Institution: Aston University

Unit of Assessment: 17 Business and Management

Title of case study: Enhancing productivity and competitiveness of small and medium sized enterprises in the UK and India through low carbon initiatives

Period when the underpinning research was undertaken: 2014 – 2021

Details of staff conducting the underpinning research from the submitting unit:

Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Prasanta Kumar Dey	Professor	2004 to present
Soumyadeb Chowdhury	Dr	2017 to 2020
Pawan Budhwar	Professor	2003 to present
Chrisovalantis Malesios	Dr	2018 to 2020

Period when the claimed impact occurred: 2016 to 2021

Is this case study continued from a case study submitted in 2014? No

1. Summary of the impact

Research at Aston University has led to productivity and competitiveness related impact both at national and global levels by reducing the carbon footprint of 100 UK and 20 Indian energy-intensive SMEs from a wide range of industries. Across the Low Carbon SMEs project, calculated average energy cost and CO2e savings per company reached £8,879 and 40 tonnes CO2e, respectively. **[E7]**

The project enhanced SME competitiveness by improving resource and energy efficiency, optimising processes and logistics, and enabling the businesses to adopt effective renewable energy, eco design and waste management strategies. This led to increased overall efficiency, and improved the productivity, performance and social welfare standards of the businesses. Testimonial evidence obtained indicates at company level the project helped to:

- Reduce emissions by an average 120 tonnes of CO2 equivalent (CO2e) **[E8]**
- Accelerate business growth by an average of 10% **[E8]**
- Achieve an average annual energy cost reduction of £33,000 **[E8]**

2. Underpinning research

Presently, climate change is the world's foremost challenge. To keep the global temperature rise within 1.5C, worldwide industries must be carbon neutral by 2050 (or 2041 according to WMCA). Although many large organisations have launched sustainability and low-carbon initiatives, these are still uncommon in small and medium-sized enterprises (SMEs).

The reasons are well documented, SMEs typically prioritise economic over environmental performance (**R1, R2, R5**). But SMEs make up around 90% of the world's businesses and employ 50-60% of its population. There are 5.7 million UK SMEs, employing approximately 15.8 million people and generating approximately 47% of GDP. UK SMEs will contribute £240 billion to the economy by 2025 – 19% more than now (**R5**). There are also 42.5 million SMEs in India, employing approximately 106 million people (40% of the workforce) and accounting for 45% of India's total manufacturing output (**R1, R2**).

While SMEs play a significant role in economic development, they are also collectively (**R1**) voracious consumers of resources and energy, and generate significant levels of waste. Further, environmental measures undertaken by SMEs have been poor compared to large

companies. Data suggests SMEs generate more than 70% of industrial pollution (**R1, R5, R6**) and account for 50% of UK's energy consumption. The UK government's objective to improve energy efficiency in SMEs by over 20% by 2030, saving over £6 billion and 22 million tonnes of CO2e, means significant intervention is required.

The research was led by Dey with colleagues from the Operations and Information Management (O&IM) and Work and Organisations Departments at Aston University's Schools of Business and Engineering and Applied Science. The projects were funded by the British Council, European Regional Development Funding (ERDF), Marie Sklodowska-Curie actions (Horizon 2020), and the Royal Academy of Engineering.

The research developed analytical frameworks using Data Envelopment Analysis (DEA) (**R2**), Structural Equation Modelling (SEM) (**R3**) and case studies (**R5, R6**). It analysed the impact of sustainability practices (from lean practice, logistics optimisation and renewable energy adoption to energy efficiency measures and waste management through the reduce, reuse and recycle philosophy) on sustainability (economic, environmental and social) performance.

The comparative analysis of SMEs in developed (UK) and emerging (India) economies revealed the current state of sustainability practices and their performance, and the challenges and critical success factors (**R1**). The research explored the factors that influence the uptake of sustainability practices, including staffing, sales turnover and geographical location. It also considered psychological and social wellbeing at work and its effect on sustainability.

Using DEA to measure the energy efficiency of SMEs helps develop techniques for improving SMEs' sustainability performance (**R2**). The research also developed an analytical framework to link sustainability practices with business growth to objectively determine which environmental measures have the greatest impact on that growth (**R3**).

The research established the relationship between specific sustainability practices – such as lean approach (**R4**) and sustainability-oriented innovation (**R5**) and sustainability performance in both UK and Indian SMEs (**R4, R5**). It also developed a diagnostic tool that enables SMEs to move towards a circular economy (reduce, reuse, recycle) (**R6**) and its effectiveness has been robustly demonstrated.

