

InCrops Annual Report 2008/2009

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Welcome from Director



This is the first annual report covering the period to December 2009 for the InCrops Enterprise Hub and its publication represents an exciting stage in the development of the InCrops project from concept to reality.

The Enterprise Hub owes its existence to the visionary support of the University of East Anglia coupled with the funding support of two East of England funding bodies, the East of England Development Agency and the European Regional Development Fund. In addition, a unique partnership of thirteen Institutes and Universities has come together and forms a unique component of the initiative providing critical inputs, funding, resources and most important – capability.

The InCrops Enterprise Hub is unusual and differs from many enterprise hubs because:

- it is distributed across a virtual network covering the whole of the East of England
- it is demand led and market focussed
- its primary focus is biorenewables
- it is one of six enterprise hubs delivering low carbon outcomes for the region
- it provides specialist business support to companies located anywhere in the East of England
- it is supported by thirteen partners
- it has staff based in Norwich, Cambridge and Watford
- it collaborates actively with NNFFCC and the KTN Network
- it has projects and collaboration across the UK, Europe and internationally including China and India.

InCrops is a major project designed to stimulate the economy in the area of green innovation and green technology development – an important sector for the future development of the UK. It is worth reflecting on some of the steps that have taken place in bringing InCrops to this position by the end of 2009.

A handwritten signature in black ink, appearing to read 'H J French', with a large, stylized flourish extending from the bottom right.

Dr H J French
Director

The InCrops journey

2004

- o Proposals for a technology led capability in alternative and non food crops outlined to the RDA
- o Government strategy for non food crops (Nov 04)

2005

- o Feasibility study initiated (March 05)
- o Regional review of capability
- o NNFCC* strategy for regional roll out of national policy and strategy (May 05)

2006

- o Strategy for alternative and non food crops for the East of England completed with recommendations to establish a new hub (July 06)

2007

- o EEDA Animateur capacity building and partnership development project launched (May 07)

2008

- o Final proposals submitted to EEDA and ERDF (April 08) and grant funding from EEDA and ERDF awarded (September 08), Company registration.

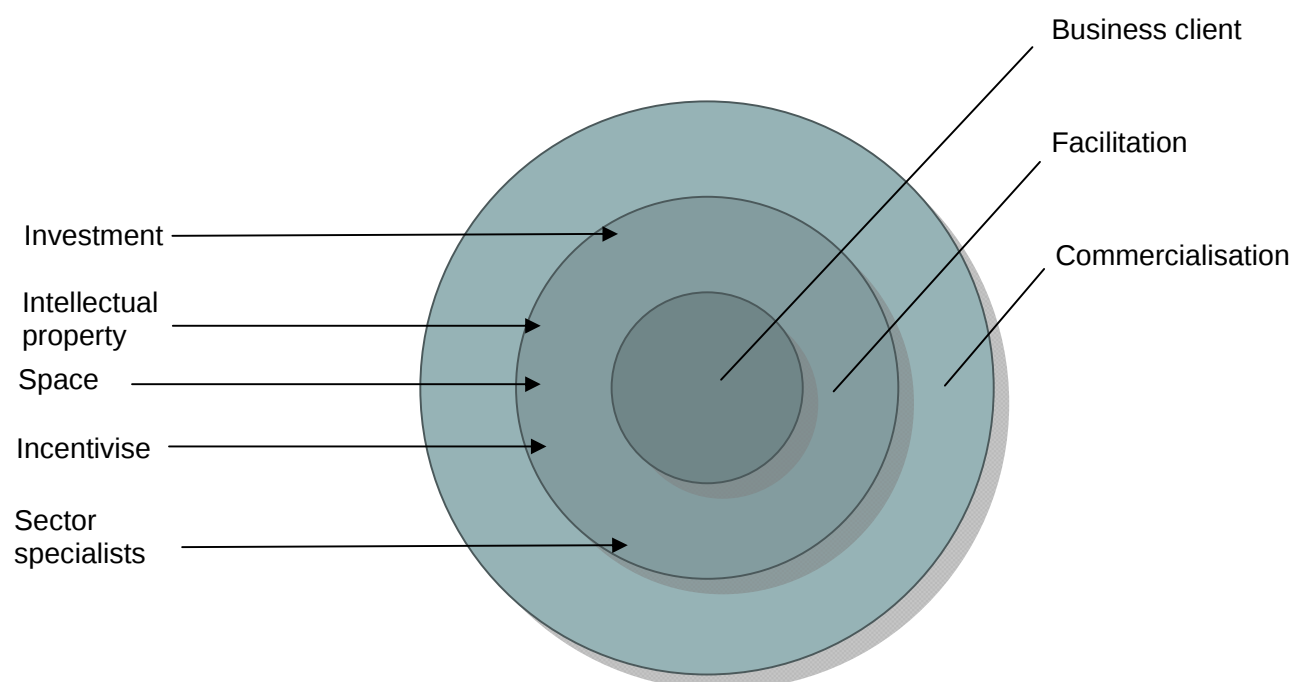
2009

- o Recruitment of InCrops staff team and project delivery infrastructure, business support manual developed.
- o First demonstration crop trials
- o Official launch of InCrops Enterprise Hub (July 09) and website
- o First InCrops Annual Report (December 09)



Lotus Engineering EcoElise with natural fibre panels

InCrops eHub concept



The InCrops Enterprise places the client at the centre and seeks to provide business support for companies and entrepreneurs to enable them to develop and succeed in their plans to promote and develop green innovation, technologies and products across the biorenewables sectors. To do this InCrops strategy group have developed an applied research and development policy and strategy. In addition InCrops has carried out iLab sessions to brainstorm important new areas of development such as Algal Technologies, Nanotechnology and also Phytochemicals and Health. Such areas have the potential to benefit many businesses in the region in future years. A number of strategic initiatives of this kind are described in more detail in this report.



BBC Radio 4 journalist Quentin Cooper discusses innovation at the InCrops launch June 2009

InCrops – Creating an innovation cluster in the East of England

The InCrops Enterprise Hub is a not for profit company set up and based at the University of East Anglia. The InCrops project was established in 2008 as a regional partnership of research, academic and commercial interests to commercialise the breadth of research expertise in the East of England relating to Innovative and Non Food Crop markets and built upon an Alternative and Non Food Crops Strategy for the East of England which was published in 2006 and authored by InCrops Director John French

The InCrops partnership has a five year (2008-2013) funding package agreed, with the European Regional Development Fund (ERDF) and the East of England Development Agency (EEDA) to develop an enterprise hub linking the region's top plant science research with businesses looking to develop new products from biorenewables for the marketplace.

