

The Strategic University Steel Technology and Innovation Network Presents

Task 4: UK Digital Steel Innovation Hub (DSIH)

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Giovanni Montana, Warwick



EPSRC

Engineering and Physical Sciences
Research Council



Positioning of T4

Table 2: An overview of the initial core research activities.

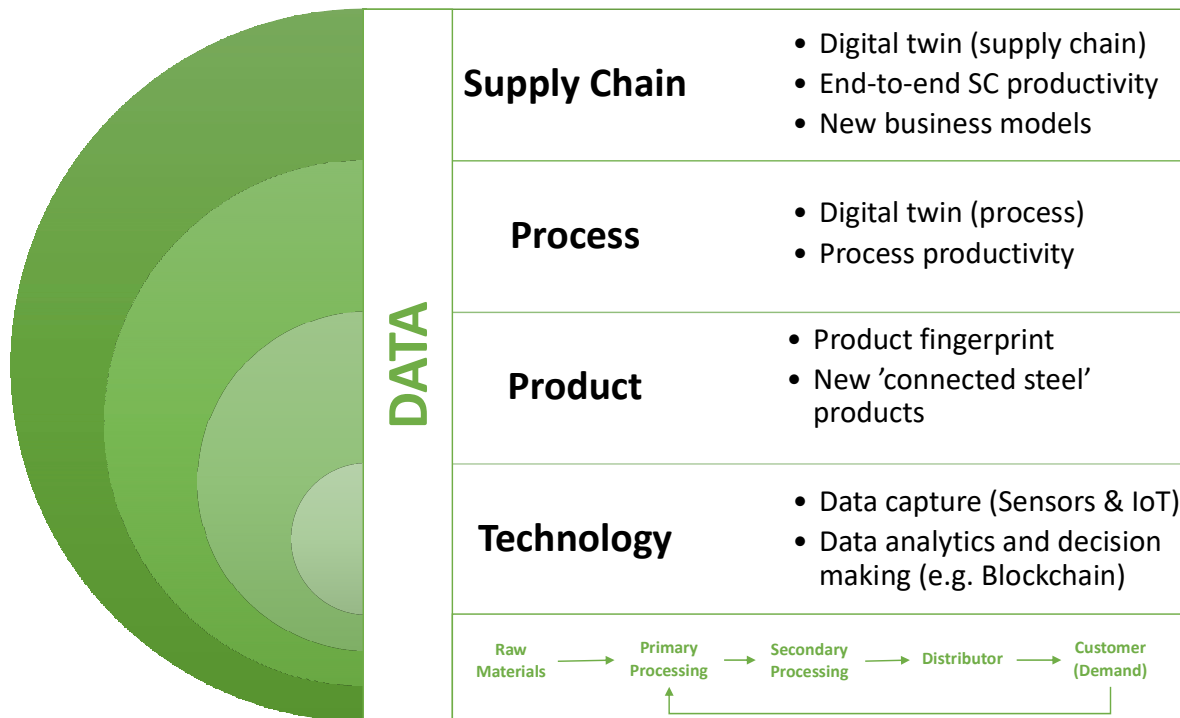
		<u>STRATEGIC PRIORITIES</u>	<u>ACTIVITIES AND RESOURCE</u>			<u>SCIENTIFIC CHALLENGES</u>	
GCRA 1	T1	TEmissions Management & Utilisation SP1	Carbon conversion / environmental pollution	Sheffield (PS) & Swansea (AB)	2 x RF	Computational modelling & big data High temperature reactions & kinetics	
	T2	Zero Waste Steelmaking SP2	Integrated steelmaking to reprocess waste	Sheffield (RT) & Swansea (PH)	1 x PhD 1 x RF		
	T3		Scrap segregation and utilisation	Sheffield (RT) & Warwick (ZL)	1 x PhD 1 x RF		
	T4	Data Driven Innovation SP3	Digital Steel Innovation Cluster	Swansea (AB), Warwick (JG, GM) & Sheffield (JL)	2 x RF 2 x PhD		
	T5		Intelligent steel production	Sheffield (RT) & Warwick (MA)	2 x RF		
GCRA 2	T6	Smart low energy production SP4	Thermal Efficiency	Swansea (CPP, DW)	1 x RF 1 x PhD		Metallurgical Rules Characterisation & monitoring
	T7		Disruptive processes: DRI and near net shape casting	Warwick (ZL & CD)	2 x PhD		
	T8	New processes for new products SP5	Smart sensors for real-time measurement	Swansea (CPP) & Warwick (CD)	1 x PhD 1 x RF		
	T9		Late stage product definition and integration	Sheffield (EP & BW) & Warwick (BS)	1 x RF 1 x PhD		

