

*Coca-Cola Enterprises*

# Sustainable manufacturing for the future:

Investigating the current and future landscape across  
the food and drink industry in Great Britain

June 2015

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## White paper authors:

Dr Peter Ball, Cranfield University  
Professor Mark Jolly, Cranfield University

### Cranfield University

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## Commissioner:

### Coca-Cola Enterprises Great Britain

Coca-Cola Enterprises, Inc. (CCE) is the leading Western European marketer, producer, and distributor of non-alcoholic ready-to-drink beverages and the one of the world's largest independent Coca-Cola bottlers. CCE is the sole licensed bottler for products of The Coca-Cola Company (TCCC) in Belgium, continental France, Great Britain, Luxembourg, Monaco, the Netherlands, Norway, and Sweden. In Great Britain (GB) Coca-Cola Enterprises Ltd (CCE) employs some 4,000 people across England, Scotland and Wales across six manufacturing sites, offices and depots.

The Sustainable Manufacturing for the Future roundtable discussion was held in March 2015 at CCE's Milton Keynes factory.

The following experts contributed to the debate and content of this white paper:

Steve Adams	Coca-Cola Enterprises
Dr Peter Ball	Cranfield University
Mike Bernon	Cranfield University
Dr Nancy Bocken	TU Delft
Wayne Boden	Coca-Cola Enterprises
Geraldine Brennan	Imperial College London
Bev Burnham	Coca-Cola Enterprises
David Cooper	Schneider Electric
Dr Nigel Davies	Muntions
Joe Franses	Coca-Cola Enterprises
Professor Janet Godsell	University of Warwick
Julian Hunt	Coca-Cola Enterprises
Professor Mark Jolly	Cranfield University
Angus Kippen	Coca-Cola Enterprises
Richard Little	Processing & Packaging Machinery Association
Elliot More	University of Cambridge
Nicholas Nixon	Coca-Cola Enterprises
Sarah Perry	Coca-Cola Enterprises
Matthew Rowland Jones	ESM Rexam
Stuart Santon	Ardagh Glass
Dr Palie Smart	Cranfield University
Selena Taylor	Coca-Cola Enterprises
Dr Benny Tjahjono	Cranfield University
Professor Richard Wilding OBE	Cranfield University

## Foreword

We are excited to have embarked on this project with Cranfield University as we look to the future of sustainable manufacturing in our industry. This white paper investigating the current and future landscape across the food and drink industry in Great Britain marks the first step of that journey.

It follows our successful roundtable held earlier in the year and captures the discussions from the day with industry and academia that will help inform the final research paper, to be issued in the near future.

At Coca-Cola Enterprises (CCE) we take our responsibilities in the future of manufacturing extremely seriously and we are constantly looking for new ways to progress and improve. We view this research project as a collaborative effort, and will continue to involve our industry peers as we assess the findings from Cranfield University.

In involving our industry peers we recognise the important role that leaders play – whether in business, government or academia – as we consider the future of sustainable manufacturing in the food and drink sector. Business and industry have been leading action to reduce their impact on the environment, energy consumption and waste, as well as influence the supply base, customers, communities and beyond. Academia has been capturing this progress and leading on theories and technologies to share best practice and facilitate further progress. Leaders in government have been arguing for strong regulation as well as incentives to drive behaviour change. Finally, trade and professional membership organisations have been showing leadership by raising awareness of the debate and providing approaches and examples for industry to adopt.

Leaders recognise that large scale changes are needed urgently. Some of these changes will be radical. We know many businesses have started this process, some are experimenting with new approaches and others have imminent plans to change. At CCE we've truly challenged the way we think about our business since launching our sustainability plan in 2011, and we continue to explore how we can be more sustainable across all aspects of our value chain.

Businesses will constantly evolve to create new opportunities and respond to the pressures they face. The environmental impact of our activities, the stewardship of our resources and the engagement with society are massive global challenges to businesses in the decades ahead. History has shown that manufacturers like us who engage in the debate on the future shape of their sector will not only be better prepared to address challenges and lessen risks, but will also be able to capitalise on new business opportunities. The journey towards sustainability requires practical, radical and disruptive thinking beyond the lean manufacturing focus of the last few generations.

The manufacturing of products and goods has improved the quality of life and benefited billions of people, and this is something about which we at CCE are deeply passionate. But we know that to continue to support and improve the quality of life of more people, manufacturing must be sustainable. It must utilise materials and resources, such as energy and water, responsibly so that future availability is assured and waste does not have a long term impact on the environment. Finally, it must contribute to a healthier and safer population, consisting of not just those it employs but all of those it impacts. While these are massive challenges, those manufacturers who lead in addressing the opportunities will in turn strengthen the economic sustainability of their own businesses. Pioneering companies and inspiring individuals will drive the agenda, leading us all into a better and brighter future.

### Steve Adams

Group Director of Supply Chain Operations  
Coca-Cola Enterprises Great Britain

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## Executive summary

What does a sustainable food and drink manufacturing business look like in Great Britain today? How will this change in the future? What will a sustainable factory look like in 2050? How will the needs of customers and society change, and how will this impact the manufacturing process?

These are the topics that Coca-Cola Enterprises (CCE), in partnership with Cranfield University, academia and industrialists, examined through roundtable discussion as part of the first stage of research into what the opportunities and challenges are for sustainable manufacturing in the future.

All attendees agreed that industry's understanding of the way forward is maturing and will continue to do so. Both at corporate as well as shop floor level, it became evident that there was a movement away from the era of Corporate Social Responsibility (CSR) - that has suffered from accusations of 'greenwash' - toward a fundamental understanding that being a responsible business involves shared value creation.

Businesses also now understand their own impact on the environment more clearly. This can create added complexity in separating environmental impacts from cost and other inter-dependent factors and can present challenges on how to communicate back to consumers.