By 2013, the scheme aims to have helped SMEs to create 140 new jobs and to support entrepreneurs to start 100 new businesses, whilst bringing in €3M of new public and private sector funding to the region. The Enterprise Hub operates a virtual network across the whole of the East of England with staff located at seven sites with a distributed operating structure.

The InCrops project partnership consists of 13 regional public sector partners, whose complementary knowledge and capability has been brought together to support and assist the project. The partners are: National Institute of Agricultural Botany (NIAB), University of Cambridge: Dept of Plant Sciences, Forestry Commission England, Rothamsted Research, BRE, Easton College, University of East Anglia (including the School of Biological Sciences), Low Carbon Innovation Centre (LCIC), Institute for Food Research (IFR), John Innes Centre (JIC), Renewables East, Norwich Research Park Enterprise (NRPe) and the University of Essex.

Our aims are to: Stimulate the commercialisation of new biorenewable and low carbon products from alternative and non-food crops; build on the East of England's world-class research capability in plant and crop science; facilitate supply chain development, market integration and product innovation; and support the business and commercial sector and stimulate sustainable economic growth.

The InCrops Enterprise Hub provides specialist business support to companies, SMEs, micro-businesses and entrepreneurs based in the East of England; develops applied and collaborative industry-led projects with academic partners, develops new products and processes for the exploitation of alternative and non-food crops and promotes natural and renewable technologies into the low carbon economy.

We support a spectrum of market sectors including green chemicals and biopolymers, natural fibres, composites and nano-materials, the built environment, personal care, transportation and low carbon vehicles, bioenergy, biomass heat and power, biopharming and high value chemicals. We have in-house experts in those sectors and are linked to the expertise of our partners. Additionally, InCrops has an expertise in Life Cycle Analysis.

The economic context for InCrops

A baseline study was commissioned in 2009 in order to reassess the case and economic context for the Enterprise Hub activity as it became operational. The study was delivered by Collison & Associates and some of the report findings are summarised here.

The consumer marketplace and policy context is currently very supportive for the future of the renewable materials sector in which the InCrops project operates. Whilst there are short term problems created by the economic downturn, all the evidence points to both increased consumer and policy focus on sustainable lifestyles.

DEFRA (2009) has found in its recent survey of consumer attitudes towards the environment that despite the recession consumers are more inclined to select sustainable products, and are increasingly concerned about the impact of their product choices on the environment.

Since Spring 2009 government has made a series of major policy announcements on targets for renewable energy, investing in the green economy and sustainable construction. Given the cross party, and emerging global, consensus on taking action in these areas the sector is in an enviable position in terms of policy support. This does not of course guarantee success or large profits for businesses, but assuming that the region and UK can take a lead in these technologies, the range of incentives governments globally are injecting into the renewable material sector will help to underpin rapid market growth.

The current economic downturn is however a significant short term hurdle for the development of the sector. Even for established businesses raising finance has become more difficult, and for new start ups particularly problematic if not impossible. Whilst some markets, e.g. functional food have continued to grow, other such as construction materials and automotive components have been hit hard by big falls in their markets. Current evidence would suggest that as the UK emerges from recession during 2010-11 the markets for those products most severely affected will recover, although many commentators suggest full recovery will take many years given the level of personal, corporate and government indebtedness.

There is big potential for biomaterials to secure a larger share of established product markets. The plastic market is a large (\$80bn) and growing sector globally, which currently utilises mainly fossil fuel derived plastics, with most estimates putting current bio-plastic market share at under 1.5%. Research suggests this could grow to 10% of the market, but will take many years to do so because of current concerns over performance and standards. It is nevertheless a significant market for growth.

The use of natural fibres in the automotive sector is supported by well established trends to reduce weight as part of efforts to improve fuel economy. The sector is, however, in the midst of its worst global recession in at least 50 years and this is severely restricting market growth as well as leading to significant changes in sectoral ownership. Until the market recovers the potential which exists (for maybe 100,000 tonnes per annum of bio-components in the UK alone) will be difficult to realise.

There are very big opportunities in the construction sector, both for new build and refurbishment. There is growing demand for sustainable buildings and this is driving the materials and product industry to develop innovative products that enhance the sustainability performance of buildings. Housing accounts for 27% of carbon emissions and uses 420million tonnes of materials per year in the UK. More than 60% of the houses that we will be living in by 2050 have already been built and this creates a big market for retrofitting improvements e.g. extra insulation. This sector is also heavily supported by government policy and incentives from the new zero carbon homes plan to research support and a major drive to upgrade the existing building stock. The construction sector is, however, one of the sectors which has been most severely affected by the economic downturn, and targets in the sector must therefore be quite conservative at present.

The markets for chemicals and solvents have witnessed big short term problems created by the economic downturn with most businesses reducing their staff and reporting falls in revenues and profits. The long term prognosis for replacing oil derived components is however very good. Oleochemicals are predicted to grow their market share and as the market grows, due to population growth and increased wealth, will outperform reaching some \$6bn by 2015. Some markets, e.g. solvents where current market penetration is less than 2% are predicted to grow fast with some countries such as Germany targeting a minimum of 5% because of reduced emissions of volatile organic compounds (VOCs).

There is also a rapid increase in specialist chemicals such as bio-pesticides in the US where they now account for 4% of the market, although use in the EU and UK is much more restricted due to more stringent safety testing which is slowing market development.

The market for plant derived health and nutrition products is growing rapidly and our research suggests the InCrops project can safely increase its targets in these areas by over 45% in every case. The market for personal care products is now expected to reach over \$100bn by 2015 with natural products predicted to be 5-10% of this. The pharmaceutical market will reach \$120bn by 2012.

In relation to food additives, functional foods and health foods the market projections have all been recently increased and these sectors have continued to show growth despite the recession. The global market for functional foods is now expected to reach \$175bn by 2012. In addition, and an area which was not researched in the original InCrops scoping study, the market for livestock and pet foods (and particularly health additives) is growing very strongly. The market for pet food, feed additives and animal health products collectively is estimated to grow to over \$85bn by 2010, with both the pet and livestock markets showing a growing preference for natural ingredients.

