

Working Together to Commercialise Graphene Applications

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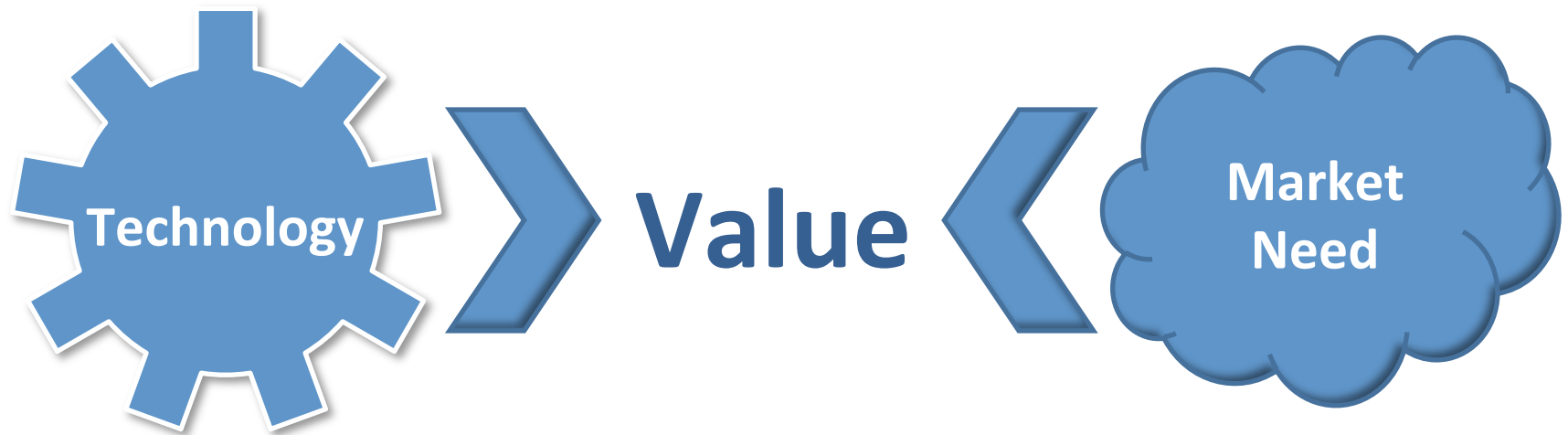
The Graphene Special Interest Group

HVM Graphene+ 2014 Conference
Oxford, UK

www.hvm-uk.com

15th May, 2014

Successful technology enabled innovation



A Strategy for chemistry-enabled innovation

- First half of 2013
- Examined how the use of chemistry can further add to the UK economy
- Started from the market need end of innovation