Analysis of the roundtable discussion identified six major themes: People, Big Data, Technology, Collaboration, Value and Resilience, which shape what the food and drink industry needs to address in the future. Whilst there remains a role for government through policy and legislation, the discussion was specifically framed around how industry can take ownership of these topics. These findings will set the agenda for deeper research, which will follow in a second white paper later this Autumn.

Initial findings included:

**People are core to enacting change and must be engaged, well-trained, flexible and skilled.**

Sustainable businesses must focus on their staff as well as potential new recruits, customers and suppliers. Accessing and retaining knowledge is a key factor. Inspiring and embedding truly practical sustainable practices within the organisation will attract high calibre recruits.

**Big Data will play an ever more important role in organisations and society as a whole.**

Capturing, managing, accessing and using data will be a major challenge and opportunity. Linking data from manufacturing plants to customer preferences and the internet of things (IIoT) will give rise to the opportunity to tailor products and outputs to a customer base increasingly accustomed to instant and bespoke responses to their needs. This move to personalisation should not burden the environment. Big Data will enable greater traceability and open up opportunities in the circular economy. It could lead to more localised manufacturing and the use of more SMEs in the supply chain.

**Technology may not be the sole solution to creating a sustainable future.** Linking it with Big Data and localisation (SMEs) could lead to some radical innovations. Technology will play a vital part, but it must support new ways of working. Moving from economies of scale where centralised large factories produce at high volume to a "small is beautiful" scenario was perceived to be more socially acceptable, but will demand many technological challenges to be overcome. In this case product design may change and therefore the technology for delivering that product will be important.

**Collaboration will develop to a more symbiotic relationship between a company and its supply chain.** Collaboration and collaborative ventures could be changing the transactional arrangements between suppliers and customers in a reflection of what has happened in the automotive sector. A move to a more symbiotic relationship between a company and its supply chain may be more socially acceptable and could lead to positive local community involvement. Equally, collaboration could occur between competitors to reduce resource use and waste to benefit the consumer. Knowledge sharing will also become key, and attitudes towards the development, generation and protection of Intellectual Property (IP) will change. IP may even become open source as it has in the IT industry where we have seen developments like Android and Linux OS.

**Value will have a fundamental impact on which resources are used.** Value is more than basic quality. It captures high standards, convenience, trust and doing good for humankind, as well as the environment. Business models such as Rolls-Royce's engine lease "power by the hour" and Xerox's "pay per copy" have changed their markets to a view of servitization\* of products as becoming the norm. The adaptability of products that can be used differently beyond their intended purpose to deliver 'value beyond profit' will increase. Developing circularity in how a business controls its resources will become increasingly prominent. How this translates to the customer's perception of value in the food and drink sector requires some creative thinking. Consumers are increasingly concerned about the traceability of products and the value of waste, and in turn are beginning to become aware of the huge waste associated with the food industry including losses in the field, products not meeting the required grade specification or degradation in the supply chain.

**Resilience, the ability to adapt to change and do this at speed, will be key to future decision-making as businesses seek to maintain a supply of quality, ethically-sourced raw materials.** Increasing competition and/or a declining absolute amount of resources will result in higher prices and volatility. Securing access to consistent resources will become increasingly important. Energy and water are two resources whose availability is currently taken for granted, but which may be scarce in the future. Flexibility and transparency in both sustainable manufacturing and the supply chain will be key in achieving resilience.

*The journey toward sustainable manufacturing of the future in the food and drink industry is complex. Issues are inter-related, both within the business as well as between businesses. The six themes of **People, Big Data, Technology, Collaboration, Value and Resilience** cannot be addressed in isolation but understanding each one will enable a better understanding of what the largest manufacturing sector in Great Britain needs to do to make the most of them. Companies that make this effort will mitigate significant risks and create competitive advantage.*

*Although industry excels at continuous improvement to reduce risks, it has the opportunity to develop skills in radical innovation that will side-step major challenges with game-changing strategies. Rapid and fundamental change will result from strong leadership within and across companies accepting the need to change, and from working across boundaries - not only within individual manufacturing sectors, but across the entire manufacturing industry.*



\*The servitization of products describes the strategy of creating value by adding services to products or even replacing a product with a service







## Challenges to address

Sustainable manufacturing for the future will require radical change and people are core to enacting that change. Challenges, however, arise as fewer people are recruited within each business and employees, particularly those who are 'younger', have greater mobility. It is recognised that a significant percentage of skilled and knowledgeable experienced employees will retire in the next 10 years across Europe.

As businesses strive for greater efficiency, factories will increase hard and soft automation so fewer people will be needed. People are expensive and governments focus most of the tax burden of business on individual employees rather than finite resources (oil and coal for example), therefore further compounding the costs. The irony is that people, who are the innovators, are becoming fewer and the incumbent technology is expanding.

Acquiring skills and recruiting new employees presents interesting challenges. For some, an industrial career in manufacturing is not always seen as attractive. With growing automation, fewer people see factory life other than in news stories that focus on the manual assembly line, these are often fast-moving for visual effect and therefore implicitly lower value of production. The high skill, high innovation, high pay industrial career that exists in those very same businesses needs to be more clearly articulated.

But a note of caution for prospective employers:

*"...the number one question in the graduate recruitment programme is, 'What are you doing on CSR?'"*

## Opportunities to explore

- Companies need to engage people into setting the sustainable manufacturing agenda, including current employees and potential new recruits as well as those beyond the company walls such as customers, suppliers and wider society.
- There is a demand for well educated people. They need to be flexible, technically competent, independent and creative. They must understand the company's environmental footprint and minimise the impact of its activities. School leavers and graduates entering the workplace will need to take ownership and maintain their education, while the industry must re-think how to support on education as careers can last up to 50 years.