The market for renewable energy is supported by very ambitious targets set out in the UK Renewable Energy Strategy (2009). Whilst short term performance has failed to meet earlier targets, momentum is now increasing with for example new biofuels shortly coming on stream which will increase biofuel production by over 2% of the market. Compared to the original scoping study, however, this report concludes that it is important to be looking at a wider range of energy markets to include biomass heat and biogas. This is supported by government policy which has set very big targets (a 14 fold increase) in biomass heat for 2020. Overall the government is predicting a potential investment of £100bn and the creation of 500,000 new jobs in the renewable energy sector.

There remains, however, real issues about which bio-energy sources should be developed given concerns about the potential displacement of crops for food with crops for energy, the energy balance and the carbon benefits of bio-energy.

Our objectives

We have developed a sector distribution document which maps global markets to regional economic opportunities and identifies which InCrops staff members are leading work in each sector. This document shows how InCrops thinks globally and acts locally to build advanced clusters for business exploitation. This activity addresses priority development areas in the alternative and non-food crop sectors and utilises the East of England's world-class research base in plant and crop science. We see these areas as exploitation platforms that enable us to work with our partners to provide effective business support.

Key:

JF	<i>Dr John French</i>	<i>Managing Director</i>
LS	<i>Dr Liliya Serazetdinova</i>	<i>Business Innovation Manager InCrops/JIC</i>
BSR	<i>Dr Beatrix Schlarb-Ridley</i>	<i>Business Innovation Manager InCrops/University of Cambridge</i>
MC	<i>Dr Mark Coleman</i>	<i>Business Innovation Manager InCrops/UEA School of Biological Sciences</i>
BB (joined InCrops 2010)	<i>Benedict Binns</i>	<i>Business Innovation Manager InCrops/BRE</i>
CGE	<i>Dr Carlos Gonzalez-Esquivel</i>	<i>Agri-Business Manager InCrops/Easton College</i>
BT	<i>Dr Bruce Tofield</i>	<i>Consultant</i>

Global Market Highlights	Regional Economic Opportunities for East of England	InCrops team lead	InCrops team interest
Plastic packaging - Global market \$80bn - Principally food uses - Biopolymer market share 1.5% -2%, potentially 10% - Petrochemical substitution	Plastic packaging - technology transfer required to exploit market potential - significant fresh food packaging sector in EE - proportion of world share can come to EE linked to innovation in bioplastics especially polysaccharide technology - requires LCA and enhanced production and disposal	LS	BSR
Oleochemicals consume 14% global vegetable oil production 30% surfactants plant-derived - Biolubricants market share expected to rise from 2% - Plant-based solvents 1.5%-2% market share due to opposition to VOCs	Oleochemicals - specialist oil crops capable of growing in E of E - scope to develop new biolubricants - proportion of world share can come to - E of E linked to biorefining expansion	BSR	CGE
Natural fibres as alternatives to	Natural fibres as alternatives to glass fibre	MC	LS
			LS (biorefining)

glass fibre in composites • EU automotive demand potential 100kt by 2010 • Current 7-8kg per vehicle, potentially 12-13kg	in composites • scope for hemp, flax and ‘other’ fibres into composite panels, body internal panels and reinforced fibreglass. Scope to stimulate demand through best practice in the region. • scope to increase above 12-13kg with technological innovation			CGE
Natural fibres into construction • Hemp into building • New fibres into insulation, miscanthus, flax etc • Finished wood products into housing • Shopfitting & other commercial applications • Civil engineering applications	Natural fibres into construction • market demand for hemp and other innovative housing products • low carbon functionality as well as low carbon through sequestration • E of E housing growth projecting 400,000 new homes • technology transfer to enhance U value performance • need to substitute finished wood imports • soft flood defence works • sustainable urban drainage	BB		LS CGE MC BT
Plants as service providers (ecosystem services) • Biodiversity • Climate regulation • Aesthetic & health services • Water regulation • Waste treatments	Plants as service providers • Plant propagation and application • Species selection • Standards in construction and maintenance • Community mgt • Urban and peri-urban agriculture • Green-infrastructure • Green roofs, green walls etc.	JF/BT		CGE MC
Personal care product markets £50 billion market value • Herbal renaissance in alternative healthcare and well-being • Predominance of wild harvested herbs and fragmented supply chains • Natural product markets in skin creams and beauty products • Fashion and clothing and consumer product markets multi-billion	Personal care products • few companies in EE exploiting high value crops • scope to reach out to high value purchasing chains in Europe • present E of E companies not locally sourcing biological materials • multinationals able to mentor new spin outs • scope to exploit berry crops for flavouring and colorants • technology barrier over harvesting	MC		CGE
Functional foods • Global market value over 120	Functional Foods • scope for local production of	MC		BSR

• billion • Rapidly growing international consumer market • Health foods/ diabetes management/high soluble fibre	• functional food crops eg naked barley, camellina, slow foods and extracts • scope for local high value added supply chains • scope to increase essential oil production	CGE LS
Transportation fuels as 50%-60% global oil demand • EU target of 5.75% renewable sources by 2010 • US/Brazil ethanol production cost 50% that of EU • Biofuels demand may double in 10 years	Transportation fuels as 50%-60% global oil demand • scope to advance technology to allow waste cellulose conversion via LC into ethanol and avoid food vs fuel conflict through co-product resource efficiency • scope to prototype new fuels through high tech industries	BSR JF CGE MC
Biomass Heat and Power • EU biomass supply 3% from crops in 2003, 50% by 2030 • Cost competitiveness vs oil and gas crucial • Weak demand pull means government incentives	Biomass Heat and Power • Region has under-utilised biomass crops due to poor supply chains eg miscanthus • scope to route fibre based crops into biomass and materials usage • Forestry waste resources not fully utilised in region	BSR MC
Biopharming • \$50bn biopharmaceuticals market 2003 • Cost and scalability advantages of bioreactors vs conventional production • Substantial potential for production of complex chemicals in plants • Barrier of public acceptability in EU	Biopharming • eg algae based suncreams – future alternative C capture and metabolite production • biotech industry slow to exploit - scope to accelerate • steer towards closed controlled systems and culture systems linked to CHP heat and CO₂.	BSR LS MC
New green consumer markets • Emerging markets in household goods, ecopaints, furnishings, • Fashion and clothing and natural pigments	New green consumer markets • isolated examples in E of E with scope for support for expansion and new business start ups with local supply chains • examples of high value fashion based markets in South East and Europe that can be supplied from E of E.	LS BSR JF
Other areas	• nanotechnology applications • IBTI biorefineries • Life Cycle Analysis	LS LS BT BSR, MC BSR, MC

Our business support activities

The Business Innovation Managers in the InCrops team provide specialist business support for businesses and entrepreneurs wishing to set up businesses. The support is available for SMEs as well as new company registrations and is a Networking for Innovation product within the Solutions for Business programme. This support is targeted at areas of green innovation and its stimulation within the East of England economy.

