

POLYMERS & PLASTICS

Industry Overview Report
2017

DEFINING plastics and its component fields of research

OUTLINING challenges and trends for the sector

MAPPING plastics businesses in Norfolk and Suffolk

LISTING available sources of funding

NAME NEW ANGLIA
**ADVANCED
MANUFACTURING
& ENGINEERING**



European Union
European Regional
Development Fund

H HETHEL
INNOVATION

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We welcome feedback on the issues raised by this study and comments should be sent to:

info@hethelinnovation.com

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1. WHAT ARE POLYMERS & PLASTICS?

POLYMER ENGINEERING REFERS TO THE DESIGN, ANALYSIS, AND MODIFICATION OF POLYMER MATERIALS.

Polymers and plastics are commonly interchanged in casual conversation, but it should be noted that in the context of engineering, polymers are long chains of repeated units of chemical molecules called monomers and plastics are synthetic materials composed of polymers; plastics are synthetic materials made from polymers which can be moulded into shape before becoming set in its rigid form.

The British Plastics Federation (BPF) categorised the plastics sector into 20 groups (as shown in Figure 1).

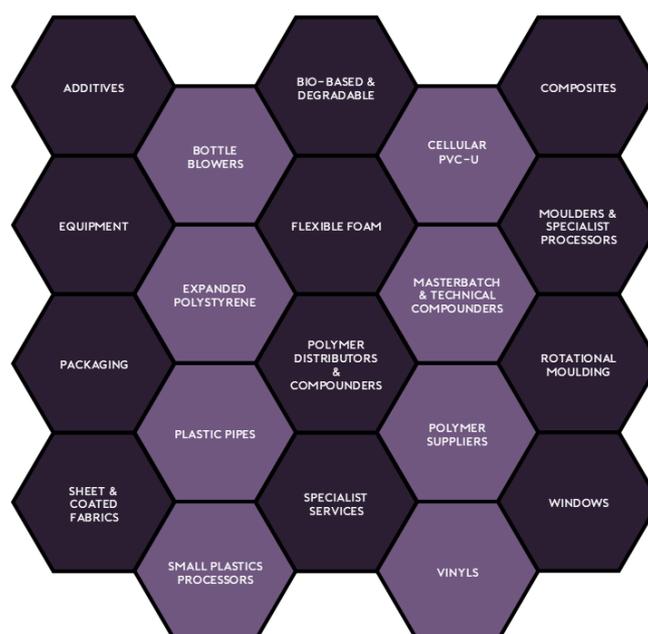


Figure 1. Grouping of businesses in the plastics sector¹.

The products and technologies produced from this sector benefit the entire economy because, so many other sectors rely on polymers. Figure 2, for instance, displays the degree to which a myriad of UK industries relies on the plastics sector in their applications.

UK APPLICATION SPLIT FOR ALL PLASTICS

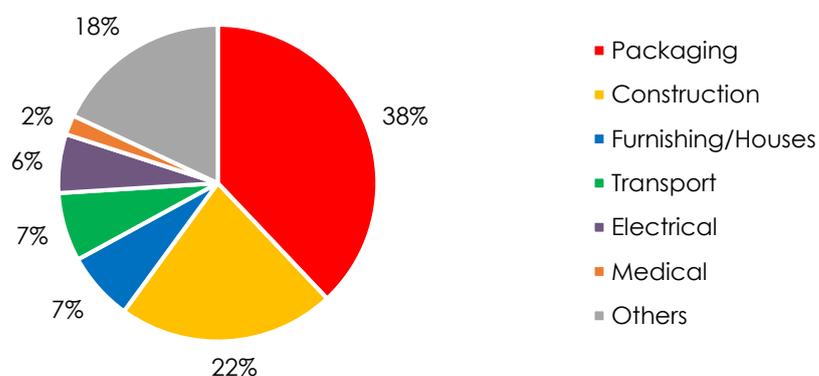


Figure 2. Industry shares of plastic consumption in the UK¹.

¹ Davis, P. (2011) *Challenges for the British Plastics Industry*.

2. CHALLENGES, TRENDS, & TRAJECTORIES

This section discusses the various global, national, and regional challenges and trends in the polymer sector as well as its future trajectory. The trend of increasing need and usage of disposable products in certain industries has resulted in greater utilisation of cheap plastics for alternative materials. Additionally, challenges such as reducing the volume of material going to landfill sites (especially with environmentally harmful plastics) has encouraged the development of biodegradable plastics and other disposal methods (e.g. energy from waste).

2.1. GLOBAL

Disposable Items

The price of products composed from synthetically polymer can be dramatically cheaper than those traditionally made from more robust yet valuable materials. This has affected several markets from consumer goods (example shown in Figure 2) to medical supplies. In medical applications in particular, the utilisation of single-use equipment reduces the risk of contamination patients.



