work on real life decision-making problems.
- References:
    - Brandt, T., Klein, T. L., Reuter-Oppermann, M., Schäfer, F., Thielen, C., van de Vrugt, M., and Viana, J., (2023), Integrated patient-to-room and nurse-to-patient assignment in hospital wards. arXiv preprint arXiv:2309.10739.
    - Rachuba S., Reuter-Oppermann M., and Thielen C., (2023), Integrated planning in hospitals: A review, arXiv preprint arXiv:2307.05258v1

- Rachuba, S., Imhoff L., and Werners, B., (2022), Tactical blueprints for surgical weeks - an integrated approach for operating rooms and intensive care units, European Journal of Operational Research 298:243–260
- Rachuba, S., and Gulpinar, N., (2023), An Integrated Approach for Flexible Restructuring of Inpatient Wards, Available at SSRN 4227808

Using inventory to build supply chain resilience in humanitarian operations

- Supervisors: Professor Fang Liu, fang.liu@durham.ac.uk, potentially with Jeannette Song (Fuqua School of Business, Duke University)
- Description: The escalating frequency of natural disasters, from earthquakes and floods to extreme weather events, along with pandemics like COVID-19 and monkeypox, underscores an urgent need for governments to bolster emergency response capabilities. Environmental shifts such as the Amazon rainforest becoming a net emitter of carbon dioxide and the accelerated melting of Greenland's glaciers are exacerbating the frequency of catastrophic events like cold spells, heatwaves, typhoons, and floods. Significant recent examples include the February 2023 earthquake in southern Turkey, registering a magnitude of 7.8, and the severe rainfall and flooding in northeastern China in late July due to Typhoon Doksuri. These events are part of a larger trend observed globally; approximately 6,800 disasters occur annually, causing an average economic loss of USD 250-300 billion each yea. In 2022 alone, 387 climate-related natural disasters were recorded, resulting in over 30,704 deaths, affecting 185 million people, and incurring an estimated USD 223.8 billion in economic losses.

  In the face of these alarming statistics, the imperative for governments to develop and implement robust strategies to mitigate the impacts of these increasingly frequent and severe disasters has never been more pronounced. These strategies must encompass not only immediate relief efforts but also long-term planning and investment in resilience and adaptation initiatives.

  A primary challenge for governments in responding to frequent disasters is ensuring timely delivery of relief supplies while minimizing operational costs. Traditionally, emergency supplies are stored in dedicated warehouses, available exclusively for use during emergencies. However, this method often incurs high maintenance costs and can lead to wastage due to inventory expiration.

  An alternative and more efficient practice involves partnering with private companies that manage similar products in their regular supply chain. In this approach, the government collaborates with these companies to reserve emergency supplies within their regional warehouses. These reserved supplies are kept separate from the company's daily inventory and are not utilized for regular business demands.

  We tend to analyze which type of product the government should keep at its warehouse and which type of product should be kept at private companies. Furthermore, how to design incentive-compatible partnerships with the private companies to keep these inventories.

Strengthening the resilience of the UK food system

- Supervisors: Professor Fang Liu, fang.liu@durham.ac.uk and Assistant Professor Yanlu Zhao, yanlu.zhao@durham.ac.uk.
- Description: Research on supply chain resilience, especially regarding interconnected risks and extreme management, is still emerging, particularly since the COVID-19 pandemic highlighted areas like ripple effects in supply chains. Yet, resilience measurement remains narrow in scope. Thus, there is still an urgent need for broader modeling approaches that integrate insights from supply chain management, reliability engineering, economics, and social science.

  This project aims to fortify the resilience of the UK's food supply chain through three main research objectives (RO). These packages focus on aligning stakeholders, understanding community perspectives on food system resilience at various levels, and offering insights to shape the strategies of governments and businesses against potential disruptions. The key areas of focus are:

  RO1: Assessing the resilience of the UK's food system, evaluating the effects of global food security challenges on the UK's strategies, including food reserve quantities, infrastructure capacity, and annual maintenance planning.

  RO2: Enhancing proactive resilience in the food supply chain, particularly through strategies for stockpiling food rotation.

  RO3: Improving community preparedness for potential disruptions in the food supply chain, including strategies for post-disruption responses (e.g., resource allocation and distribution).