An aerial photograph showing a large industrial steel mill complex on the left side, characterized by numerous rectangular buildings, pipes, and infrastructure. To the right of the mill is a vast, dense forest with a mix of green and autumn-colored trees. The word 'Aim' is written in white text in the upper right corner of the image.

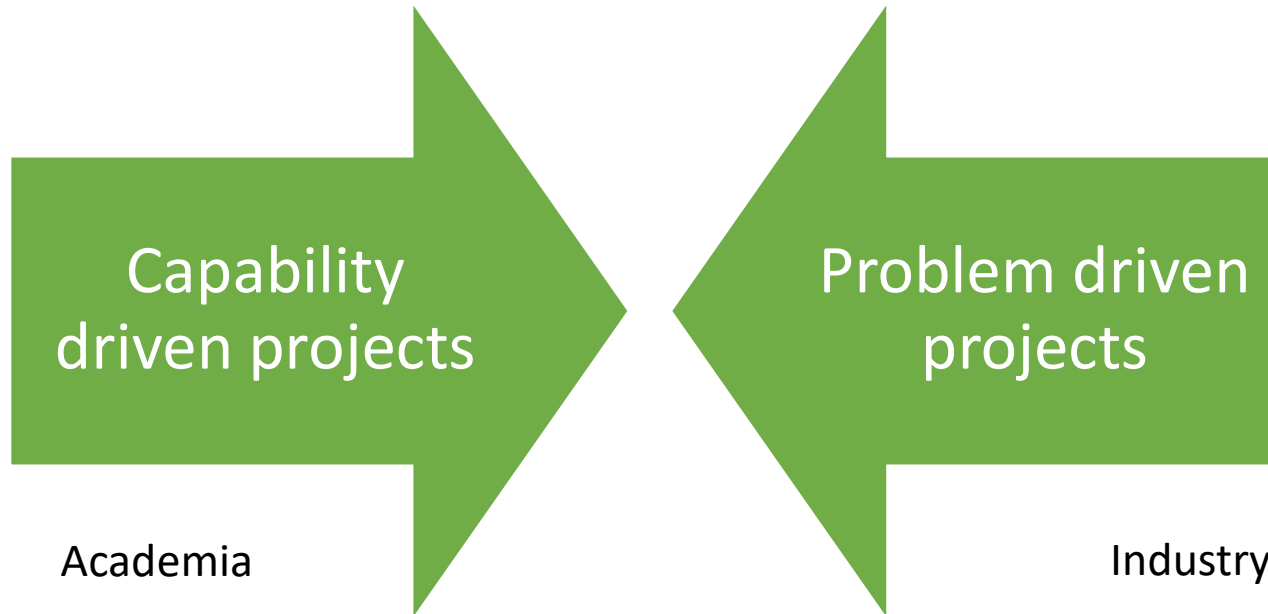
Aim

The digital steel innovation hub is a dynamic network that provides industrial partners with the opportunity to rapidly identify promising data driven innovations and funding for further development

Broad opportunity for digital steel innovation



Brings together...