Figure 3. Plastic Kodak FUN Flash disposable camera and the metal Canon Powershot G7 X Mark II camera (sold for ~£20 and ~£500, respectively).

However, this plastic revolution comes at a price: with these disposable products increasingly being used, more and more material is ending up in landfill sites or as litter.

Challenges Identified by the European Union

Across the world, only 4% of oil is used in the production of plastics¹ Europe also matches this global consumption with roughly 5% its oil usage utilised in plastics² (see Figure 3).

TOTAL EUROPEAN CONSUMPTION OF OIL

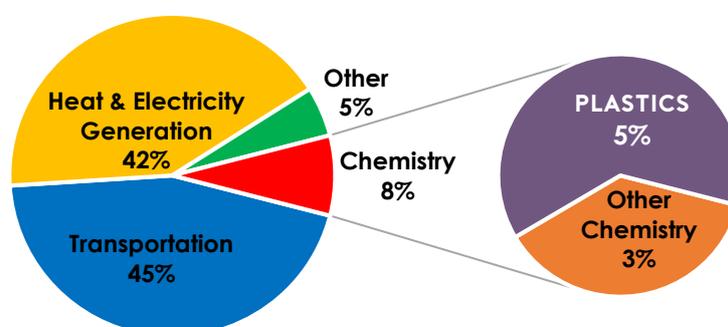


Figure 4. Break-down of Europe's oil consumption based on application².

¹ Davis, P. (2011) *Challenges for the British Plastics Industry*.

² **Plastics Europe** (2016) *Plastics – the Facts 2016*.

The European Union Commission Communication identified 3 issues facing the plastics industry³:

- 1) High dependence on virgin petrochemical feedstocks.
- 2) Low rate of recycling and reusing of plastics.
- 3) Significant leakage of plastics that is deteriorating the environment.

These challenges have also been identified on a national and a local scale. Because of this, collective efforts are being made on a macro- and a micro-scale to address these 3 prominent issues.

Sourcing Polymers from Renewable Resources

Lowering the planet's dependency on crude oil as a polymer feedstock is driving worldwide research towards developing polymers from natural and renewable resources. Modifying monomer structures from plant-based oils (e.g. sunflower, cotton, and linseed) into synthetic polymers could potentially prove to be a cheap alternative in the future⁴.

Despite their benefits, there are currently 2 main drawbacks of polymers from renewable resources: their limited mechanical properties and relatively higher prices in comparison to their traditionally-sourced counterpart⁴.

Efforts need to be made to ensure that these barriers are overcome as research into renewably and sustainably sourced polymers matures.

Circular Economy

The need to maximise plastic materials that are reused and recycled are synonymous to the concept of a circular economy (shown in Figure 6 below). Currently, a majority of the world practises a linear economy which includes: raw material feedstock, plastic production, product manufacturing, use, and finally disposal. This is an unsustainable model as the raw material is commonly sourced from crude oil which is a finite resource.



Figure 5. The circular life-cycle of plastics³.

³ **Plastics Europe** (2017) *Strategy on Plastics*. [Last accessed: 01/12/17].

⁴ **Musto, P.** (2013) *Grand challenges in polymer chemistry: energy, environment, health*. *Frontiers of Chemistry*, 1 (31).

2.2. NATIONAL

The following statistics covering the UK's plastic processing industry were sourced from the British Plastics Federation¹:

The following statistics covering the UK's plastic processing industry were sourced from the British Plastics Federation³:

- 4.8 million tonnes of material processed.
- 2.5 million tonnes of plastic materials produced.
- £13.1 billion of process sales turnover.
- 186,000 people employed.
- 3,000 primary processors.
- 7,430 companies in the polymer industry.
- Plastics industry turnover £19.0 billion.
- 25% of plastics products manufactured are exported.

The polymer industry is set to continue to grow as plastics consumption increase alongside the UK's dependence on polymers and plastics as it has over the years (see Figure 6).

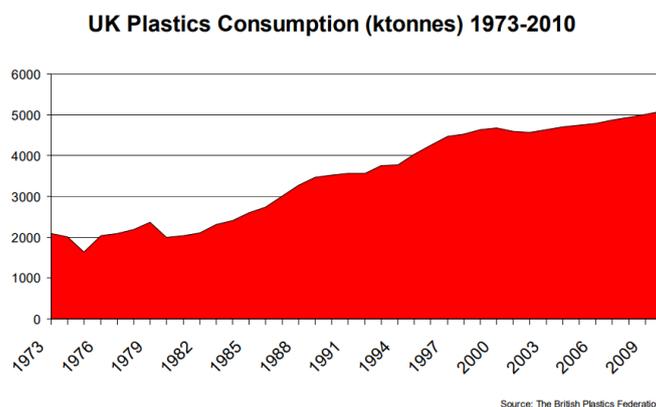


Figure 6. UK plastics consumption gradually increasing between 1973-2010¹.

¹ Davis, P. (2011) *Challenges for the British Plastics Industry*.