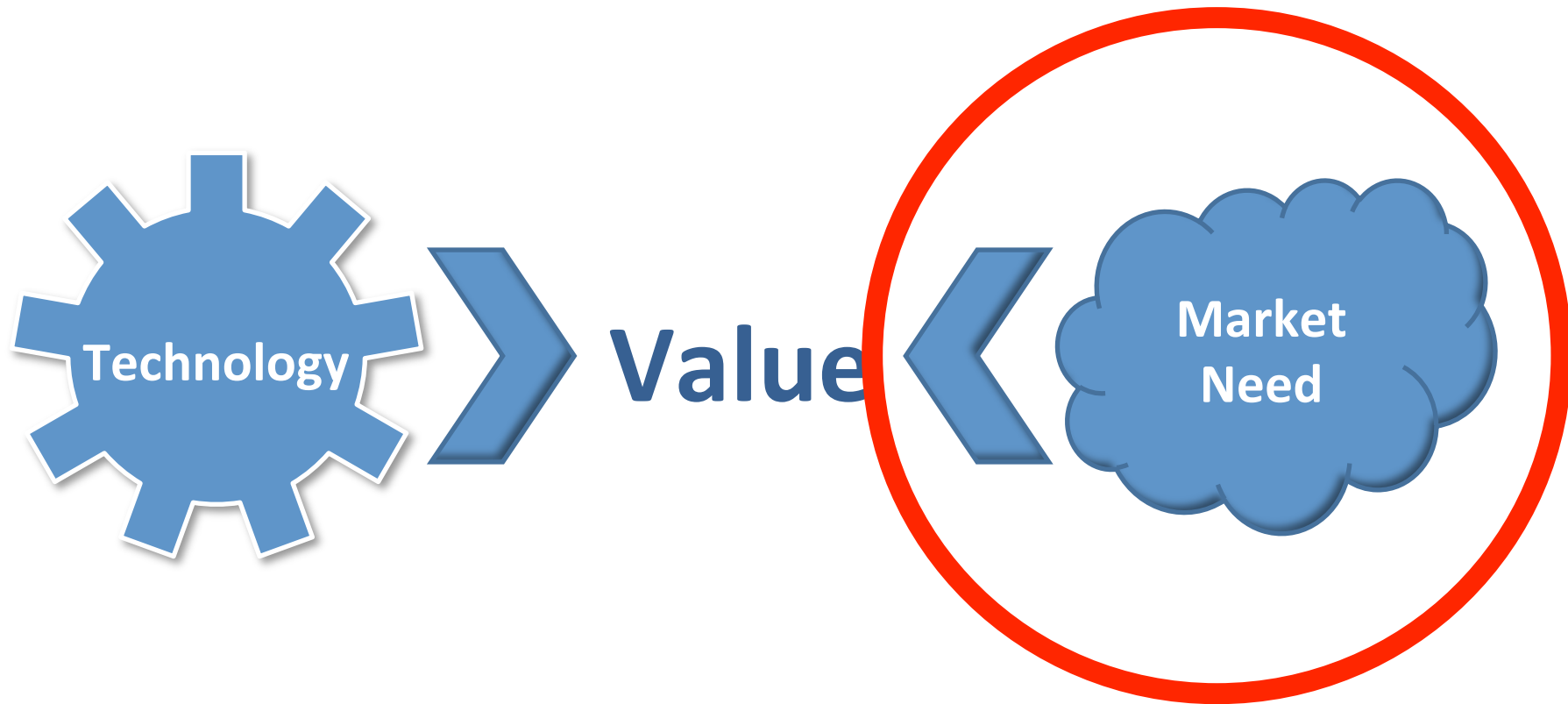
Examined the UK priority industry sectors



Uncovered many needs and opportunities

Aerospace	Lightweight materials and formulated products for lower cost and environmental impact
Automotive	Low carbon vehicles with improved driver experience
Construction	Sustainable, low carbon buildings delivered through the value chain
Energy	Delivering secure, economical, sustainable energy
Life Sciences	Personalised treatments requiring niche, high value products with improved delivery
Food	Food for the world: nutritional, pleasurable, and sustainable
Home & Personal Care	Delivering desired functionality to a demanding consumer base using natural ingredients and clever formulation
Chemicals Manufacturing	Manufacturing chemicals more competitively and sustainably from a variety of feedstocks

Successful technology enabled innovation



Identified three focus areas for innovation

Raw materials for the 21st century

Smart manufacturing processes

Design for functionality

Renewable feedstocks

Unconventional
oil and gas

Scarce metals and
minerals

Chemical processes

Biological
transformations

Resource efficiency

Novel materials and
their creation

Formulated products

Design for a circular
economy

Prerequisite: Sustainable and with compelling UK advantage

One of these: Novel Materials

The efficient design and manufacture of chemical entities, materials and systems which offer desired functionality

Novel materials and their creation

- Designing, developing and manufacturing novel materials and material systems specified to deliver desired effects
- Materials including sensor materials, piezoelectric elements, semiconductors, and magnets, as well as reinforced composites and multi-layered films
- The assembly and manufacturing methods which create novel materials and systems through additive manufacture, 3-D printing, layer deposition, net shape manufacture, self-assembly and such