  Our methodology combines qualitative and quantitative techniques to analyze various supply chain models. We will carry out in-depth interviews with key stakeholders, including government bodies, businesses, and NGOs, to evaluate the state of the UK's food system (RO1). Additionally, we aim to advise the UK on reserving specific food items and managing their rotation according to an optimal schedule (RO2). In the event of a disruption, we will also focus on the strategic allocation of stockpiled food, taking into account diverse societal and environmental factors (RO3).
- Key words: Supply chain resilience, UK food system, stockpiling rotation, dynamic programming
- References:

  - Ahumada, O., & Villalobos, J. R. (2009). Application of planning models in the agri-food supply chain: A review. European journal of Operational research, 196(1), 1-20.
  - Behzadi, G., O'Sullivan, M. J., Olsen, T. L., & Zhang, A. (2018). Agribusiness supply chain risk management: A review of quantitative decision models. Omega, 79, 21-42.
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- Liu, F., Song, J. S., & Tong, J. D. (2016). Building supply chain resilience through virtual stockpile pooling. Production and Operations management, 25(10), 1745-1762.
- Kendall, K. E., & Lee, S. M. (1980). Formulating blood rotation policies with multiple objectives. Management Science, 26(11), 1145-1157.
- Kim, B., Kim, J. G., & Lee, S. (2023). A multi-agent reinforcement learning model for inventory transshipments under supply chain disruption. IISE Transactions, (just-accepted), 1-23.
- Zhou, Q. S., & Olsen, T. L. (2017). Inventory rotation of medical supplies for emergency response. European Journal of Operational Research, 257(3), 810-821.

Harmonizing predictive and prescriptive analytics

- Supervisor: Associate Professor Gar Goei Loke, gar.g.loke@durham.ac.uk
- Description: I am keen to work with students who are interested in studying the differences between existing predictive analytics approaches, such as machine learning, and prescriptive approaches, such as optimization, in the broad scope of decision-making under uncertainty through the lens of mathematical and statistical models and analyses. Apart from solving emerging real-world problems in the joint predictive and prescriptive setting from healthcare and retail to supply chains and sustainability, I am keen to work with a student in developing fundamentally new methodologies that might over time come to replace the existing state-of-the-art methods, such as deep learning and reinforcement learning. Students with backgrounds in mathematics, statistics and / or data science are strongly preferred. Students with backgrounds in computing, engineering, econometrics, quantitative finance are also preferred. Students with backgrounds in related STEM fields (e.g. computational biology) or social science or business with specializations or minors in quantitative areas (such as quantitative economics or business analytics) can consider applying. Students with no quantitative experience will not be considered. Coding experience in languages such as Python, R, Matlab, Julia or similar languages are strongly preferred, while experience in languages such as C/C++, SQL, Java or similar can consider. In exchange, students will receive intense one-to-one technical training with me in areas of (graduate) mathematical optimization, stochastic processes and statistics, and will have the chance to collaborate with world-class leading researchers in the area through my networks. They will also receive very close supervision and guidance via experiential learning through research. Students with an inclination to pursue research careers after their PhDs are also strongly preferred. If prospective applicants are interested, I can also provide contacts to my graduated and current students who could give a better and more personal picture of the process of collaborating with me. Students are highly recommended to read my publications to get a feel of what they would be getting themselves into. If interested, students should contact me as soon as possible.