³ Davis, P. (2011) *Challenges for the British Plastics Industry*.

The Price of Crude Oil

In the UK, the price of oil from the Brent Oil Field (located in the North Sea) has increased since its discovery in the mid-20th century. Despite the price of oil decreasing over the past 5 years, the upward trend of oil prices is set to continue as reserves both in the North Sea as well as across the rest of the planet diminish and the price of oil increases with its resulting scarcity.

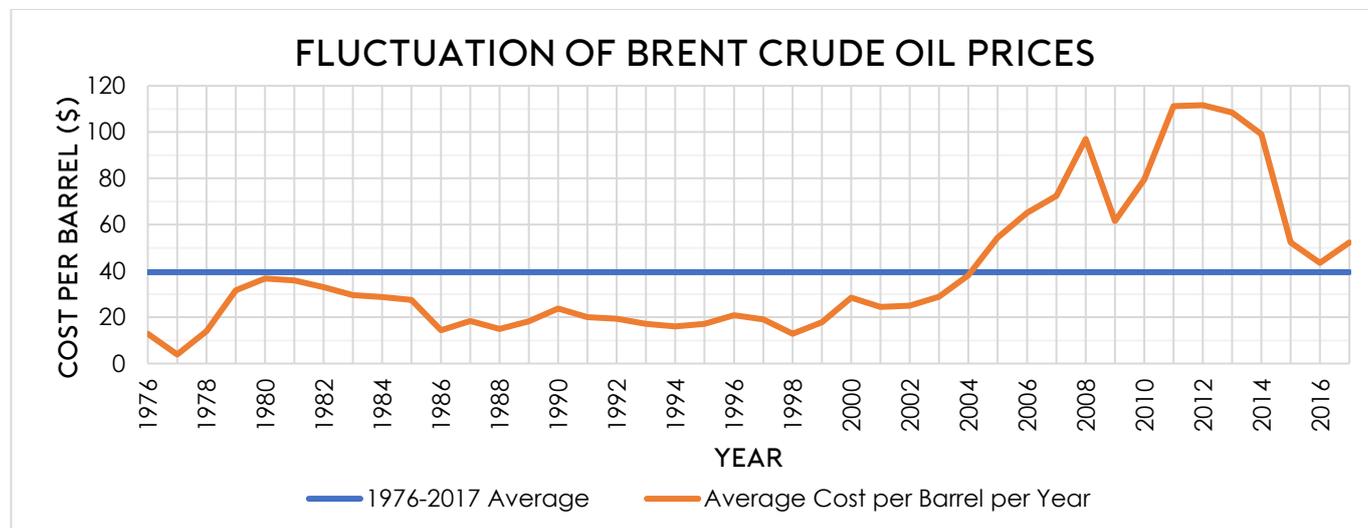


Figure 7. Price of Brent crude oil steadily increasing between 1976-2017⁵.

This affects polymer production as the main resource of materials for the polymer industry is crude oil. To address this issue, researchers and manufacturers have shifted their focus onto producing polymers, plastics, and composites from alternative materials.

In 2009, 3 leading organisations in the plastics industry – PlasticsEurope, the Packaging and Films Association (PAFA), and the BPF – launched its Plastics 2020 Challenge campaign in the UK. The aim of the challenge was set for consumers and government to step-up resource efficiency and stop sending plastic materials to landfill sites.

The following were examples of the commitments made to achieve these goals:

- Recycle plastics whenever possible.
- Utilising non-recyclable plastics as a source of thermal energy.

⁵ Statista (2017) - Average annual Brent crude oil price from 1976 to 2017 (in U.S. dollars per barrel). [Last accessed: 30/11/17].

2.3. NORFOLK & SUFFOLK

One of the main obstacles facing the development of Norfolk and Suffolk's polymer sector is increasing its productivity⁶. Figure 8 visualises how the social, economic, and physical challenges within Norfolk and Suffolk causes a regionwide skills shortage, low start-up rates, lack of skills training and social mobility, and limited start-up space.