InCrops is funded from several sources - as a result we are able to provide free EEDA funded initial business support for a wide range of clients and for eligible SMEs this can then be continued for an additional two days of free business support consultancy funded by ERDF under our European funding mechanism targeted at specifically at regional SMEs.

InCrops clients receive:

- o Confidential discussion of initial ideas
- o Access to free consultancy based advice from the InCrops team and from within the wider InCrops partnership.
- o Access to scientific, knowledge transfer, patent or branding technical advice
- o Access to product development support and partnership facilitation
- o Access to finance or investment
- o Access to various kinds of public sector support
- o Networking and Partnership development support

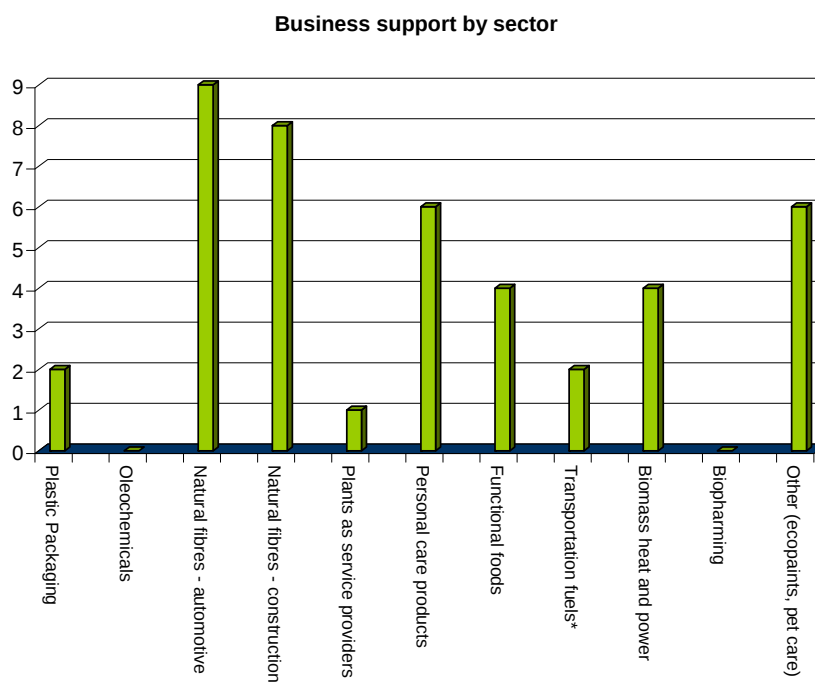
Business Support Results:

Business activity, client engagement and support became a significant activity for the new team during after April 2009 and during the period to December 2009. Despite the suppressive effects of the economic downturn InCrops results show that we -

- o **actively supported 42 businesses**
- o **delivered 263 hours of business support**
- o **worked with businesses in every sub region of the East of England**
- o **supported our first new business spin out company in November 2009**



The distribution of this support across our sectors is shown in the table below and demonstrates a strong demand from businesses in the natural fibres sector during this period.



* *Transportation Fuels* - Business support shown does not include support given by other agencies such as *Renewables East* etc.

Our expert team of staff work to bridge the gap between R&D, business and regional economic growth.

The value of natural fibres

Dr Mark Coleman

Reversal of the 20th Century trend of increasing use of synthetics derived from fossil fuels (and the consequent decrease in use of biomaterials) is leading to significant market pull for natural fibre products, particularly for automotive and construction applications.

In vehicles, natural fibres are increasingly finding favour as alternatives to glass fibre in composites. Current automotive use of natural fibres in the EU is estimated at 100 kt per year, equivalent to approximately 7-8 kg per vehicle, but potentially this could grow, even over the short term, and with little technological change, to 12-13 kg. This presents a significant regional opportunity since the East of England boasts major capacity in the processing of hemp, flax and other fibre crops, capacity for processing into composite panels and capacity in biopolymer production. There is scope to move above 12-13 kg per vehicle with technological innovation and InCrops is working with client companies to facilitate development of products that not only replace synthetic composites but do so with materials that reduce vehicle weight (and thus emissions) and which are derived from low GHG farming systems and supply chains.

In construction, recent trends have seen increasing use of hemp-based materials, new fibre insulation products, and finished wood products, and with estimates that the East of England will see 780,000 new homes by 2030, there is considerable regional opportunity for bio-based materials. InCrops is working with clients to support the development and adoption of modern, environmentally-friendly building materials with excellent energy conservation characteristics, low-carbon supply chains and high-levels of carbon sequestration.

Case study: Hemp Technology Ltd

Hemcore Ltd was established in 1993, becoming Hemp Technology Ltd when it was acquired by Lime Technology Ltd in 2009. The main facility, located in Halesworth in Suffolk, processes hemp straw from regional growers to produce fibre, shiv (the woody core) and fines (cellulosic dust). Fibre is used in automotive applications (principally as a biocomposite component), and in the production of insulation (including the recently released Breathe™ insulation material), paper, and matting materials; the shiv is used in construction (as a component of Tradical Hemcrete®) and in animal bedding; the fines are processed to produce hemp logs, which can be burned in place of coal and wood.