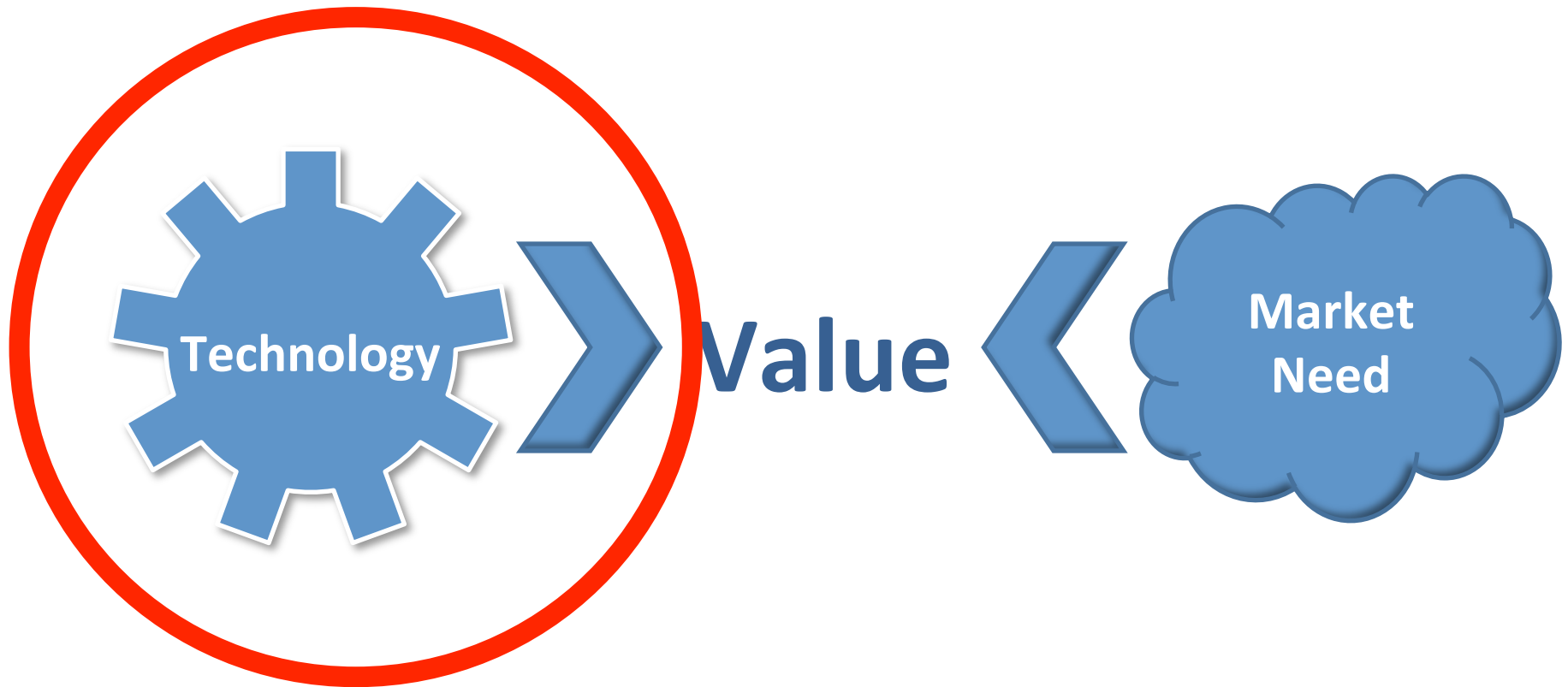
Formulated products

- The fundamental application of physical chemistry and other sciences, design methodologies, numerical and experimental, production approaches
- Provision of the component ingredients to create formulated products by combining several ingredients

Design for a circular economy

- Business models, design concepts and materials which enable an economy in which waste materials are put to use and where materials and products are recycled and re-used at end of life