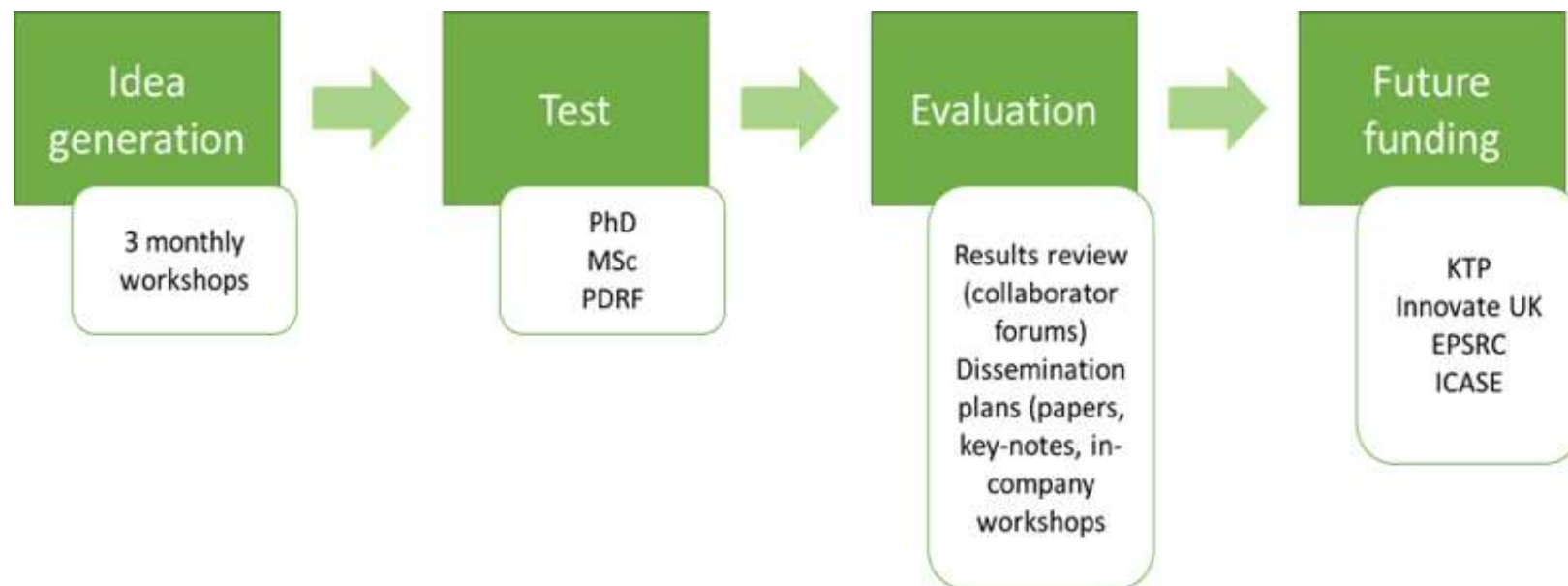


Broad range of academic capability

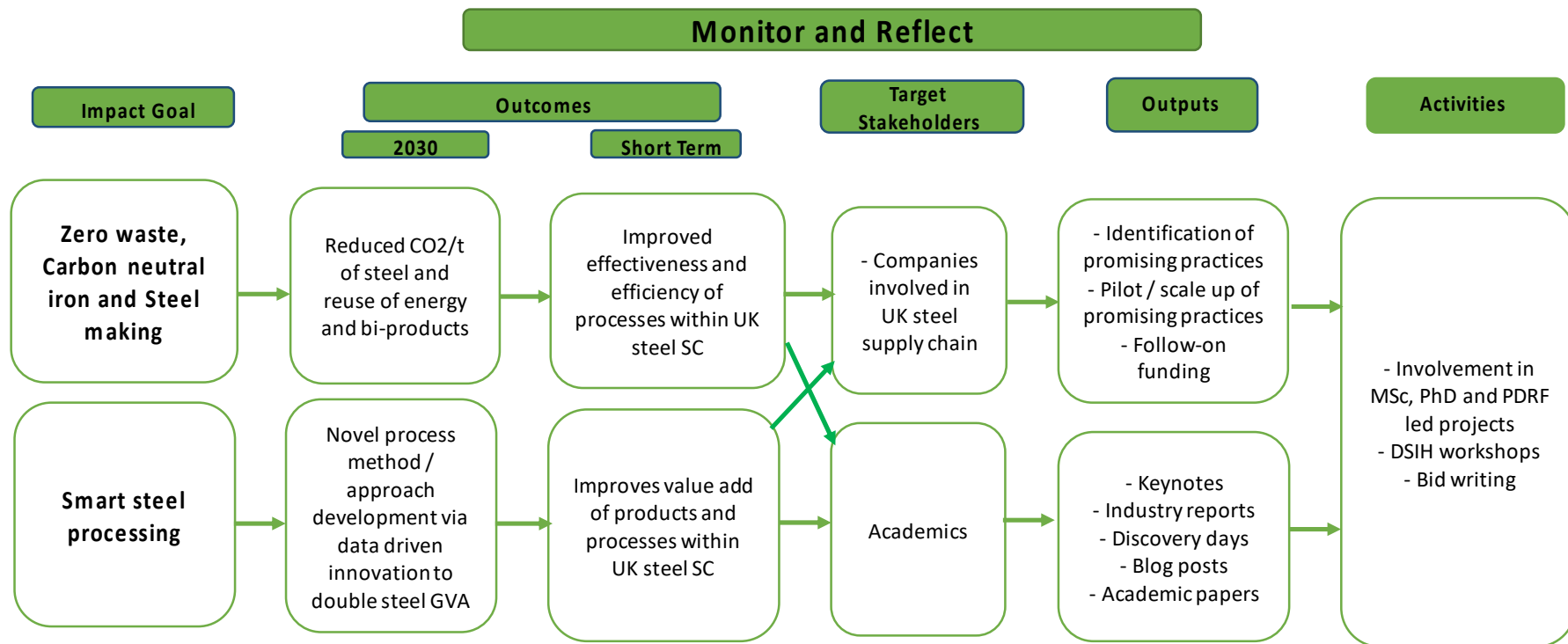


University	Academic	Expertise
Sheffield	Prof. Jonathan Linton	Operations and Technology Management
Swansea	Prof. Arnold Beckmann	Computer Science
Warwick	Prof. Jan Godsell	Operations & Supply Chain Management
	Prof. Giovanni Montana	Data Science