*"...people now have multiple employers during their working life, which impacts on the retention of skill-sets, as well as how people look for work"*

- Companies also play an integral role in educating employees on the subject of sustainability in manufacturing. As part of the education process, organisations are able to crowd-source ideas from their people and feed these into the business. For example, CCE's employee education project generated 400 sustainability ideas.
- Training must be frequent, in part because of rapidly changing roles and because the young expect to have numerous employers over the course of their careers. We are demanding higher skills from our employees. So who is responsible for training? Companies do not necessarily have the large training departments of the past, but there are moves by some governments, including the UK's, to invest in high quality technical apprenticeships, to develop the syllabus in school academies and to up skill sectors by accessing the primes/OEMs in a supply chain. Up-skilling and reskilling the workforce is key to productivity and competitive advantage, and can potentially be achieved through further Continual Professional Development (CPD). The older generation, which holds immense tacit knowledge, is retiring from industry, and urgent attention will have to be given both to how employers will retain skills in a fluid employment market and to how new employees will acquire skills.

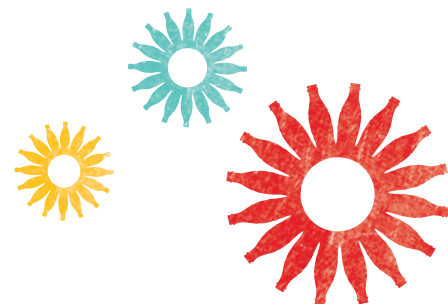
- The role and value of social networks to access expertise, especially on the sustainability agenda, will increase.
- The health and well-being of staff will continue its prominence, complemented by greater social investment.
- Legislation is moving towards making manufacturers more responsible for contractors as well as permanent employees. Conversely, large companies, as well as SMEs, are improving productivity through increasing use of robotics and automation.
- Employees working alongside each other are not necessarily equal in contract terms and maintaining values within the business requires focus.

*"...the increasing emergence of the 'haves' and 'have-nots' in terms of the skills base must be addressed."*

- Inspiring the young through practical sustainability programmes and not boardroom sustainability strategies is paramount. With a transient workforce, companies must understand how the values of the organisation can be remembered and embedded within the workforce. Addressing skills and values is the enabler for companies to use data, develop technology, collaborate with the supply chain, develop resilience and provide value to customers in pursuit of sustainable manufacturing for the future.

### Considerations for the Future – key conclusion:

**People** are core to enacting change and must be engaged, well-trained, flexible and skilled. Sustainable businesses must focus on their staff as well as potential new recruits, customers and suppliers. Accessing and retaining knowledge is a key factor. Inspiring and embedding truly practical sustainable practices within the organisation will attract high calibre recruits.





## Challenges to address

Engaging people into initiatives and long-term programmes will make fundamental differences to how businesses operate. The increasing role of data to inform fact-based management will challenge businesses on how they source data and use it to make decisions. The internet of things (or internet of everything) will expose the complexity of decision-making, as well as confront current norms. In the consumer goods sector, manufacturing companies such as Amazon and Apple are using information on customers' spending patterns to "know what you want before you buy it". Others must work out how to follow.

How can data help us on the journey to sustainability?

The quantity of data companies capture and store is exploding. Data entry by people has been overtaken by data collected by sensors, whether from a machine in a factory, a potential end customer's web-browsing activity or a distant weather station. In a world where product features and functions are personalised, the burden of personalised configurability has to be just-in-time.

## Opportunities to explore

- Business will become increasingly sophisticated in using data analytics and bridging missing data. The internet of things (IOT) will enable us to learn how to exploit the connectivity available to inform good decision-making and minimise environmental impact.
- Obtaining data at a system, rather than a machine, level is more challenging but offers huge opportunities for reducing resource consumption and the impact on the environment. Understanding how a whole factory is performing, as well as the life cycle impact of products, will allow companies to optimise the whole and not be distracted by optimising the detail at the expense of the whole.

*"...most of the environmental impacts are not internalised or realised on a company's profit and loss."*

- Data needs to be accessible. Within factories, equipment can provide impressive insights into operations and can be complemented by portable or retrofitted sensors to capture more information. Data that is important to us and our eventual customers must be captured. This data and its publication will enable customers to trace sources, make informed decisions and build trust.

*"...the provenance of product ingredients is essential."*

*"...are people willing to pay for this?"*

- Keeping stock may become an anathema. Products will have to be designed to be made to order or, at minimum, configured to order. Understanding how a product has been used and where it has been will enable better recovery and re-use of materials (either product or packaging) in a circular economy. Many companies believe this will be driven by IT, knowledge of the customer and a move towards the "consumerisation of manufacturing." It is thought this will influence machine equipment, performance measures, processes, workforce and skills, and the manufacturing footprint. Here we must be careful not to increase transportation to meet demand for rapid delivery. The expectations driving the changes in these industries will also impact on the (FMCG/food/drinks) industry.
- Clear, timely metrics and key performance indicators (KPIs) to operate the factory of the future need to be developed and integrated as part of a balanced score card. Simplicity in data capture and reporting is essential in order for consumers to understand whether in-store shopping or home deliveries are more efficient, for example. The KPIs used must aid understanding of the business for the years ahead, not just today and tomorrow.
- Greater insight into the big trade-offs will help companies better understand the smaller, more numerous trade-offs. Both producers and consumers want carbon reduction but it is a challenge. Minimising or removing the environmental impact through eco-design has the potential to transform products, production systems and delivery to the customer. An understanding of the fundamental impacts and a careful consideration on how legislation is formed is key. For example, the lightest product using lower resources may seem preferable, despite a heavier, legally penalised product lasting longer and having a lower impact. For packaging we must ensure that any return cycle is beneficial and does not use excess resource, especially energy.