Successful technology enabled innovation

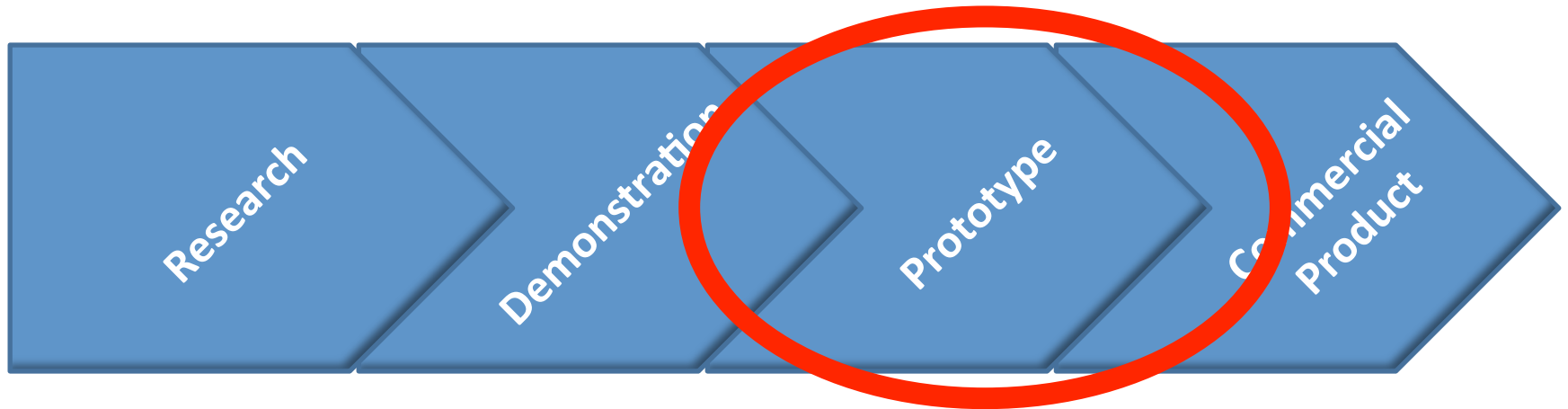


Graphene: a potential solution

- UK invested significantly in Graphene science capability
- Yet, no clear indication of the killer app
- And, businesses maintaining a watching brief
- Questions asked:
 - Where is Graphene on the journey to commercialisation?
 - Will fundamental properties translate in practice?
 - Can the graphene promise be delivered in applications?