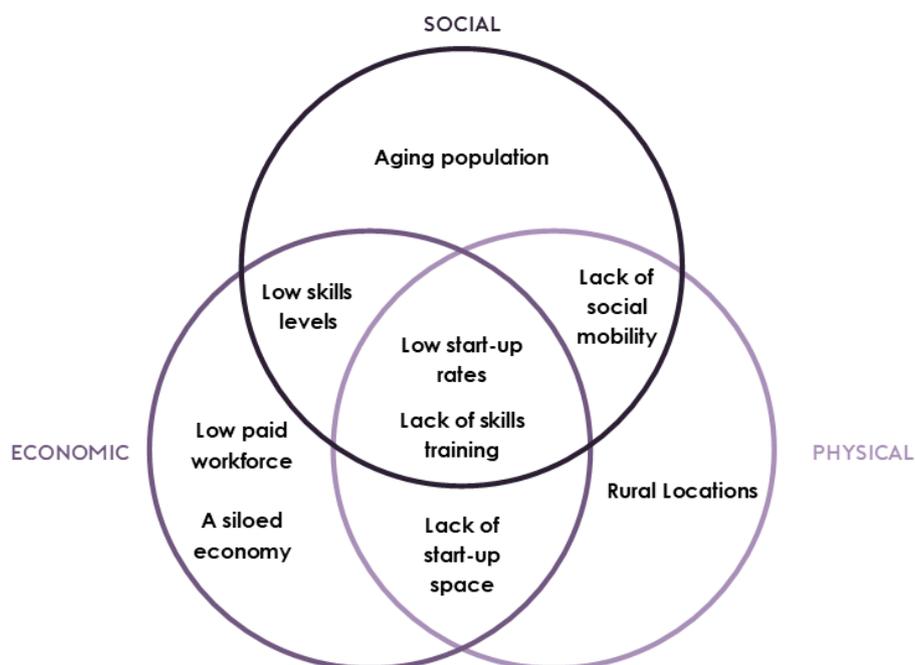


Figure 8. Social, economic, and physical challenges in Norfolk & Suffolk and their resulting outcomes.

In particular, the rural locations of Norfolk and Suffolk have hindered the development of its polymer sector as its infrastructure inhibits the mobility of people from in and around the region. Because of this, the transferral of skills and knowledge are limited and supply chains for the polymer industry are sparse.

Plastic Waste Management

Norfolk and Suffolk county councils both encourage their people reduce, reuse, and recycle their plastic materials – the former going as far as to offer financial incentives to non-profit groups (such as charities, churches, and schools) to collect and recycle materials⁷. Additionally, Norfolk County Council (NCC) have since expanded their range of plastics for kerbside collection⁸.

Despite the region is internationally recognised for its research, there are few core plastics companies (as opposed to services or suppliers) in Norfolk and Suffolk. Increasing this number will depend on meeting coordination challenges through better unity within the industry, investment challenges through attracting more investors into the region, and operational challenges through developing the existing infrastructure for the commercial development of the region's research.

⁶ New Anglia Local Enterprise Partnership (2015) *New Anglia Strategic Economic Plan*.

⁷ Norfolk County Council (2017) *Recycling credits*. [Last accessed: 01/12/17].

⁸ Norfolk County Council (2017) *Norfolk's Recycling Revolution is plastic fantastic*. [Last accessed: 01/12/17].

3. SECTOR INNOVATION MAP

The sector innovation map (shown in Figure 9) was made using the trends and areas of research outlined in Section 2 of this report. Going outwards from the centre of the map are the trends that are driving the sector; the areas of research that align with these trends; the emerging technologies; and finally, the types of market that will be created for or benefit from the sector's technological developments.

For instance, research is being conducted into harnessing energy from waste (EFW) to reduce the flow of waste material including plastics to landfill sites. SITA Suffolk is an EFW site based outside of Ipswich generated 175GW of energy from 260,000 tonnes of waste in 2015⁹.