*"...we must have eco-design built throughout product design from the very start."*

Today, environmental impacts are understood, but willingness to compromise still exists. Encouraged by their seniors, today's employees will not compromise on product quality and will stop production if they believe there is an issue. This "line stop" thinking needs to extend to the environment, with the refusal to accept negative environmental impacts.

- Scale of operations has been the mantra for industrial efficiency. By building bigger factories and having fewer suppliers, supply consistency and quality can be assured. But the availability of data has the potential to challenge this. Faster access to more detailed data will allow us to break the link between scale and consistency. This enables sourcing from numerous smaller and local suppliers and has the potential to benefit SMEs (Small to Medium-sized Enterprises) as well as more communities. The environmental impact - from logistics to the centralisation of waste - could be reduced whilst achieving sufficient concentration locally.

## Considerations for the Future – key conclusion:

**Big Data will play an ever more important role in organisations and society as a whole.**

Capturing, managing, accessing and using data will be a major challenge and opportunity. Linking data from manufacturing plants to customer preferences and the internet of things (IOT), will give rise to the opportunity to tailor products and outputs to a customer base ever-more used to instant and bespoke responses to their needs. This move to personalisation should not burden the environment. Big Data will enable greater traceability and open up opportunities in the circular economy. It could lead to more localised manufacturing and the use of more SMEs in the supply chain.





## Challenges to address

Technology is often seen as a solution to many of the challenges we face. It is tempting to buy solutions but newer, more efficient equipment might be the wrong choice. Technology provides possibilities and we must design for customer needs carefully.

*"...if technology was the answer to sustainability then companies with the biggest cheque books would be the leaders."*

Certainly technology will be an enabler for new ways of working. There are challenges in the pursuit of innovation; whether to follow a path of incremental efficiency changes or more radical step changes. Without the former we cannot build a culture of continuous improvement. Without the latter we will optimise the currently broken industrial system with an expanding base of incumbent technology.

The expectation customers have of receiving products will challenge the speed and location of production, while new materials and new methods of assembling those materials are on the near horizon. Graphene and additive manufacturing are two examples of developments on which we are placing very high expectations. So how can the food and drink industry exploit such advances to create game-changing opportunities?

## Opportunities to explore

- Innovations in product and process technology will continue to challenge as well as inspire manufacturers. Additive manufacturing is one headline approach, where instead of creating products by removing material we build them up by adding material. Such technology has potential for products that use less material and create less waste.
- Will we all have 3D printers in our homes by 2050? They certainly allow today's incremental factories to complete tasks better and faster, potentially resulting in fewer staff recruited to replace those moving on or retiring. How are new capabilities to be managed so that we do not produce more goods than we really need?

*"...increasing efficiency by 25% begs the question, what do we do with that extra 25% capacity? Increase production? Reduce headcount?"*

- Increasing digitisation in communications (from verbal to digital messaging), purchasing (from high street to doorstep) and entertainment (from scheduled to on-demand) will impact on what a product is and how it is delivered. We will see the increasing expectation for personalised products delivered exactly to the customers' specifications. This will need to be tempered by better design for sustainability or eco-design.
- Legislation will drive change, potentially through reducing waste and increasing recovery. Companies have the opportunity to start understanding the impact of product return on their supply chains. Eco-design will feature strongly as companies seek to protect resources and possibly delay their return from the market, by making products more durable and cheaper to fix rather than replace. For example, technology development may allow us to add water to products at the point of use rather than the point of manufacture to reduce transportation.
- SMEs have a significant role to play. Increasingly they will use automation more and use their technology to offer solutions to customers.  
*"...the role of the SME will change by offering, for example, vision technology that fills a gap that businesses don't realise they need."*
- More radical innovations will transform the shape, size and location of factories. As companies become more specialised they can move materials globally to improve cost efficiency. This minimises environmental impact by having technology, people and materials close to market. For example, distributed manufacturing allows centralised production for commodity parts and localised production for rapid response to the customer, something already practiced in the military and motor racing sectors. The new local factory could be based on current material removal processes or rapidly maturing additive manufacturing techniques.



- Currently there is a belief that "big is beautiful" and the problems of processing waste water, waste heat and so on have been mastered. The factory of the future may be smaller, ensuring it does not use or waste so much, and possibly trading with the local community. Scale is seen as a means of achieving efficiency in production and distribution. Perhaps industry is missing the obvious infrastructure at-scale and local to most of the population: the high street, the retail park, the shopping mall. The localisation of production has the potential to enhance the recovery of materials and packaging as we seek to build circularity into the flow of valuable technical and biological resources.

*"...one of the biggest shifts has been around technology and data, which raises the issues of reducing globalisation and reverting to localisation."*

- Much public discussion centres on reducing the impact of manufacturing rather than the environmentally benign factory. Factories are big 'machines' that transform materials in value-added products for better quality of life - but they have downsides in the visible and non-visible wastes they produce. Whilst there are examples of machines that emit air or discharge water cleaner than that which entered, there are still not enough of these examples. We need to design such features into new facilities so the only acceptable factory is the environmentally beneficial factory.

## Considerations for the Future – key conclusion:

**Technology may not be the sole solution to creating a sustainable future.** Linking it with Big Data and localisation (SMEs) and a move away from globalisation could lead to some radical innovations. Technology will play a vital part, but it must support new ways of working. Moving from economies of scale, where centralised large factories produce at high volume, to a "small is beautiful" scenario was perceived to be more socially acceptable, but will demand many technological challenges to be overcome. In this case, product design may change and therefore the technology for delivering that product will be important.