Unravelling Innovation Ecosystem Networks and Firm Behaviours

- Supervisors: Associate Professor Stephanie Scott email s.a.scott@durham.ac.uk Assistant Professor Farzana Chowdhury email farzana.chowdhury@durham.ac.uk Associate Professor Zsofia Toth email zsofia.toth@durham.
- Description: Innovation ecosystems have become a crucial resource to provide firms with regionally accessible business support; thus, becoming a cornerstone to many worldwide economic development agendas, policy initiatives, and social development goals. Lauded by policy-makers and innovators alike, there is a growing evidence-base that reflects effective ecosystems *may* enable and unlock various socio-economic benefits; including venture creation, new technologies, and economic growth. However, the rapid explosion of interest in this concept has been outpacing the empirical and theoretical development within the literature. This has led to many concerns, as the reasons why wide-sweeping benefits are often sought but not appropriated, investments fail to reach their full potential, and the process of establishing and engaging with such complex systems without adequate returns remains elusive in research and practice. It is becoming evident that firms are not behaving as predicted within these systems, leading to many questions as to what motivates and incentivizes firms to engage with ecosystems, how these systems can be configured for optimal functionality, and, thus, how embedded resources can be harnessed. As an example, while much of the work on innovation ecosystems to date suggests a symbiotic relationship between the way firms and entrepreneurs behave in a facilitative business environment, studies have largely overlooked the need to simultaneously consider actor characteristics and behaviours within the context of their network structures and the ecosystem literature. This gap demonstrates a need to further explore how this interaction and the evolution of the systems links to well-established theories (i.e., knowledge spillover activities). Furthermore, methodological complexity has constrained many studies to provide merely contextual descriptions of place-based models from a macro-level conceptualisation, which has the potential to oversimplify a far more complex phenomenon and diverts attention away from crucial value-creating activities occurring on the micro-level. Therefore, the research team welcomes Ph.D. project proposals that aim to further theorize the behaviors of actors within ecosystem networks, the facilitative mechanisms that can enable knowledge spillovers, and further contribute to our understanding of how firms behave within these environments. We strongly encourage applicants to consider longitudinal and social network methodologies in their proposals, but will consider a range of techniques suggested.
- References:
    - Audretsch, D. B., & Feldman, M. P. (2004). Knowledge spillovers and the geography of innovation. In *Handbook of regional and urban economics* (Vol. 4, pp. 2713-2739). Elsevier.
    - Granstrand, O., & Holgersson, M. (2020). Innovation ecosystems: A conceptual review and a new definition. *Technovation*, *90*, 102098.
    - Jones, C., Hesterly, W. S., & Borgatti, S. P. (1997). A general theory of network governance: Exchange conditions and social mechanisms. *Academy of*

management review, *22*(4), 911-945.
- Scott, S., Hughes, M., & Kraus, S. (2019). Developing relationships in innovation clusters. Entrepreneurship and Regional Development, 31(1-2), 22-45. https://doi.org/10.1080/08985626.2018.1537145
- Wurth, B., Stam, E., & Spigel, B. (2022). Toward an Entrepreneurial Ecosystem Research Program. Entrepreneurship Theory and Practice, 46(3), 729-778. https://doi.org/10.1177/1042258721998948

The strategic role of Corporate Digital Responsibility (CDR) in operations and technological innovations

- Supervisors **:** Associate Professor Zsofia Toth contact: zsofia.toth@durham.ac.uk, Associate Professor Efpraxia Zamani contact: efpraxia.zamani@durham.ac.uk, Associate Professor Stephanie Scott contact: s.a.scott@durham.ac.uk
- Description: Corporate Digital Responsibility (CDR) explores the significance of ethical and responsible use of digital technologies, and how companies can integrate it into their operations and innovation efforts. CDR aims to ensure the creation of sustainable and socially conscious business practices in a digitally enhanced business environment. Drawing on normative business ethics (or other alternative approaches), the project aims to theorise the role of CDR in operations and innovations, and identify business practices that hinder and/or enable CDR. At a practical level, the identification of business responsibility, accountability and the impact on successful innovation can inform how companies formulate CDR guidelines.
- References:
  - Lobschat, Lara, Benjamin Mueller, Felix Eggers, Laura Brandimarte, Sarah Diefenbach, Mirja Kroschke, and Jochen Wirtz. "Corporate digital responsibility." *Journal of Business Research* 122 (2021): 875-888.
  - Wirtz, J., Kunz, W. H., Hartley, N., & Tarbit, J. (2023). Corporate digital responsibility in service firms and their ecosystems. *Journal of Service Research*, *26*(2), 173-190.

On the Linkage Between Strategy and Innovation in Non-Entrepreneurial Firms

- Supervisors: Professor Lenos Trigeorgis, lenos.trigeorgis@durham.ac.uk, and Associate Professor Angelo Solarino, angelo.solarino@durham.ac.uk
- The project addresses the critical importance of innovation in maintaining competitive advantage in today's globalized and technologically changing business environment. It highlights a significant gap in the understanding and application of innovation within non-entrepreneurial firms. The study focuses on two primary areas of concern:
  - Conceptual Ambiguity: The term "innovation" is broadly used to encompass a variety of related concepts, which leads to a lack of clarity and theoretical consensus. This broad use of the term impedes the ability to fully understand and leverage innovation ideas in practice, as it encompasses a wide range of types and magnitudes of change within organizations.
  - Uncertain Performance Outcomes: There is a prevailing belief that innovation leads to positive outcomes for organizations; however, the actual impact of

innovation on performance remains uncertain. The study, by differentiating across different types of firm strategies and different types of innovation activities, aims to assess via a contingency model how firm strategy enhances innovation and how innovation in turn informs the strategy of the firm.