Hemp insulation

InCrops has supported Hemp Technology in several ways, including conducting field trials to assess the performance of different industrial hemp varieties, assessment of the effects of variation in different agronomic parameters and in developing an improved hemp harvester. InCrops also assisted a significant number of clients in the construction and built environment sector seeking to utilise Hemp based construction methods

Case study: EcoTechnilin Ltd

EcoTechnilin's main production facilities, located in Cambridgeshire and Northern France, process flax and linseed straw into woven mats using carding/cross-lapping/needle-punch or a patented air-lay process. Three main product lines; Fibrelin (needle-punched mat and felt), Fibrelin Lite (air-laid mat and felt) and Fibrelin Ultra (biocomposites and laminates) are used in a wide range of automotive and other transport applications (principally in interior panels), in construction and industrial applications (including spill



Spill mats in use

control), and as geotextiles. All of these products improve upon the materials to which they offer alternatives. They have low carbon footprints, are derived from a sustainable resource and have excellent application performance.

InCrops has supported EcoTechnilin conducting by field trials to assess the performance of different linseed varieties, assessment of the effects of variation in different agronomic parameters and in exploring new product and market potentials.

International innovation in renewable materials for construction

Dr Liliya Serazetdinova

InCrops sees its duty in maintaining that East of England remains at the forefront of innovation. Our objectives are to foster links with international centres of innovative and applied research, attract entrepreneurial spirit, and create new spin-in companies in the UK. One of the areas where innovation could bring significant reductions of the greenhouse gas emissions is the construction industry. Structural Insulating Panels (SIPs) is a well established construction product with excellent thermal insulation properties, opportunities for off-site manufacturing and use in affordable housing. The construction industry would benefit from the development of lightweight insulating material based on renewable plant-derived feedstocks with properties comparable with conventional SIPs. The value of the UK SIPs market in 2007 was estimated at around £49million and is among the fastest-growing new building methods on the market. InCrops is facilitating the development of products embedding renewable materials such as plant fibre and natural binders. We are working with a cluster of companies and organisations developing renewable infill for SIPs panels and are building up international links in this sector.

As part of this activity InCrops has built strategic relationships with several European organisations, leaders in the development of innovative knowledge and technology. Built upon work with C3 Greenbuild Ltd (see below), InCrops has formed a collaborative relationship with Fraunhofer Institute in Halle, Germany. The Fraunhofer Society comprises 59 institutes at 40 locations in Germany and holds an internationally leading position in commercially-led technology-centred projects, attracting 36% of its funding from industry. InCrops and Fraunhofer will be developing collaborative projects on the use of plant-derived materials for production of insulation materials, paints, and polymers. InCrops is collaborating with the nova-Institute in Germany, a private and independent institute founded in 1994 with expertise in innovative technologies to advance and develop the use of renewable resources as energy and material. It specialises in projects on economy and resource management, biomaterials and is also active in the field of sustainable regional development. As part of the work on development of industrial hemp applications in the UK, InCrops is also a member of the „European Industrial Hemp Association (EIHA)“ founded in 2005 to support the development of the European hemp industry, establish information exchange and business connections.



German entrepreneur Peter Werner

Case Study: C3Greenbuild Ltd

InCrops has been providing business support for a German entrepreneur, Peter Werner, who has developed a business and technological concept for “Natural Composite Sandwich Panels” used for construction of sustainable and affordable housing solutions. His idea is that these ecologically friendly composite panels should be made from indigenous materials and produced sustainably and locally.

The technology and product development has been undertaken in Germany. InCrops assisted Peter with setting

up the UK operation and registering a new East of England start-up company, C3Greenbuild Ltd, in December 2009. C3Greenbuild is working on the development of an affordable eco-housing solution for the UK market. Once developed, patented and introduced in the UK, Peter Werner will use the UK as a hub for operations in Japan, Syria, Algeria, India, and other countries of the developing world where this system could also be used for providing fast but eco-friendly housing solutions with high impact resistance building temporary houses in the areas of natural disaster.

InCrops has been supporting Peter in the UK since the inception of his concept by connecting with UK supply chain and project partners. InCrops has strong links with project partner BRE, as well as developers and builders who can assist C3 Greenbuild in identifying UK building standards and performance requirements and connecting with testing and pilot production facilities. For the next stage of business development, InCrops will facilitate negotiations with venture capital providers.

Agri-supply chains – the full story

Dr Carlos Gonzalez-Esquivel

Case study: Industrial hemp

Industrial hemp (*Cannabis sativa* L.) is being increasingly used in the construction industry as part of carbon-negative building blocks and insulation panels. Other high value applications include lightweight composites for the automotive industry, mulch mats and animal bedding. The oil from hemp seed has remarkable nutritional qualities. The East of England region has been for several years the main producer of hemp, thanks to optimum growing conditions. This is the reason behind the establishment of the only UK processing plant Hemp Technology Ltd in Suffolk. InCrops is currently assisting this company in agronomic trials, as well as promoting the establishment of a growers' co-operative.



Hemp is a low input crop requiring no biocides. Its fast growing period makes it an excellent break crop for arable farmers, as it suppresses weeds and can fit within two winter crop seasons. The harvesting method favoured by the company involves a modified forage cutter, yielding short stem sections (around 60 cm) that can be processed easily. However growers, especially those around the Fens and Breckland areas, experience substantial yield losses when using this method. The stubble left on the ground also complicates baling and preparations for the following crop.

Using the lessons learnt from 5 years experience of growers with different cutting methods, it is possible to develop a new technology that can overcome the above described constraints. The proposal is to manufacture a multi-blade cutter able to work on most soil conditions. This tractor-mounted prototype would produce cut sections that can ret quicker and be baled and processed more easily. It is estimated that the machine could cover a minimum of 500 ha.s during a three week cutting window in August.

SJ and LJ Eyles is an agricultural engineering company based in Thetford specialised on designing, manufacturing and operating hemp and reed harvesting equipment, working closely with hemp growers and the Broadlands Authority. InCrops is funding this company to design and manufacture the prototype, thereafter more harvesters can be produced on demand.

Protecting crops – with plant oils

Dr Liliya Serazetdinova

The global pesticide market value was estimated at £18.49 billion in 2009 with the UK market for agricultural and horticultural pesticide in 2006 valued at £329m. While applied to improve the productivity of agriculture, pesticides cause environmental and economic damage, which in US is estimated at \$6.5m (Pimentel, Environment, Development and Sustainability (2005) 7: 229–252). Commercial sales of pesticides in the EU are regulated by the Plant Protection Products Authorisations Directive (Directive 91/414/EEC). In 2008, a major review programme took place under Directive 91/414/EEC which was designed to ensure that all active substances meet modern environmental standards. The resulting amendment to Annex I of the Directive regulating approved active substances could mean the loss of up to 23% of current products on the market which would lose their approval from 2010. According to assessment by the Pesticide Safety Directorate the loss of these banned active substances could have serious implications in both agriculture and horticulture by removing the foundation stone of several pest control programmes and resulting in between 50% and 100% losses for certain crops. At a time when an increasing global population and climate change are putting more demands on agricultural output, there is an urgent need to develop new, effective and environmentally friendly crop protection products.