# Collaboration

## Challenges to address

The way in which businesses offer value to customers will challenge us on how we collaborate with others. There is evidence of businesses moving from transactional, cost-based relationships in the supply chain to more collaborative behaviour. These relationships, which may be deeper, yet conversely at times also transient, could become the new norm.

Regardless of the relationship with others in the supply chain, provenance has become critical; where materials came from, who was involved in getting them and how fundamental quality is assured, are now givens. Currently the focus on sourcing is on the product and the ingredients, but increasingly customers and wider groups are likely to worry about where all resources used for production were sourced and what their impact was, including water and electricity.

Tackling how products are designed to be environmentally benign or even environmentally beneficial could change behaviours. Interesting developments could come from how companies are allowed to collaborate to enable sharing of best practice, or even working together on more eco-efficient supply chains.

## Opportunities to explore

Transactional relationships abound across sectors but collaboration offers a means to seek new opportunities, as multiple companies come together for mutual benefit. Flat team structures are the norm within companies offering flexibility, speed, resolution of issues and potential for innovation. Across companies this is less typical, though benefits could be gained.

*"...working together in teams, through partnership is key."*

Collaborative ventures have been seen in the automotive sector, with SMEs bidding for supply contracts and co-operatives existing for the mutual benefit of smaller operations - also seen in the agricultural sector. Micro partnerships, involving several small complementary skills and capabilities, have the potential to trade with receptive large companies or OEMs (Original Equipment Manufacturers).

- Cross-function collaboration needs to be encouraged to ensure project teams work more closely together to generate leading edge ideas in sustainability practices. For example, manufacturing teams may be able to work with OEMs and alongside universities and government bodies, to jointly develop new ideas and thinking.
- Collaboration could offer environmental benefits and, importantly, major social benefits. Companies with local ownership working with local suppliers relate more closely to the local community, local employment and local environment. This idea may allow more SMEs to bid into large procurement contracts. Companies need to navigate legal requirements to ensure collaboration can thrive even between competitors.
- There are opportunities for the sector to work closely on environmental audits so that burdens are minimised and benefits maximised, especially for the SMEs in the supplier base.
- The manufacturer is the transformer of materials; as a producer it has the most impact on resource use. Impact may be through the amount of resources it uses directly or the amount suppliers use to provide the manufacturer with what they need, or because of what the customer will subsequently use. The move from the vertically integrated company that does everything, to horizontally integrated companies that rely on others in the supply chain, has meant that many organisations have absolute reliance on others upstream and downstream in the supply chain. Leaders will understand impacts and drive them down even if they are beyond their own control.
- The life cycle impact of some products is very high. For example, the amount of fertiliser a farmer uses or the amount of water the customer uses. Working with suppliers and customers, manufacturers will educate, train and persuade others to change their behaviour. By using available data and showing leadership, manufacturers will partner with retailers, suppliers and others to promote benefits, capture ideas and agree what is good (and not what is less bad). Collaboration also involves competitors to benefit the end customer. This will be through greater co-operation with suppliers, for example competitors sharing packaging weight reductions, as well as innovation with customers, such as bakery competitors who formed a joint company to manage the circulation of the large brown bread crates between the supermarket shelves back to the bakeries for re-supply.

- Knowledge sharing will become key. The trade-off between keeping data and intellectual property private, against the opportunities to minimise environmental impact if data is shared will need to be debated. It is difficult to optimise the use of resources and the capture of wastes across the supply chain if data is not available and traceability poor. Challenges in the area are exaggerated if procurement metrics motivate cost reduction rather than impact reduction; if properly structured, sustainability across a supply chain results in reduced costs for all and does not require payment of a premium for a more sustainable solution. Thus raw material supply can become more efficient and supply protected.

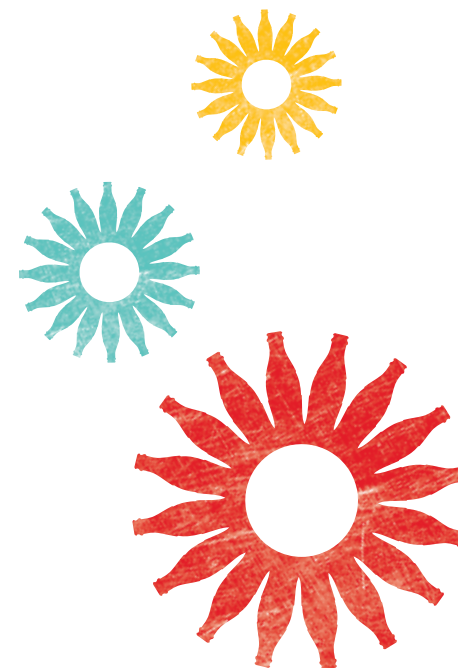
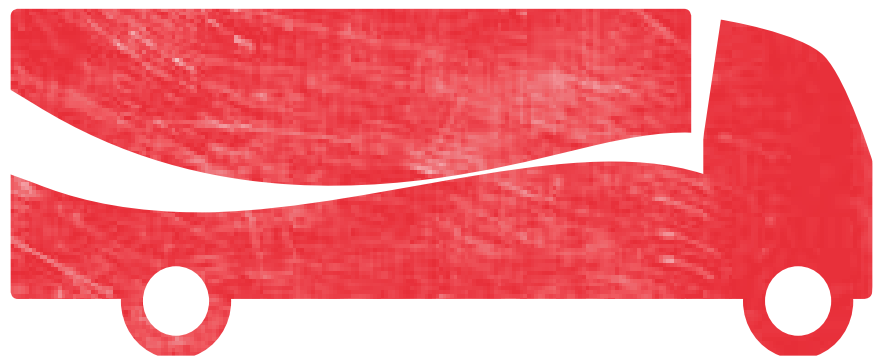
*"...a company might be able to influence the group of 100 suppliers, but how does it influence the group of small suppliers who fix the lights? The question becomes what is the value of transaction."*

- Exciting openings exist as intellectual property (IP) is made open source. Current examples of open source include the Android and Linux operating systems, and the Riversimple and Tesla hybrid and electric automotive platforms. Manufacturing companies will learn to use this flexibility on offer. The concept of 'mashups' could extend from the IT to the industrial world, with nimble 'plug and play' companies learning to integrate and exploit technology as short term 'pop-up' operations or longer term collaborations to provide new products and services. Such collaborations will rely on high skilled people utilising data analytics and technological innovations.