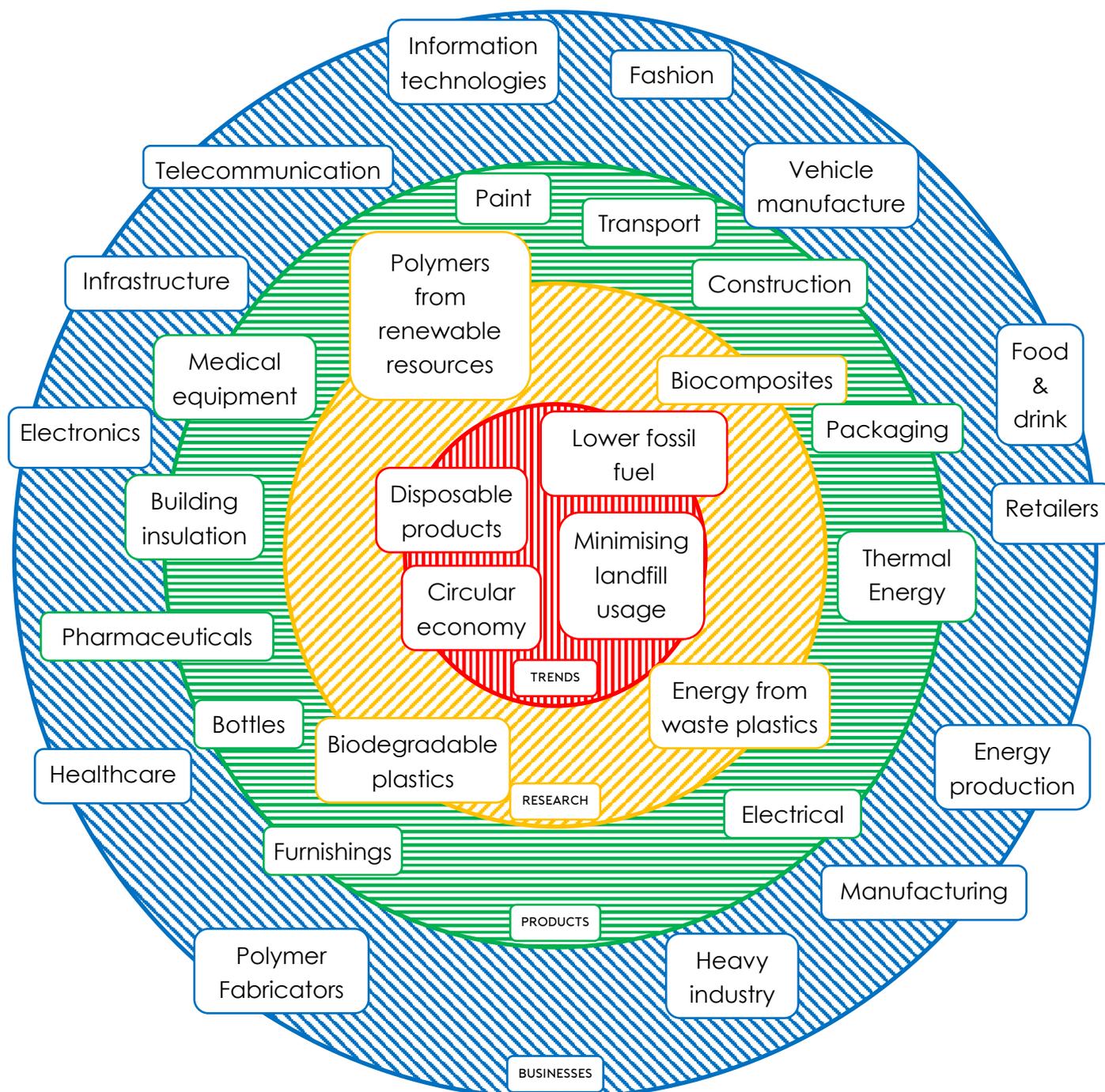


Figure 9. Polymer sector innovation map.

⁹ Suez (2015) Suffolk energy-from-waste facility annual report 2015.

4. POLYMERS IN NORFOLK & SUFFOLK AS WELL AS THE REST OF THE UK

Driving the development of the polymer sector are the research institutions and the businesses. The following sections discuss examples of these drivers and their impact on the sector's growth.

4.1. RESEARCH INSTITUTIONS

The Engineering and Physical Sciences Research Council (EPSRC) have designated almost £50mil in grants for UK polymer material research⁹. This funding went towards institutions (shown in Figure 10) researching polymers in applications such as energy, healthcare, information and communication technologies (ICT), engineering, and manufacturing future.



Figure 10. Locations of institutions across the UK to receive EPSRC grants for polymer research.

The EPSRC have donated over 100 grants across the UK for research and development of polymer materials. From Figure 10, one can see a distinct lack of institutions within Norfolk and Suffolk receiving funding from the UK's main body for funding research and training. However, the closest institution receiving the funding, Cambridge University, accrued over £5.6mil in grants (the second highest out of all the research institutions in the UK) (see Figure 11).

⁹ The Engineering and Physical Sciences Research Council (2017) *Polymer materials*. [Last accessed: 30/11/18].

PERCENTAGE OF TOTAL EPSRC FUNDING RECEIVED FOR POLYMER RESEARCH

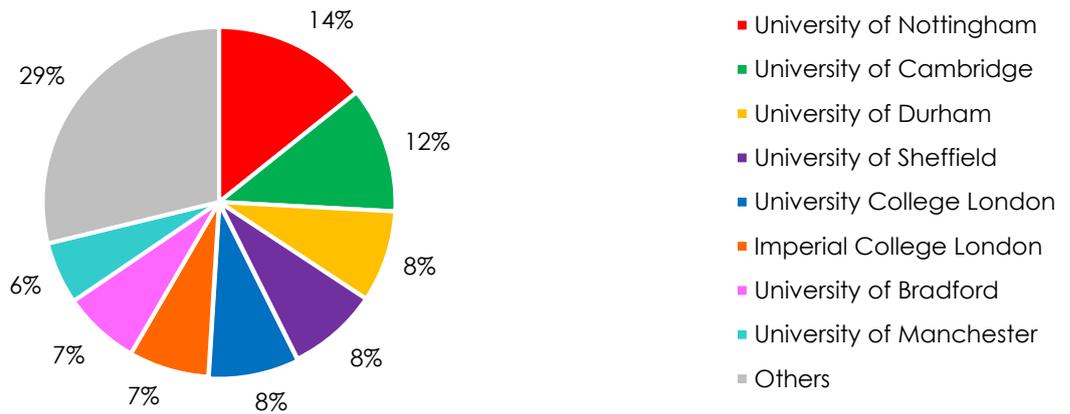


Figure 11. The nearest polymer research institute to Norfolk and Suffolk that received funding from the EPSRC, Cambridge University, received 12% of its £48.2mil donations.