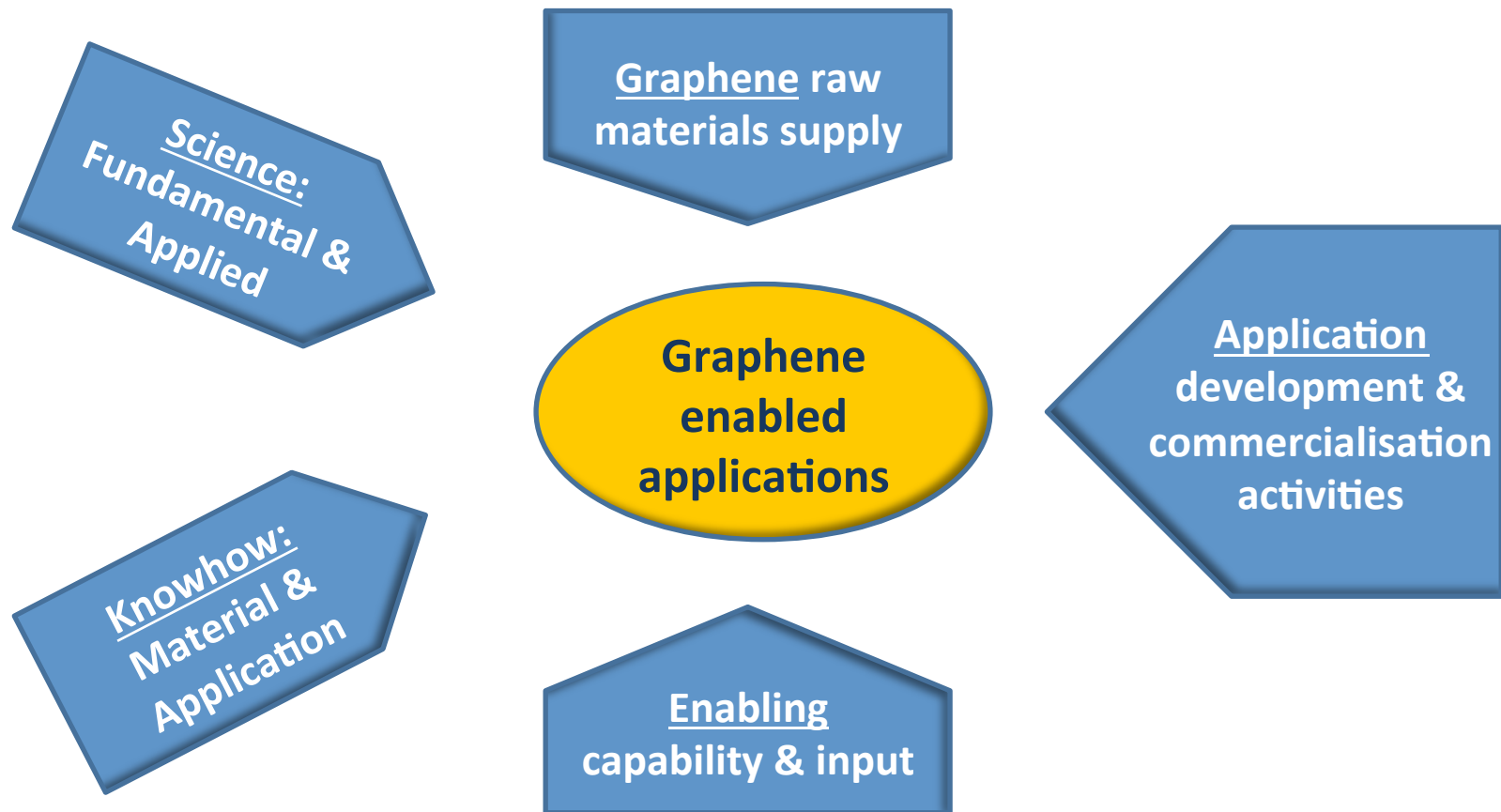


The journey to commercialisation



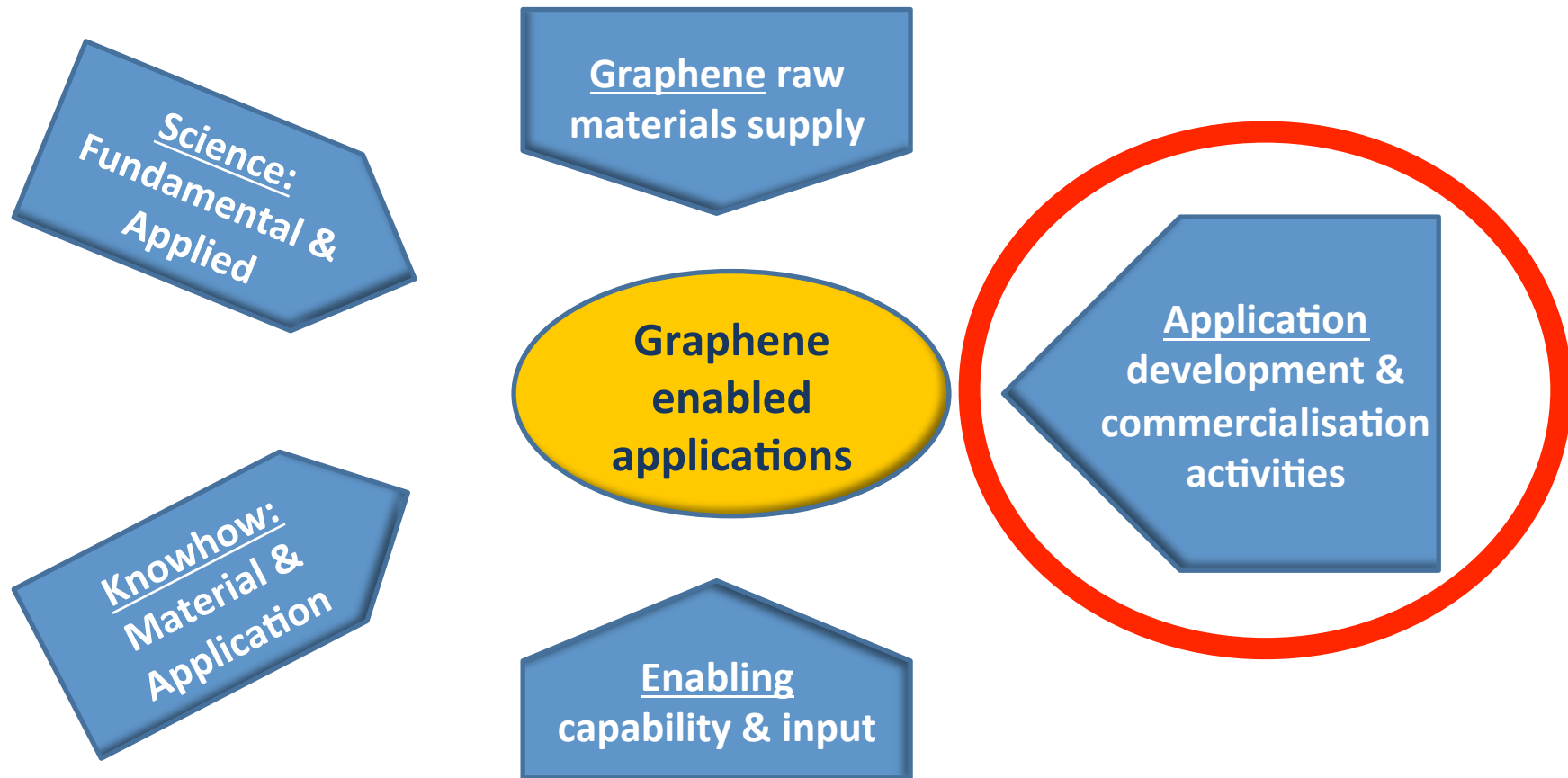
How long before graphene enabled products are commercial?