Case Study: Barrier Biotech Ltd

Norfolk based micro-SME, Barrier Biotech Ltd, designs and manufactures products for animal healthcare based on plant-derived active ingredients. Using its technical knowledge and 20 years of experience in plant oils, Barrier Biotech Ltd is expanding to other markets - it licensed the UK's first environmentally friendly herbicide in 2001. In 2009, Barrier Biotech Ltd embarked on a new project to develop novel biocontrol products. The global market for biocontrol products is estimated at £0.6 billion. Substitutes for existing chemical pesticides coming off the market due to changes in the Plant Protection Products Directive need to be found and Barrier Biotech Ltd with its long experience working with plant oils is looking to provide cost effective replacement products. The plant oils used in these formulations are derived from sustainable sources and represent a minimal risk for environment. Biocontrol products based on natural active ingredients are likely to provide more durable pest control due to the complexity of chemical composition and naturally occurring variability.

InCrops Enterprise Hub is providing business support for Barrier Biotech Ltd by facilitating interactions with experts in entomology, developing a collaborative partnership involving the John Innes Centre and assisting in attracting funding and providing project management for the development of natural biocontrol products.

Biomass for Biorefining – Energy and High Value Products from Algae

Dr Beatrix Schlarb-Ridley

There is no question about it, in the spectrum of renewable energies, bioenergy has and will have an important role to play, both in Britain and world-wide. However, the controversy surrounding current practice is not entirely unfounded: Biomass is a limited resource, and a growing world population increases the competition for its uses for food, feed and materials, in addition to energy. This increased demand puts additional pressure on the equally limited resources of arable land and water.

One clear message is that – in addition to reducing energy demand - we need to make best use of the biomass available, and concentrate on using waste materials for generation of bioenergy. One way of doing that with current technology is to divert food waste away from landfill towards Anaerobic Digestion (AD), a process that yields biogas (a mixture of methane and CO₂, which can be burnt to generate

combined heat and power, upgraded to pure methane for injection into the grid, and even used as transport fuel in cars with simple modifications).

Adding Value - Case study CH₄ Power

The Cambridgeshire-based company CH₄ Power uses AD to turn waste from the food processing industry into electricity. However, together with InCrops and researchers at InCrops project partners the University of Cambridge and University of East Anglia, it is also investigating a novel way to generate feedstock – growing algae.

Algal technology has great potential for generation of bioenergy, since algae need no arable land and can grow considerably faster than land plants. But especially for generating liquid biofuels, it also has substantial challenges associated with it – such as high parasitic energy for harvesting, drying and processing the biomass to arrive at the fuel. Careful Life Cycle Analysis is necessary to make sure these processes do not use more energy than the algae contain. With InCrops support, CH₄ Power is looking at a different approach: to feed the wet algal biomass directly into their Anaerobic Digester for generation of biogas. The nutrients for growing the algae will come from by-products of the AD process, liquid digestate and CO₂. Hence a circular process will be set up that converts solar energy into methane. Once the technology has matured, the algal biomass may also be fed into biorefineries to generate higher value products, eg proteins, oils and pigments for animal feed.

Commercialising new high value crops

Dr Mark Coleman

Personal care products. The personal care product market is expected to reach in excess of \$100bn by 2012, with 5-10% of that being natural products. Some markets are expected to show particularly vigorous growth over the next few years. These include anti-ageing products (especially skin care products; targeted at the baby-boomer generation), products for babies and children, and products for the developing world. Botanicals are predicted to exhibit greater than 200% growth (2007-2017).

Functional foods. The global functional food market is expected to grow to \$1.75bn by 2012 (~45% growth since 2007). Key target markets include digestive health, beauty products, healthy ageing and weight management. Fruit and juices are expected to be particularly strong with nutraceutical drinks expected to exhibit ~50% growth over a five year period (2008-2013).

Case study: On The Wild Side Ltd



As part of a strategic initiative to introduce sea buckthorn to the UK InCrops is working with the Essex-based company On The Wild Side. Sea buckthorn, a recognized 'superfruit' with juice, oil and leaf based nutraceutical and personal care products, is grown on a very significant commercial scale internationally (greater than 2m ha in China alone) but, although it is indigenous to the UK, it is not grown commercially here. InCrops have linked with major international players in sea buckthorn agronomy, including the Lisavenko Research Institute in Russia, which is foremost in sea buckthorn breeding, to source the best modern varieties. Together with On The Wild Side we are establishing agronomic and commercial trials (at two sites, in Essex and Suffolk) and supporting development of On The Wild Side's market and supply chain analysis, with the aim of bringing a new sea buckthorn product to the UK market.

Sea buckthorn (Hippophae rhamnoides)

Strategic developments

Natural composites

Regionally, development of the biocomposites sector is severely constrained by the lack of a large-scale resin production and lack of a biocomposite product development and testing facility. Natural composites could find applications in different market sectors (automotive, construction, maritime, textile and packaging). InCrops has developed a cluster of regional companies producing fibres, timber, and resins that have expertise in the manufacture and design of natural composites. The markets for composites



based on fibres and timber are growing, and have enormous growth potential. It is clear, however, that market expansion, especially for composites employing bioresins, is at present limited by the cost of bioresins and the need for pilot scale production of new materials for application testing. InCrops is working on supporting those businesses and leveraging funding into the region to support an infrastructure for natural composite production and to facilitate commercialization. InCrops is working with and providing business support for the key regional stakeholders in biocomposite sector – Hemp Technology Ltd, Cambridge Biopolymers Ltd, EcoTechnilin Ltd,

and Automotive Design Partnership Ltd. We also work with other organisations interested in the development of natural composite sector such as Forestry Commission England, Lotus, BRE, and TWI.

As one of its own initiatives, InCrops launched an international Eco-Furniture Design competition in December 2009, with the Sainsbury Centre for Visual Art, calling for designs for an outstanding and innovative piece of furniture - manufactured utilising natural products and materials. Also in development is a networking event promoting use of biocomposites in sport applications. The event is scheduled for April 2010 and will bring together companies across the whole supply chain from manufacturers and developers to sports professionals to discuss the future use of biopolymers, natural fibres and composites in sport products.