The EPSRC provided funding for research across multiple fields (see Figure 12). Interestingly, over 40% of the funding went towards furthering the development of plastics in two areas: pharmaceuticals and biotechnology, and healthcare. This included studies into polymer-drug interaction and manufacturing bespoke, 3D printed organs (conducted at The University of Nottingham and University College London, respectively).

GRANT VALUE

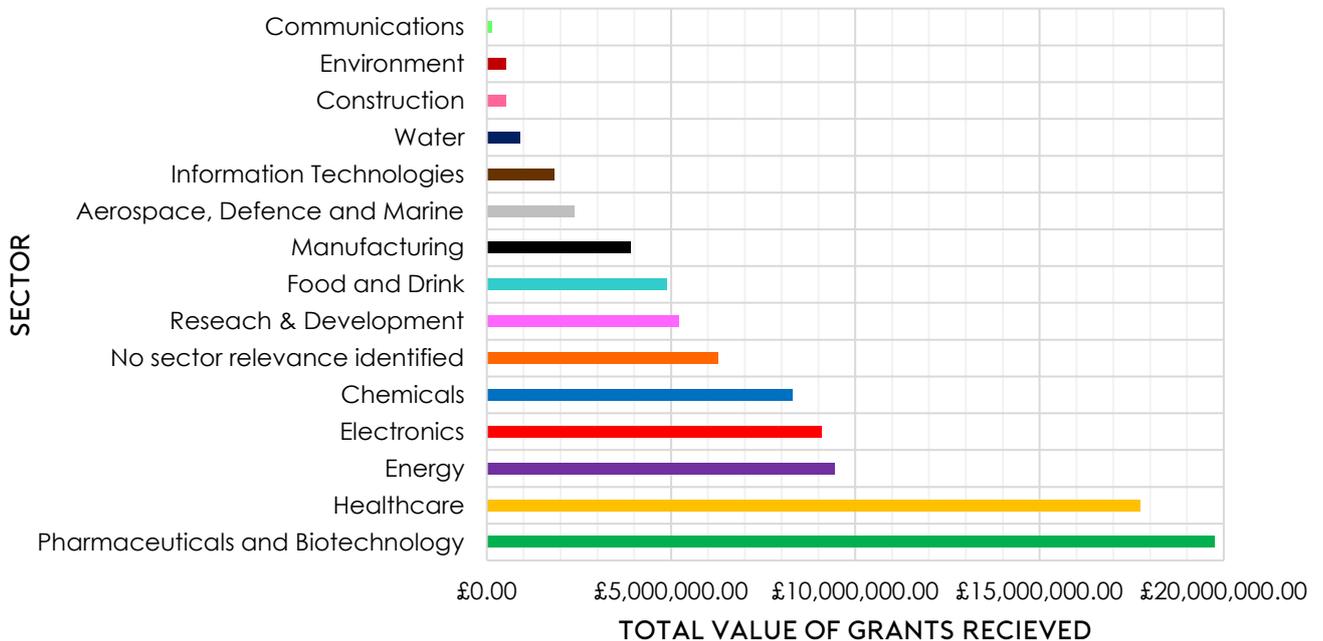


Figure 12: Breakdown of sectors receiving funding EPSRC for polymer research.

4.2. BUSINESSES

Figure 13 contains a map of Norfolk and Suffolk annotated with businesses involved in New Anglia's polymer industry (the complete list of these businesses can be found in Appendix A).

The companies cover a broad range of products and services including bottle manufacturing, polymer synthesis, injection moulding, and 3D printing.



Figure 13. Locations of polymer and plastics businesses across Norfolk and Suffolk

As seen in Figure 13, there are clusters of polymer and plastics businesses around Norwich, Norfolk, and Beccles, Suffolk. These clusters have developed their own specialisation in injection moulding and bottle manufacture, respectively – with companies in based in the latter being acquired by multi-national plastics firm, RPC Plastics.

4.3. INNOVATION PLATFORMS

Innovation platforms could propel the polymers and plastics industry within Norfolk and Suffolk in various ways: pop-ups, physical spaces, pilot schemes, and virtual platforms.

Pop-up events are sporadic interventions which are designed to stimulate people to innovate in exciting, challenge-led scenarios. Cross-sector meet-ups are arranged to inspire businesses in different industries that experience similar thematic issues with their companies.

Physical platforms are spaces which are dedicated to creating an environment to encourage people to interact with one another, collaborate, and potentially form long-lasting partnerships. These platforms are found in innovation hubs around the counties including Hethel Engineering Centre and Norwich Research Park as well as sector networks such as NAAME.