3. References to the research

R1 Dey, P. K., Petridis, N., Petridis, K., Malesios, C., Nixon, J. D. & Ghosh, K., 2018, Environmental Management and Corporate Social Responsibility Practices of Small and Medium-sized Enterprises, *Journal of Cleaner Production,* 195, p. 687-702. https://doi.org/10.1016/j.jclepro.2018.05.201

R2 De, D., **Chowdhury, S**., **Dey, P. K.** & Ghosh, S. K., 2020, Impact of Lean and Sustainability Oriented Innovation on Sustainability Performance of Small and Medium Sized Enterprises: A Data Envelopment Analysis-based Framework, *International Journal of Production Economics*, 219, 416 – 430. https://doi.org/10.1016/j.ijpe.2018.07.003

R3 Malesios, C., Skouloudis, A., **Dey, P. K.**, Abdelaziz, F. B., Kantartzis, A. & Evangelinos, K., 2018, Impact of Small and Medium-sized Enterprises Sustainability Practices and Performance on Economic Growth from a Managerial Perspective: Some Modelling Considerations and Empirical Analysis of Results, *Business Strategy and Environment,* 27, 7, 960-972. https://doi.org/10.1002/bse.2045

R4 Dey, P. K., Malesios, C., Abdelaziz, F. B, **Chowdhury, S.**, De, D., (2020), The Impact of Lean Management Practices and Sustainable Oriented Innovation on Sustainability Performance of Small and Medium Sized Enterprises: Empirical Evidence from the UK, *British Journal Management*, 31, 141-161. https://doi.org/10.1111/1467-8551.12388

R5 Dey, P. K., Malesios, C., De, D., **Chowdhury, S.** & Abdelaziz, F. B., May 2019, Could Lean Practices and Process Innovation Enhance Supply Chain Sustainability of Small and Medium sized Enterprises? *Business Strategy and the Environment*, 28, 4, 582-598. https://doi.org/10.1002/bse.2266

R6 Dey, P. K., Malesios, C., De, D., **Budhwar, P. & Chowdhury, S.**, (2020), Circular Economy to Enhance Sustainability of Small and Medium Sized Enterprises, *Business Strategy and the Environment*, https://doi.org/10.1002/bse.2492

Key Funding:
G1 British Council, UKIERI, £15,912: Climate change issues and environmental performance of Indian small and medium sized enterprises, in collaboration with Jadavpur University, Kolkata, India

G2 European Commission, ERDF, £3,448,582: Low Carbon SME

G3 European Commission, Marie Sklodowska-Curie actions (H2020), £158,661: UNIFORM

G4 Royal Academy of Engineering, Industry/Academic Partnership Programme, £49,092: Circular Economy Adoption within Small and Medium sized Enterprises in India and the UK

Indicators of research quality are the publication of research outcomes in established academic peer-reviewed journals and the securing of peer-reviewed research funding from established public and private sectors bodies.

4. Details of the impact

The research has had a significant impact on 120 SMEs, based in the UK and India by:

- Improving energy efficiency and reducing carbon emissions **[E1-E6]**
- Increasing resource efficiency and recycling, and reducing waste **[E1,E4,E6]**
- Enhancing overall productivity and business performance, leading to job creation **[E2, E6]**
- Motivating SMEs to shift towards more renewable energy resources **[E3, E6]**
- Enabling SME growth plans/expansions **[E4]**
- Enabling SMEs to gain ISO 14000 and AS9100B certification **[E1,E3,E6]**

In the UK, the Low Carbon SMEs project supported the aim of Priority Axis 4 of the European Regional Development Fund's (ERDF) operational programme "to move England's economy towards a low carbon model by reducing greenhouse gas emissions, increasing the share of renewable energy and enhancing energy efficiency". It has led to major impact via the implementation of low carbon interventions across 100 West Midlands SMEs.

Beneficiaries received specialist support to reduce their carbon footprint through diagnostics, financial support via energy efficiency capital grants, workshops and collaborations with Aston University researchers. This led to an average annual reduction of 120 tonnes of CO2e per company, average energy cost saving of £33,000, average carbon footprint reduction of 27% and average increase in business growth of 10% **(E8).**

Aligned with the 'Make In India' and 'Clean India' missions of the Government of India, Aston University also collaborated with several Indian universities to enhance the sustainability performance of 50 Indian SMEs. In India, process re-engineering and benchmarking were used to assess the SMEs' environmental and social parameters, set targets for enhanced performance, and implement improvement projects.