On a national scale, InCrops is working closely with NNFFC and the Materials Knowledge Transfer Network in identifying the key strategic actions to facilitate the development of this sector.

Algal development

Algae are an amazing group of plants – hugely versatile and with amazing productivities. Currently their main commercial exploitation lies in high value products such as speciality health foods, fish food for hatcheries, and carotenoids. However, there is great potential for much wider commercial use. To explore this potential for the East of England, InCrops and its project partner Renewables East organised a one-day Networking Meeting on Development of Algal Products and Processes for Bioenergy, Bioremediation and High Value Processes in October 2009. As a consequence of this and of a stakeholder meeting in November 2009 on algae in the UK commissioned by DECC and organised through NNFFC, InCrops applied for and secured EEDA funding to carry out a Feasibility Study in 2010 for an Algal Innovation Centre in the region. Such a Centre could showcase different algal technologies and their applications in commercial contexts, and hence accelerate uptake by companies. Successful commercial application in the East of England is currently hampered by a lack of authoritative information, and by confusion created by exaggerated claims of several international algal bioenergy start-ups.

On a European level, InCrops is also involved in writing a joint proposal with collaborators from the UK, Ireland, France, Germany and the Benelux Countries to the EU Interreg North-West Strategic Initiative on Algae. The proposal, if successful, would give companies in the region access to Algal Pilot Plants and to a bespoke Decision Making Tool to assess suitability of algal technologies for particular scenarios (read more [on p xxx](#)). InCrops is already working with companies in the East of England on integrating algal growth with Anaerobic Digestion ([see Case Study on p xxx](#)), and is expecting to stimulate the uptake of algal technologies especially for bioremediation and biorefining in the future.

Utilisation of oilseed crops



Hemp seed

There is a growing market interest in cold-pressed seed oils from either conventional (rapeseed) or alternative crops (linseed, hemp, camelina, borage). Cold pressed oils maintain most of their chemical properties, and because of their lower content of saturated fatty acids, can be used as part of a healthy diet. Other applications include VOC-free paints for both indoor and outdoor use. InCrops has made initial contacts with regional companies working in this area, and is investing in facilities for cold oil pressing and chemical analyses, in order to find specific properties for applications in the food and oleochemical sectors.

Experimental and demonstration trials

InCrops has started a research and development programme on fibre crops, focusing on the effect of variety choice, sowing density and fertiliser rates on yield and properties of hemp and linseed. Experimental plots were established at Easton College using a low-input approach, with low fertiliser rates and minimum or no use of herbicides and pesticides. Field work has involved a relevant number of Easton staff and students. The results have been shared with those clients directly using these fibres, and it is expected that the companies will in turn advise their growers on variety choice and agronomic management.



Demonstration plots with high value crops have also been established under certified organic management. The potential uses for these crops include pharmaceutical, food and cosmetic products. The ultimate purpose is to demonstrate the technical viability of such crops to farmers, and benefiting from having students from a farming background at Easton. It is nevertheless clear that the markets should be the driving force; hence commercial growth must be encouraged by companies or farmer cooperatives willing to invest in such crops.

Low carbon supply chains for forest products

There is a need to catalyse and deliver a step change within the supply, value adding and use of wood in construction in the East of England. This will boost the delivery of low carbon and low impact solutions to meet increasing demands for lower impact housing and other buildings in the region. The project links the expertise and knowledge around the wood resource in the East England in the Forestry Commission Estate, private estates and other woodlands with a comprehensive understanding of the end use requirements for wood products.

The work is being conducted using an in-house project team of independent BRE experts in materials and construction products. These are combined with expertise in forestry in the region from Forestry Commission as a sub-contractor to BRE. In addition the Norwich Business School and their expertise in supply chain modelling is integrated into the project team.



Biochar

Biochar (charcoal produced from biomass in purpose-built pyrolysis or gasification facilities) has attracted world-wide interest because it is long-lived in the soil and appears to promote improved soil health and to facilitate nutrient and water retention. The InCrops Project sees biochar as a potentially important tool for restoring regional soil health while reducing both input nutrient needs and also the greenhouse gas emissions associated with intensive agriculture. InCrops is working with regional land owners, with potential providers of biochar technologies, and with researchers who bring expertise to help understand the impact of biochar in soils, to develop a strategy that can make the East of England a leader in biochar production and application.

Ecohousing review

BRE have been commissioned by InCrops to produce a review of existing natural fibre based building projects in the East of England and present the findings in an information paper. The publication will include a summary of current natural fibre technologies, regulatory overview, case studies, and a discussion of the barriers and opportunities in this sector.

Bioplastics and biopolymers

Bioplastic consumption is growing in the UK and potentially offers the opportunity to reduce our reliance on fossil fuels and emissions of greenhouse gases. European Bio-Plastics estimates global production capacity in 2009/10 at 750,000-1,500,000 tonnes (3.5% of the plastics market). According to recent research carried out by the Utrecht University (2009) the total maximum technical substitution potential of bio-based polymers replacing their petrochemical counterparts is 270 Mt which corresponds to 90% of the total polymers (including fibres) that were consumed in 2007. In 2007, the most important products in terms of production volumes were PLA (0.15Mt) and starch plastics (0.15Mt). Based on company announcements, in 2020 starch plastics volumes will reach 1.3Mt, PLA 0.8Mt, bio-based PE 0.6Mt, and PHA 0.4Mt. Depending on adoption of policies and measures, and on implementation of total capacity, the predictions of the global production by 2020 vary between 1.7Mt and 4.4Mt. If nothing will be changed, the production is predicted to reach 2.94Mt by 2020. It will take two decades from now on until the meaningful benefits such as CO₂ emission reduction will be achieved at macro-level.



Cyberpac's Harmless Dissolve plastic

chemically-derived counterparts and used in either packaging, or electronics, automotive, and construction applications. Durable biopolymers could be manufactured using the same machinery and can be recycled.