*"...flexible and bespoke partnerships that will be created around individual business needs"*

## Considerations for the Future – key conclusion:

**Collaboration will develop to a more symbiotic relationship between a company and its supply chain.** Collaboration and collaborative ventures could be changing the transactional arrangements between suppliers and customers in a reflection of what has happened in the automotive sector. A move to a more symbiotic relationship between a company and its supply chain may be more socially acceptable and could lead to positive local community involvement. Equally, collaboration could occur between competitors to reduce resource use and waste to benefit the consumer. Knowledge sharing will also become key, and attitudes towards the development, generation and protection of Intellectual Property (IP) will change. IP may even become open source as it has in the IT industry where we have seen developments like Android and Linux OS.





## Challenges to address

The relationship between customers and suppliers is changing. At a consumer level this is exemplified by mobile phone contracts, which blur the boundary between buying a product and receiving a service. For business there is service contracting where the customer pays for each use of a high cost item. More generally, businesses are increasingly focusing on the value that is provided to the customer. This challenges business to radically change the industrial and commercial landscape, to reduce environmental impact and social burdens and to move from the economic view of value in order to consider 'value beyond profit'. In certain markets, younger generations prefer access and use over ownership. The challenge for businesses is how to offer convenience and greater good rather than a one-way material transaction, in order to gain competitive advantage.

Governments have their role in changing behaviours to ensure that future generations come to enjoy the benefits the current population are enjoying. There is the question over whether it will be governments who set the agenda or whether companies or consumers will be moving faster.

*"...what's the role of policy makers? Should companies be faster than legislators, or should they be led by legislation?"*

## Opportunities to explore

- What value is the business offering its customers? In a simple case this could be the supply of a product. In more sophisticated arrangements there could be a bundling of offering that includes use of product, product support and product take-back. The way in which the customer value is achieved will have a fundamental impact on what resources are used and who is incentivised to prevent the environmental impact.

*"...who are we creating value for? Is it for collective value rather than immediate economic/environmental value?"*

- The drivers for change for a business can come from within, through aspiring leaders or from outside through legislation. For some, the biggest driver of change is not legislation but alignment to the customers' vision of reducing carbon. By understanding customer requirements business will be driven to more change than from legislation.

*"...formalised CSR programmes are a huge driver for companies to improve irrespective of legislative requirements"*

- There is increasing discussion about the 'value proposition' and how providing a service, rather than a product offering, is a future direction of high value industries. Common examples used are the Rolls-Royce engine lease 'Power by the Hour' and the Xerox 'pay per copy' business models. Such examples could be used to inspire thoughts of how the food and drink industry evaluates its offering to customers, for example whether it provides product or a route to a healthy and fulfilling lifestyle.
- Increasingly, a business is evaluated not just on the quality of products it produces but the core values it demonstrates through its actions. Consumers expect companies to take care of product quality, employee welfare, etc. not just in their own company but throughout their reach. How to use a product and how much to use is no longer confined to medicines. If there are ingredients that are seen as detrimental then companies need to find ways to remove them or gradually accustom consumers to new tastes. Importantly, consumers need help to understand trade-offs that do not simply boil down to cost. For example, how should business communicate the value of ethical and organic products, not just for the consumers but for livestock, employees and communities within the wider supply chain?

*"...how do you manage to deliver today the environmental standards of tomorrow?"*

- Waste must be banished. At a resource level, parts of the sector's industrial system are impressively efficient. For example, sandwich manufacturers producing product to a customer's order and shipping country-wide within hours of completion. However the overall industrial system suffers huge wastes as a result of the variability in farm output and the fickle consumer. Losses in fresh foodstuffs from farm-to-fork can be up to 25% from the fruit or vegetables being grown in the field to potential consumption by humans (WRAP, 2011, Resource Maps (RSC-008)). The culture of just simply looking at how best to segregate waste for effective disposal must be discouraged, and instead companies should look to identify how waste streams can generate profit for the business e.g. anaerobic digestion. Exploiting opportunities here has the potential to reduce environmental impact as well as reduce costs. Further, packaging is significant and there are opportunities in recovering resource through circularity rather than leaving it to municipal waste recycling (or rather down-cycling) channels.

*"...how do we make it financially beneficial in the business model to make consumers want to 'give back'?"*

- The way society thinks of waste still has a long way to go. We will learn to always equate waste with value. The language should be changed to valuing nutrients akin to nature, where the emissions from one sub-system benefit another, for example, trees emitting oxygen that humans can breathe. There is much discussion of the concept of the circular society where resources are not lost and circulate continuously. It is not just one circle, it is a number of circles, and the business needs to decide which the correct return route is, economically as well as environmentally. There is the opportunity to understand the fundamental impact of circularity so we recover energy and water as well as product materials.

*"...companies could be environmentally neutral by 2050 if legislation were to be put into place"*

## Considerations for the Future – key conclusion:

**Value will have a fundamental impact on what resources are used.** Value is more than basic quality. It captures high standards, convenience, trust and doing good for humankind, as well as the environment. Business models such as Rolls-Royce's engine lease "power by the hour" and Xerox's "pay per copy" have changed their markets to a view of servitization\* of products as becoming the norm. The adaptability of products that can be used differently beyond their intended purpose to deliver 'value beyond profit' will increase. Developing circularity in how a business controls its resources will become increasingly prominent. How this translates to the customer's perception of value in the food and drink sector requires some creative thinking. Consumers are increasingly concerned about the traceability of products and the value of waste, and in turn are beginning to become aware of the huge waste associated with the food industry. This includes losses in the field, products not meeting the required grade specification or degradation in the supply chain.