Pilot programmes bring together specific groups of businesses and people to address specific challenges in a thought-out manner. These can include special interest groups such as polymer businesses which can deliver benefits across multiple sectors.

Virtual innovation platforms eliminate the issue of physical isolation (as highlighted in Figure 8) as people can produce long-term innovation opportunities using tools and facilities that can be found on the internet. These facilities can take the form of online innovation platforms (OIPs), web directories, and online SME marketplaces. Examples of OIPs include Innovate UK, Bridgtidea, and Datastation which all provide innovative environments for businesses including those in the polymers and plastics industry.

ABOUT INNOVATION NEW ANGLIA

Innovation New Anglia is an innovation-led business support program operating throughout Norfolk & Suffolk. Through a range of tools such as online support, a collaborative learning platform, innovation grants & emerging sector networks, the program aims to help entrepreneurs & researchers' start-up businesses, and for SMEs to harness their innovation potential.

For more information on the project please visit: www.innovationnewanglia.com.

ABOUT ERDF

The Innovation New Anglia programme is partly financed by the European Regional Development Fund (ERDF) as part of their European Structural and Investment Funds Growth Programme 2014-2020. The Department for Communities and local government is the managing authority for ERDF. Established by the European Union, ERDF funds help local areas stimulate their economic development by investing in projects which will support innovation, business, create jobs, and local community regeneration.

ABOUT THE AUTHOR

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After graduating from The University of East Anglia with a Bachelors in Energy Engineering with Environmental Management, Matt joined the NAAME project at Hethel Innovation Ltd.. As NAAME's Network Coordinator, Matt provides support to manufacturing and engineering businesses in New Anglia (Norfolk and Suffolk), facilitating collaborations between academia and industry, as well as mapping sectors and businesses within the region.