Who is needed to make it happen?



The Graphene value chain network

Who is needed to make it happen?

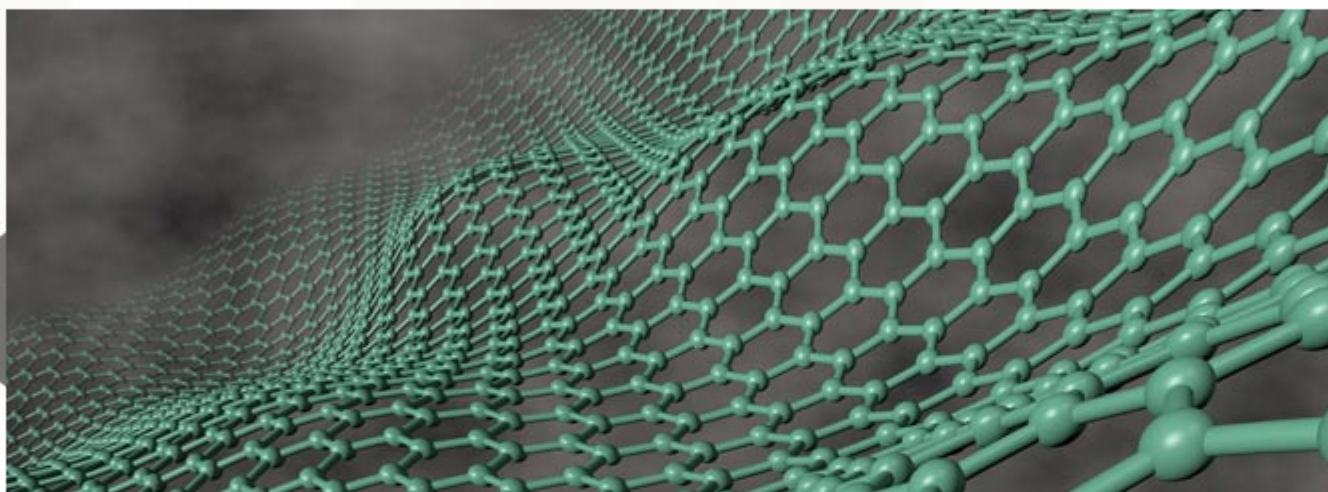


The Graphene value chain network

TSB funding competition

Realising the graphene revolution

[Home](#) / [Funding & support](#) / [Funding competitions](#) / [Realising the graphene revolution](#)



Status: Forthcoming

Key features: Investment of up to £2.5m in feasibility studies to accelerate commercial applications in the novel material, graphene.

Programme: Feasibility studies

Award: Up to £2.5m

Opens: 07 Apr 2014

Registration closes: 28 May 2014

Closes: 04 Jun 2014

Support phone number: 0300 321 4357

TSB has also established the Graphene SIG

- For the benefit of the Graphene community
 - Membership is open and free
 - Join via www.GrapheneSIG.net
- Requires engagement from the members
- Guided by the Graphene Innovation Leadership Board
- Supported by a dedicated management & delivery team
- Funded by the Technology Strategy Board and operated by the Knowledge Transfer Network

What is keeping us busy?

- Supporting the TSB funding competition:
Realising the Graphene Revolution
- Establishing the Graphene Innovation Leadership Board
- Mapping the UK capability and activity community
- Building www.GrapheneSIG.net as a focal point to benefit the graphene community

- The home of the Graphene SIG will provide a focal point
 - News articles
 - Events calendar
 - Public funding opportunities
 - Member and organisation profiles
 - Matchmaking
 - Offering ...
 - Seeking ...
- We welcome your ideas for added facilities