By focusing on these important issues and ambiguous theorizing, the proposed research underscores the necessity for a more nuanced and comprehensive approach to the study of innovation. It aims to address via an in-depth theorizing how the entire process of innovation is informed by the strategy of the firm and vice-versa, and specifically how the firm's innovation activities shape its strategy.

This project contributes to theory development on the linkages between strategy and innovation. It thus helps fill a research gap by existing frameworks that mainly see innovation and strategy as independent from each other or (at best) as having a sequential relationship in that one is an antecedent of the other whereas this research focuses on understanding their interactive linkages.

- References:

  - Ballot, G., Fakhfakh, F., Galia, F., & Salter, A. (2015). The fateful triangle: Complementarities in performance between product, process and organizational innovation in France and the UK. *Research Policy*, 44(1), 217-232.
  - Crossan, M. M., & Apaydin, M. (2010). A multidimensional framework of organizational innovation: A systematic review of the literature. *Journal of Management Studies*, 47(6), 1154-1191
  - Guo, H., Wang, C., Su, Z., & Wang, D. (2020). Technology push or market pull? Strategic orientation in business model design and digital start-up performance. *Journal of Product Innovation Management*, 37(4), 352-372.
  - Keupp, M. M., Palmié, M., & Gassmann, O. (2012). The strategic management of innovation: A systematic review and paths for future research. *International Journal of Management Reviews*, 14(4), 367-390
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Sustainability and Board of Directors Investment Decisions

- Supervisors: Professor Lenos Trigeorgis, lenos.trigeorgis@durham.ac.uk, and Associate Professor Angelo Solarino, angelo.solarino@durham.ac.uk
- The proposed research will examine the consequences of the shift from shareholder-focused to stakeholder-oriented sustainability practices on the firm strategic decision making with regard to the sustainability. The study will focus on the aspect of Board of Director's (BOD's) tendency towards short-term profits and its inadequate integration of Environmental, Social, and Governance (ESG) strategies into the firm's business model. The study aims to address changes in the BOD's approach to investment decisions, exploring how sustainability orientation can affect the BOD's

decision-making process, leadership, and the company's sustainability agenda.

The study makes a dual practical and theoretical contribution: On a practical level, it provides actionable insights for corporate leaders and boards of directors on integrating sustainability into strategic decision-making processes. This includes developing frameworks for incorporating Environmental, Social, and Governance (ESG) considerations into business practices and long-term strategic planning. By doing so, it aims to shift the focus from short-term profit maximization to long-term value creation for a broader set of stakeholders, including shareholders, employees, communities, and the environment. On the theoretical level, the study enriches the existing body of knowledge on corporate governance and sustainability by examining the dynamics between board advisory roles and the implementation of sustainable practices. It explores the mechanisms through which boards can effectively oversee and influence the integration of ESG strategies, thereby contributing to the broader discourse on the evolution of corporate governance models in response to global sustainability challenges. It aims to contribute by extending Forbes & Milliken's (1999) model to capture the role of sustainability on board processes and decision making.

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Cold-Turkey vs. Descending-Ladder: A Sustainable Anti-Fatigue Reward System Design

- Supervisors: Professor Neil Walton, neil.walton@durham.ac.uk and Assistant Professor Yanlu Zhao, yanlu.zhao@durham.ac.uk.
- Description: In this project, our goal is to create a reward system that sustainably incentivizes and combats user fatigue. We are inspired by gaming platforms and service systems (such as call centers), where users and players may become overly addicted (or feel compelled) to engage with the reward system, often without adequate breaks. It's well-documented that fatigue can lead to health and mental issues, as well as increase the likelihood of errors in service delivery. Our objective is

to design a sustainable reward mechanism that encourages users to take breaks, without significantly diminishing user satisfaction or reducing platform revenue. This project will utilize the repeated principal-agent theory and the partially observable Markov decision process method for its model formulation. We will then compare two policies and provide both theoretical and managerial insights. Collaboration with a gaming company and a call center is anticipated. Ultimately, this project aims to produce at least one research article for submission to an operations management academic journal.

- Key words: Mechanism design, anti-fatigue, repeated principal-agent, partially observable Markov decision process