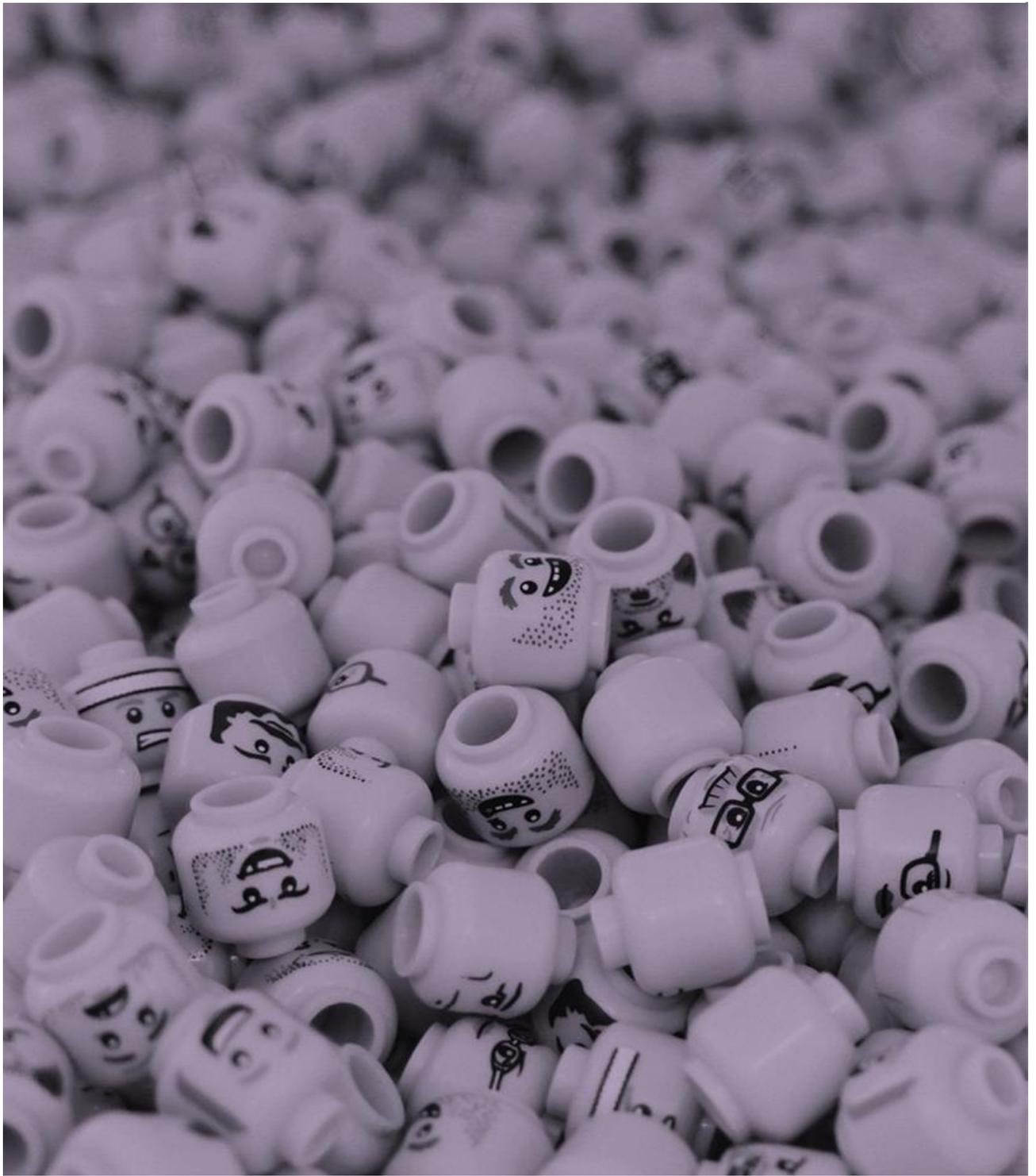
APPENDIX A: LIST OF POLYMERS & PLASTICS BUSINESSES ACROSS NORFOLK & SUFFOLK

For more details on these businesses (e.g. names of key contacts), please contact Matt Looker: mlooker@hethelinnovation.com.

BUSINESS NAME	POST CODE	SPECIALISATION	WEBSITE	TELEPHONE
Amari Plastics Plc.	NR3 2BU	Plastics manufacture	amariplastics.com	01603 787777
Bowles & Walker Ltd.	IP25 6UP	Injection moulding	www.bowles-walker.com	01953 885294
Broadwater Mouldings Ltd.	NR34 7XD	Injection moulding	www.broadwater.co.uk	01379 384145
Broadway Colours	IP19 8NQ	Plastics manufacture	broadwaycolours.com	01986 875100
BSA Mouldings	PE34 3HW	Injection moulding	www.bsamouldings.co.uk	01553 772555
Dynawest	IP2 0DG	Plastics manufacture	www.dynawest.com	01473 230248
Eiger Plastics Ltd.	NR6 6RF	PVC manufacturer	ww7.eigerplastics.co.uk	01603 418389
FL Plastics	NR3 2AW	Bottle manufacture	www.flplasticsuk.com	01603 418989
Form Mould & Tooling Ltd.	CB9 7XU	Injection moulding	www.micromoulders.co.uk	01440 763666
Fusion Composites Ltd.	NR17 1JE	Plastics manufacture	www.fusioncomposites.co.uk	01953 455156
Henderson Plastics Ltd.	NR20 5BJ	Plastics manufacture	www.hendersons.co.uk	01362 683364
Jeyes	IP24 1HF	Bottle manufacture	www.jeyes.com	
Linton Plastic Moulders	CO10 2YA	Injection moulding	lintonplasticmoulders.co.uk	01223 892143
M&H Plastics	NR34 8TS	Bottle manufacture	www.mhplastics.com/index.php?lang=us	01502 715518
Merit Plastic Mouldings Ltd.	IP22 4YE	Injection moulding	www.meritplastics.co.uk	01379 644321
Mr Plastic Ltd.	NR20 3TG	Plastics manufacture	www.mrplasticltd.co.uk	01368 691291
Phillips AVENT	CO10 7QS	Bottle manufacture	www.phillips.co.uk	
PRODPOINT	IP12 1AL	3D printing	www.prodpoint.com	01394 783033
R&S Budds Ltd.	NR6 6AZ	Injection moulding	www.tool-making.co.uk	01603 417954
Raepak Ltd.	NR18 9AQ	Bottle manufacture	www.raepak.com	01953 605700
Redco Ltd.	NR6 6AZ	Plastics manufacture	www.redco.co.uk	01603 400920
Roland Plastics Ltd.	IP13 0RF	Plastics manufacture	www.rolandplastics.com	01728 747777
Sanderson Plastic Products	IP14 4SB	Plastics manufacture	sandersonenvironmental.com	08443 350347
Sefton Transmail	NR6 6BJ	PE manufacturer	seftontransmail.co.uk	01603 404217
Skar Precision Mouldings Ltd.	IP7 6AZ	Injection moulding	www.skar.co.uk	01473 828000

APPENDIX A CONTINUED

BUSINESS NAME	POST CODE	SPECIALISATION	WEBSITE	TELEPHONE
Smartboxx	IP24 3RR	3D printing	www.smartboxx.co.uk	01842 766557
Solution Plastics Ltd.	NR29 5BG	Plastics welder	www.solutionplastics.co.uk	01692 580883
SPC Technologies	NR21 8NT	Porous plastics	www.porous-plastics.co.uk	01328 864082
Spectra Packaging	IP19 8RX	PVC / PET manufacturer	www.spectra-packaging.co.uk	01986 834190
Tootega	NR17 1QD	Kayak manufacturer	www.tootega.com	01953 455666
United Closures & Plastics Ltd.	NR7 9AL	Bottle manufacture	www.gcs.com	01603 894800
Walker Rubber & Plastics Ltd.	NR3 2BS	PVC manufacturer	www.walker-rubber.co.uk	01603 406502



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