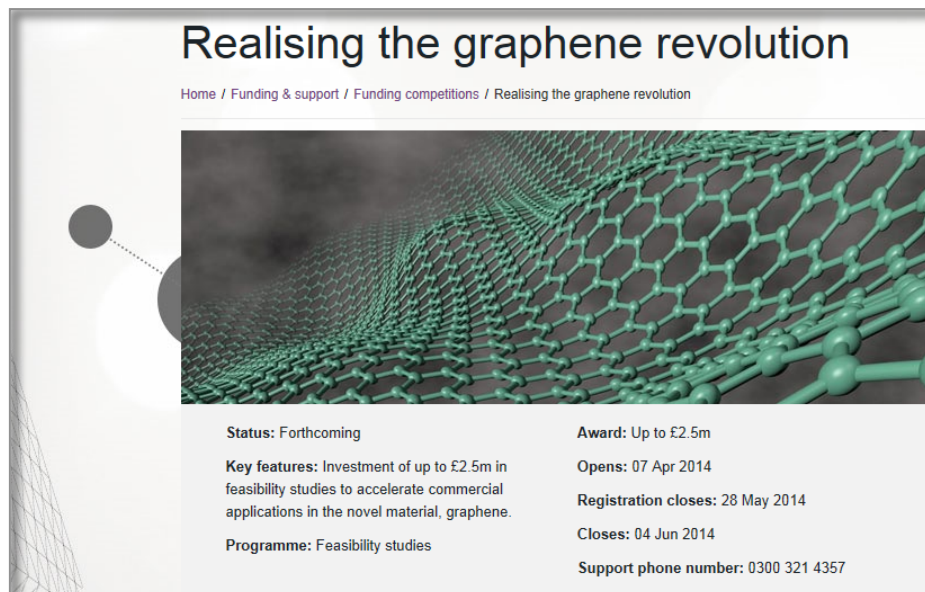
The screenshot shows the homepage of the Graphene Special Interest Group (SIG) website. The page features a navigation menu with links for Home, Networks, People, Organisations, and Events. A prominent 'Join this group' button is visible in the top right corner. The main content area is divided into several sections:

- Welcome to the Graphene Special Interest Group (SIG):** A introductory message stating the group's purpose and listing key activities: Leadership and a focal point for the exploitation of graphene by UK Industry, and A concerted resource to help connect and align the developing UK graphene value chain.
- Latest news:** A section with two news items: 'NPL measurement supports UK graphene company' and 'Beyond graphene: controlling properties of 2D materials'.
- Upcoming events:** A list of three events: 'HVM Graphene+ 2014' (15 May), 'Driving Supply Chain Innovation' (21 May), and 'Graphene Supply, Application & Commercialisation 2014' (12 Jun).
- Contact Details:** Information for the Graphene Special Interest Group, including a phone number (01928 515662), email (contact@GrapheneSIG.net), and website (http://www.GrapheneSIG.net).

The footer of the website includes the Technology Strategy Board logo and links for Terms & Conditions, Accessibility, Help & Support, and Feedback.

Supporting the funding competition

- Connecting organisations and companies wishing to participate with appropriate partners & consortia
- Providing answers to questions related to the competition
- Offering impartial advice on draft project proposals



The screenshot shows a webpage for a funding competition. The title is "Realising the graphene revolution". Below the title is a breadcrumb trail: "Home / Funding & support / Funding competitions / Realising the graphene revolution". The main image is a 3D rendering of a graphene lattice structure, showing a hexagonal grid of atoms in green and grey. To the left of the main image is a circular graphic with a white background and a grey border, containing a smaller version of the graphene lattice. Below the image, there is a table of key information:

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To commercialise Graphene, together ...

- Join the Graphene SIG:
 - www.GrapheneSIG.net
- Contact the team, e-mail:
 - contact@GrapheneSIG.net

Thank you for your attention

Extra slides

Contribution in the value chain

- Science - fundamental
- Science - applied
- Knowhow - application - Lab scale demo
- Knowhow - application - Large scale demo
- Knowhow - graphene manufacture process
- Enabling equipment - manufacture and supply
- Graphene production equipment - manufacture and supply
- Graphene raw materials - manufacture and supply
- Intermediate materials & components - manufacture and supply
- End use applications - manufacture and supply
- Standards & SHE
- Policy
- Funding
- Connecting & networking

Functionality Area

- Structural bulk materials (composites)
- Conductive bulk materials (electrical & thermal)
- Coatings (electrical conductive, thermal conductive, barrier)
- Membranes (separation, barrier)
- Printed electronics
- Opto-electronic devices
- Semi conductor electronics
- Sensors
- Biomedical functionality

Sectors

- Industry - SME
- Industry - Large E
- Academia
- Research Organisation
- Government and related