\*The servitization of products describes the strategy of creating value by adding services to products or even replacing a product with a service





## Challenges to address

Manufacturers are skilled transformers of raw materials into impressive finished goods. Do all manufacturers know if they will be able to access the raw materials they need through their supply chains next year or next decade? And even if they can access them, will they have the material quality or ethical assurance?

Challenges at national and global levels are well known and well understood but not sufficiently addressed. Major pressures are building on the availability of basic resources such as oil, gas, water and metals. Many more could be listed here. The availability of these resources is in turn impacting on price and supply stability. The 'mega forces' that are building on resources are influenced by geo-political factors but regardless of this, there are clear risks at firm level, for example securing supply before the competitor does.

We can expect legislation on waste to increase and broaden to tackle the wider issue of resource scarcity. Potentially this will extend to challenge companies to maximise value of materials and retain them throughout the life cycle, from the product creation through to the product end of use.

In addition, customers will demand more information on how sustainably sourced the product in their hand is. Ensuring transparency will become more of a business imperative and reputations will depend on it.

Strategically, manufacturers need to build resilience into their business model. Incremental innovation to become more efficient under current business models is not enough to meet the rate of change required. Only by faster, more radical change can we hope to be "more good" rather than "less bad".

## Opportunities to explore

- Resources have been mentioned in this paper frequently. Given the pressures resources are under, the impact can be addressed through the opportunity themes of People, Big Data, Technology, Collaboration, Value and Resilience. Currently, the flow of goods is valued whilst stocks are seen as capital. In the future the value of stocks will be seen as competitive advantage. This again emphasises the need to examine circularity and see value in end of life products and all packaging.

*"...we are the 'disposable generation' – some products have to be thrown away e.g. washing machines as they are more expensive [in cash terms] to fix"*

- Some resources will become hard to obtain as a result of scarcity. The increasing competition for a resource, and/or declining absolute amount, will result in higher prices and tougher negotiation to obtain. Volatility will be hard to plan around. There are already examples in the food and drink industry where companies have found it challenging to secure resource and the 'mega forces' on the world's resources will only serve to increase this in the future.

- While energy scarcity has headlined, water stewardship is paramount for the future. Availability of water, as well as the energy used to process, transport and subsequently dispose of it must all be taken into account. Rainwater harvesting is practiced, which is important in itself as well as for learning about the value and grades of water. There are examples of companies reducing water use to protect themselves from the effects of scarcity. For example, a food processor company that reduced water consumption is now enjoying the benefits of lower costs and reduced risk to supply management in times of drought. Factories of the future will carefully design out the high cost and energy intensity of heating and moving both air and water.

- The threats to supply may come from government legislation, possibly from a supplying country restricting export or from the home country taxing or banning ingredients. Alternatively, it may come from new mandatory requirements to assure provenance or security of products more tightly than existing suppliers are able to. Those companies who operate 'beyond compliance' will lessen risk and protect themselves from shocks in supply, as well as further building trust with customers.

*"...how do you prepare your business if a key ingredient gets banned? Or any other input to your supply chain?"*

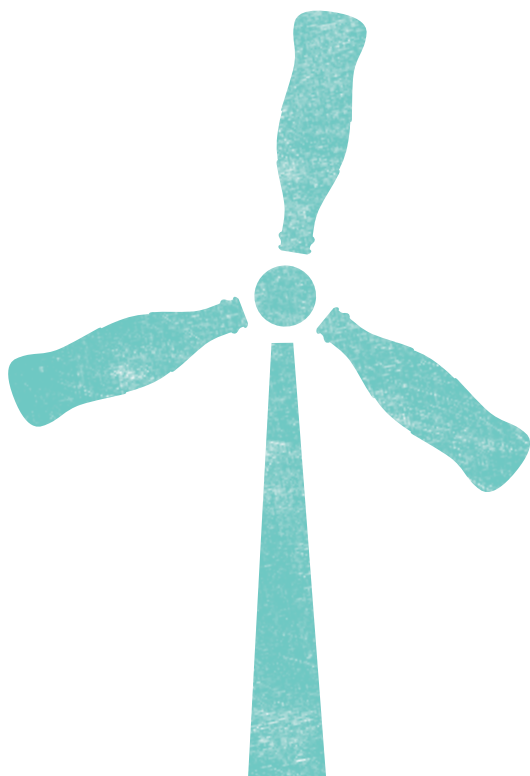
- Businesses will need to evaluate and mitigate against risks more rigorously than they do now, and find ways to ensure that leaders are rewarded rather than being seen as inefficient or costly. Companies have systems and processes to enable flexibility in production schedules, but providing more fundamental production flexibility following significant investment in technology, product development and supply chain development for current products can be difficult. Accounting convention means that technology may be retained in a factory even though the social and environmental impacts of alternative methods may be significantly less. Those that plan for the long term will be able to respond more quickly.

*"...analogy of the oil tanker that is difficult to change course quickly"*



## Considerations for the Future – key conclusion:

**Resilience**, the ability to adapt to change, will be key to future decision-making as businesses seek to maintain a supply of quality, ethically-sourced raw materials. Increasing competition and/or a declining absolute amount of resources will result in higher prices and volatility. Securing access to consistent resources will be more important. Energy and water are two resources whose availability is currently taken for granted, and which may be scarce in the future. Flexibility and transparency in both sustainable manufacturing and the supply chain will be key in supplying resilience.