Platform for further funding



Projects with real impact

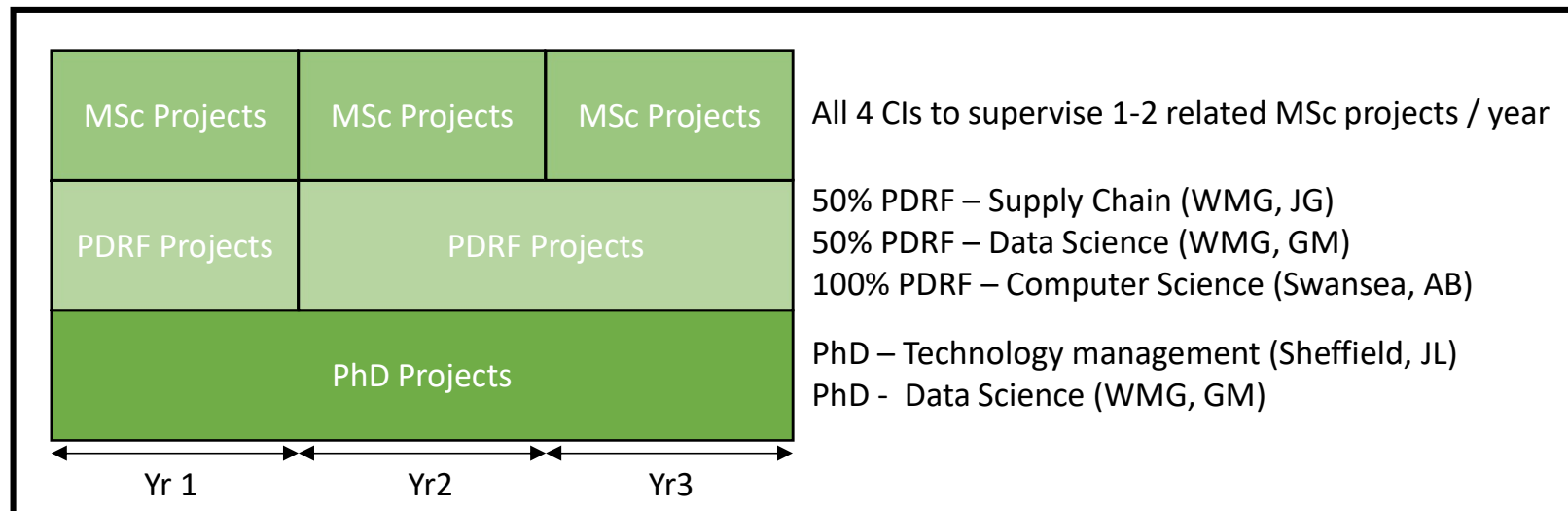


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Resources & capabilities



3 types of resource with different cadence...



Operations & Technology Management

PhD project: Utilization of Machine Learning for Learning from Process Data

- PhD Project – Utilization of Machine Learning for Learning from Process Data – PLS (a technique pioneered in intelligent design for pharmaceuticals) will be utilized to assess process data and extract further insights from Industrial Design of experiments.
- Expected outcomes, include:
 - Insight into which existing sensors provide redundant data
 - Underlying factors associated to data that have an impact on desired outcomes
 - Insight into obtaining desirable characteristics and avoiding undesirable characteristics by direct or indirect control of specific settings and sensor readings
 - Insight into the extent that existing process sensors/data measurement model underspecify outcomes/characteristics of product
- Current status
 - Awaiting administrative approval to advertise and recruit student
- Interests and Strengths
 - Technology Innovation Management
 - Digitalization
 - Business Model Innovation
 - Opportunity Recognition (new utilization of existing technology and products)
 - Process Management (e.g. see project on prior slide)
 - Sustainable/Close Loop Supply Chains
 - Environmental Management and Product Life Extension