The impacts of Aston University's research extended across the state of West Bengal in India, through transforming the environmental sustainability landscape of SME members of the Federation of Micro Small & Medium Industries (FOSMI). This work led to 20 SMEs reducing their carbon footprint by 20% each, experiencing business growth by an average of 10% with at least two jobs created per company **(E2).** FOSMI's elected president commented "*We hope to replicate this success by expanding this initiative to the rest of our 1,000 SME membership*

and encourage our network of 27 other industry consortia to accelerate their transition to a low carbon economy" **(E2).**

As a direct impact of Aston University's research leadership, the project developed strong links with the Gauge and Tool Makers Association (GTMA), a leading UK-based trade association representing over 300 companies in the manufacturing industry sectors. GTMA recognises the project's value and contribution, and now seeks to strengthen the partnership by expanding this initiative across GTMA's wider network of other regional trade associations [source: GTMA website].

Examples of the research's direct impact at a company level include:

Advanced Engineering, UK
Advanced Engineering successfully transitioned to a greener company through low carbon technology adoption and improvements to manufacturing processes. Slashing their carbon footprint by 60 tonnes of CO2e (a 25% drop) led to the company winning the sustainability runners up award at the 2019 Make UK Manufacturing Awards [source:https://ae-uk.net/news]. The Quality Manager, stated: "*We have been able to grow as a company and become more competitive"* **[E5].**

Paint360, UK
Low Carbon SMEs proved instrumental in scaling up Paint360's production processes by creating capacity to recycle paint more effectively; achieving an embedded carbon saving of 250,000kg C02e per year. Wider benefits included reducing the carbon footprint of their supply chain by minimising wastage across their contracts (e.g. with Amey and Travis Perkins). The Owner of Paint360 stated *"Aston University has been a great support for significant transformation in the scalability of our operations and will help us achieve our master plan of ten sites throughout the UK"* **[E4].**

Frank Dudley Limited, UK
Frank Dudley significantly reduced their relative carbon footprint by 215 tonnes equivalent to 26% and £78,000 per year in avoided energy costs. Improving company-wide environmental performance and transitioning to the new ISO 14001:2015 standard enabled the business to bid for new work and diversify their portfolio of products and services into the agricultural machinery and rail sectors. **[E9].**

ESW Knowles, UK
ESW Knowles has become a more socially responsible employer having reduced their carbon footprint by 116 tonnes, a 32% drop, and increasing waste recycling rates. Moreover, the firm has been able to bid for more work since meeting the pre-requisite procurement environmental requirements of customers **[E1].**

Precision Transmission Chain (PTC), India
Aston University supported PTC in realising their vision of transforming into a low-carbon operation by reducing energy consumption and operating costs by 25%, and enabling successful product diversification into the aerospace industry; which led to an average business growth rate of +10%. A Partner at PTC, stated "*Working with the University has proved instrumental in the successful transformation of our company"* [**E3**].

Neogi Technologies and Research Ltd, India
The Low Carbon SMEs project improved Neogi's overall business performance; refining key manufacturing processes through adopting circular economy models and implementing lean and six-sigma approaches**.** Lowered production costs by achieving a company-wide carbon footprint reduction of 40% and reducing energy costs by 12%. These interventions led to enhanced business growth of 10% and job creation within the company and across the supply chain **[E6]**.

5. Sources to corroborate the impact

[E1] Statement from the Managing Director of ESW Knowles stating the impact of our research on improving environmental and business performance.

[E2] Statement from the Elected president of the Federation of Micro Small & Medium Industries (FOSMI) stating the impact of our research on members of the India-based consortium.

[E3] Statement from a Partner at Precision Transmission Chain stating the impact of our research on improving environmental and business performance.

[E4] Statement from the Managing Director of Paint 360 Ltd stating the impact of our research on improving environmental and business performance.

[E5] Statement from the Quality Manager at Advanced Engineering stating the impact of our research on improving environmental and business performance. Advanced Engineering website: www.ae-uk.net/news/tag/ukmanufacturing

[E6] Statement from the Director at Neogi Technologies stating the impact of our research on improving environmental and business performance.

[E7] Low Carbon SMEs Methodology Report, setting out the evidence and methodology behind project-level calculated carbon savings.

[E8] Compilation of testimonial letters providing evidence of measurable impacts at company-level

[E9] Statement from the Managing Director at Frank Dudley stating the impact of our research on improving environmental and business performance.