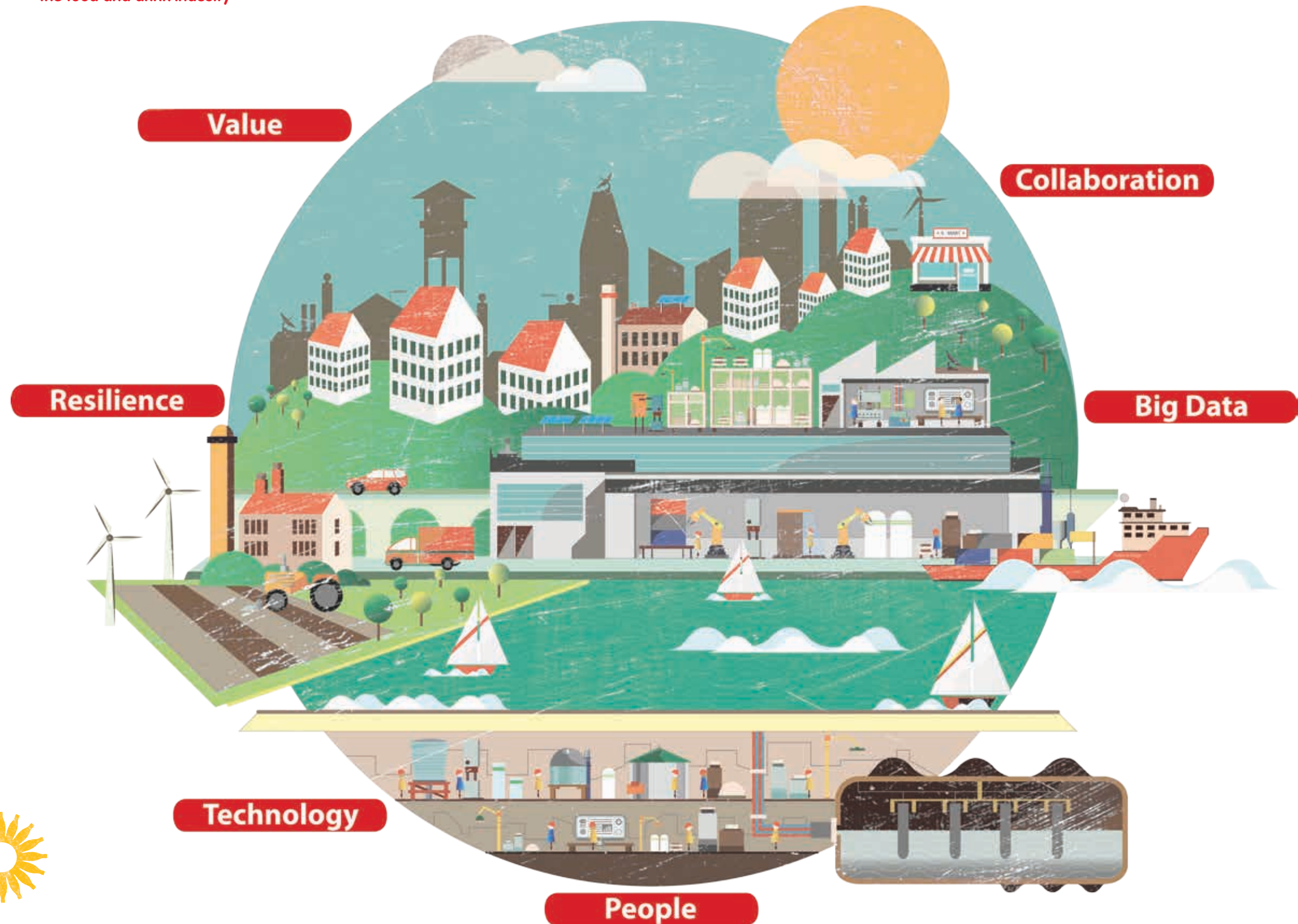
## Conclusion

In seeking to understand the challenges and the opportunities for sustainable manufacturing in the future, and the changing needs of customers and wider society, this white paper has detailed six major themes: **People, Big Data, Technology, Collaboration, Value and Resilience**, with particular reference to the food and drink industry in Great Britain. Significant risks exist should these challenges not be addressed fundamentally and addressed quickly. Mitigation could reduce the risks, radical change could avoid them.

Continual growth and operating at scale have been the industry norms, resulting in ever larger, more centralised factories specialising in key production stages. Whilst growth and efficiency will continue to dominate, the definitions of these are likely to change. Growth may not result in greater shifting of product. Scale may not be important. Localisation will enable on-demand personalisation.

The agenda will be driven by many, and many can contribute to it. Industries have the opportunity to 'adopt' incremental improvements from one another as staff move jobs or visit best practice sites, or read cases from media. More radical change, however, is essential. Such rapid and significant change will result from leadership within and across companies accepting the need to change and working across boundaries, not only within individual manufacturing sectors but across the entire manufacturing industry.

*Figure: Capturing the major themes for sustainable manufacturing for the future in the food and drink industry*





# Glossary

**Sustainability:** being responsible in our activities to ensure generations to come enjoy the same or better living standards as we enjoy today.

**People:** employees (current and future), customers, suppliers and wider community influenced by manufacturing activity (counsellors, politicians, neighbours).

**Big Data:** both structured and unstructured data that is so large it is difficult to process using traditional database and software techniques.

**Technology:** physical machinery and IT systems used to design, make and sell products. Disruptive technology: a change so radical that all the current systems and associated services would need to be different.

**Collaboration:** instances of different groups working together, these could be both intra and inter company.

**Value:** more than basic quality. It captures high standards, convenience, trust and doing good for humankind as well as the environment.

**Resilience:** ability to adapt to change.