Computer Science

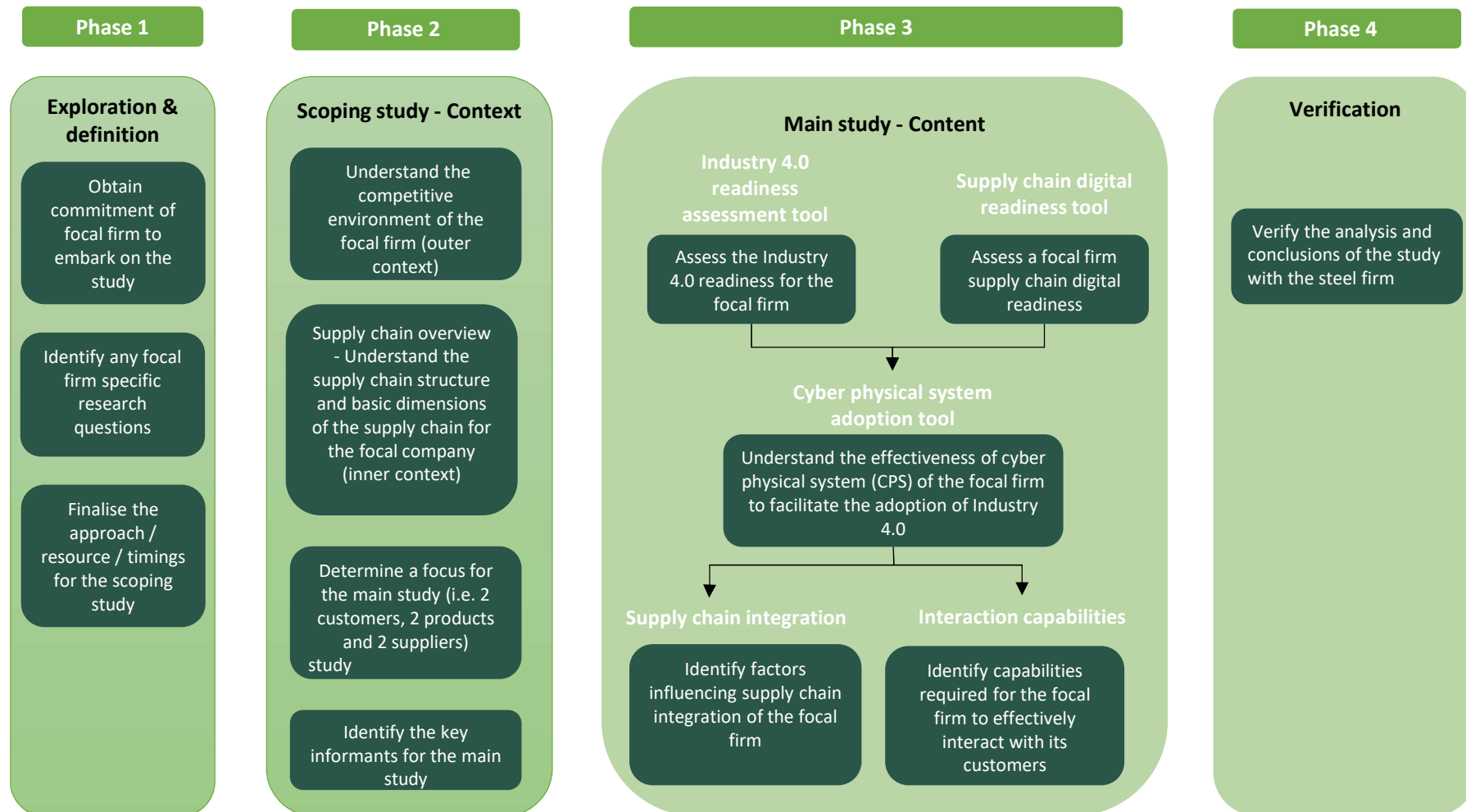
PDRF project: Model Driven Development of Digital Frameworks for Knowledge Engineering



- Model Driven Software Development capabilities
 - in context of CPS, IIoT, I4.0, digital twins
- Knowledge Engineering capabilities
 - Towards autonomous decision making
 - Capture knowledge precisely but flexibly
 - Software agents for knowledge management
- Advanced research capabilities
 - Complexity analysis and reduction
 - Formal methods for flexibility and adaptability of models and digital frameworks
 - Distributed Ledger Technologies for steel supply chain security/ product fingerprints/ traceability/ etc.

Operations & Supply Chain Management

PDRF Project: SC Digital Readiness Assessment



Data Science

PhD project



In this PhD project we will develop advanced artificial intelligence algorithms for sequential decision making for applications in smart steel processing. We will develop novel data-driven techniques that leverage the latest advances in data science and machine learning. We will also establish a “digital twin”, a simulation-based environment to help us test and develop novel reinforcement learning algorithms.

Data Science

PDRF project: Machine Learning for Sequential Decision Making

- As part of this project we will develop new technologies based on deep artificial neural networks and probabilistic models for sequential decision making with applications in Smart Steel Processing. We will exploit existing historical data repositories made available by our industrial collaboration and the availability of next-generation sensors that are now replacing traditional sampling methods in extreme environments.
- We will also develop novel reinforcement learning methodologies using deep learning and their applications in digital steel manufacturing
- Ultimately, we will be instrumental in delivering an AI system prototype able to automate and optimise certain processes that still rely heavily on manual intervention.



The
University
Of
Sheffield.

EPSRC

Engineering and Physical Sciences
Research Council



Swansea University
Prifysgol Abertawe



SUS  **AIN**
Future Steel Manufacturing Research Hub



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STEEL**



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GROUP**

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STEEL UK**

**SHEFFIELD FORGEMASTERS
INTERNATIONAL**



**LIBERTY
STEEL**

TATA STEEL