Bioplastics and biopolymers play an important societal and economic role in the modern world. They deliver environmental benefits due to use of renewable and expandable resources and decrease the dependency on limited and increasingly expensive fossil resources, and often have lower toxicity, and could be produced with fewer resources. The best known benefits of biopolymers are biodegradability and compostability, which contribute to a reduction of the amount of plastic contamination on land and in our waters. It is important to note that not all biopolymers are of ephemeral nature and use only for packaging. Durable biopolymers that are made from plant sources would have the same properties as their

The main issues with introduction of bioplastics are high raw materials costs, material performance, uncertainty of the recycling routes and end of life scenarios and supply chain issues. The major UK stakeholders see the way forward with higher volumes and improved efficiency of bioplastics manufacture, incentives and legislation, tax incentives, obligations for renewables, developed performance standards and product labelling, funding support, and in establishment of infrastructure for collection & disposal systems.

The European Commission's Lead Market Initiative (LMI) has identified bioplastics as a lead market and is pushing the introduction of the bioplastics on the market. LMI is actioning development of product performance and end-of life standards for bio-based products, carries out an inventory of the legislation affecting the sector, and encourages green public procurement.

InCrops is building links with UK based companies developing and supplying biopolymers and actively participates in work of the external organisations pushing this agenda. InCrops is a member of the UK Renewable Packaging Group led by NNFCC and a member of the DEFRA stakeholder group for biopolymers. InCrops is also a member of the UK group mirroring the work of the CEN (European Committee for Standardization) on the development of the EU standardisation for bio-based products.

Our business support network and events

As part of the support offered to regional businesses, InCrops delivers regular seminars, workshops and networking events to support knowledge transfer and stimulate new regional business activity.

InCrops business events 2009

Natural Dyes and Textiles seminar, Ipswich

This event explored the opportunities for East of England companies to utilise natural and renewable products in the dye and textiles industries. These range from the extraction of dye from plants, such as woad and weld to the use of plant fibres in textiles, for example bamboo and nettles.



Launch conference, Chilford Hall

The InCrops Enterprise Hub was officially launched on 29th June 2009 at Chilford Hall, Cambridge and attended by an audience of over 150 delegates. A wide variety of talks and workshops were well received by the diverse range of attendees, from industry, academia and government. Specialist workshops at the event included: green and high value chemicals; composite materials; renewable construction; bioenergy and biomass and agronomic issues.



Bioplastics seminar, Cambridge

Innovation in renewable packaging was the theme of the InCrops bioplastics and biopackaging event held in July 2009. This event attracted a lot of interest from industry and academia and provided an opportunity to hear from industry representatives and researchers in the rapidly expanding area of bioplastics.

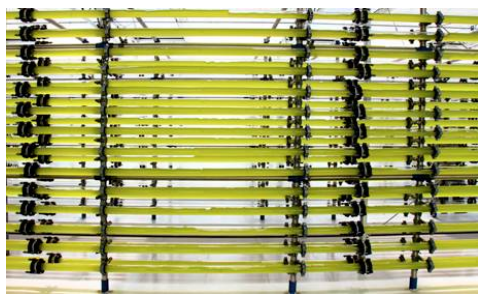


The seminar was well attended with 40 delegates from diverse backgrounds. Industrial delegates included representatives from the areas of packaging, plastic manufacturers, organic recycling, construction, and automotive. Attendee feedback was very positive - *"It was an excellent bridge between industry and academia, "[This event] allowed me to expand my knowledge and make some useful contacts"*.

Fibre Crops Open Day, Easton College

A very successful afternoon event took place in September at InCrops project partner Easton College, where despite the rain, over 60 delegates attended – including farmers/growers, processors, manufacturers, and other agencies.





Algae conference, Norwich

Jointly hosted with Biofuels East, this one day conference in October took place at UEA and addressed the opportunities and challenges in high value applications, bioremediation and bioenergy, with special emphasis on funding opportunities. A range of speakers included representation from Portuguese algal industry.



Natural materials in Construction, Cambridge

A session titled "Innovative applications and processes for natural fibres in construction" was held in Cambridge in November. With 40 delegates this event was well-received with feedback indicated that attendees found the presentations informative and the networking opportunities a valuable opportunity for detailed and focused exchange.



InCrops Drinks Reception, Cambridge – smartLIFE Centre, Cambridge

A networking reception for clients, partners and associates which included a short presentation by Dr John French on a review of the work of InCrops Enterprise Hub since the launch event in the summer. Very well received event, with nearly 80 guests and an excellent cross section of contacts. Feedback from the event has been very positive with guests and team both making new contacts and developing existing relationships.

Additionally, InCrops representatives regularly attend strategic regional, national and international events to engage with a broad range of contacts and we've listed a selection of those events here.

Spring

Biofuels East launch event • Results from RELU Biomass. How will energy crops affect our landscapes?
• Bioplastics Processing and Properties conference, Loughborough • European Industrial Hemp Association Conference, Cologne

Summer

InSite 09, bre • Royal Norfolk Show • East of England Low Carbon Vehicle Consultation Workshop, Hethel Engineering Centre

Autumn

4th International Sea Buckthorn Association Conference (ISA 2009) Belokuriha, Russia • Polymers in Sport, Sheffield • London Technology Network "Value from Waste" • Innovate 09, London • Agribusiness 09

Winter

4th European Bioplastics Conference, Berlin • Natural Fibres 09, London • BBE09

The InCrops team

Managing Director Dr John French
john.french@uea.ac.uk

John has a PhD in applied biology from the University of Cambridge and has extensive expertise and experience in agricultural crops, environmental biology, ecotoxicology, environmental impact and environmental management. He has an in depth knowledge of the sectors and end uses for alternative and non food crops and current methodology for low carbon assessment of supply chains. He is an experienced consultant and has carried out many major projects for academic and business clients including the Eden Project and also Writtle College. He was Head of School of Science at Suffolk College and went on to become Head of Academic Development, and Dean of Science and Technology at the UHI Millennium Institute. He established the Agronomy Institute in Orkney in 2001 and played a lead role in establishing a number of research and commercialisation activities, new novel crops and crop based derivatives. He has interests and achievements also in geophysics, archaeology, the arts and photography.

John has led the InCrops project since inception in the East of England, both as a consultant and now as Director.

Business Innovation Manager Dr Liliya Serazetdinova
l.serazetdinova@uea.ac.uk 0777 630 1718

Specialising in: biopolymers, plastic packaging, textiles for furnishings, fashion and design, natural pigments and eco-paints

Based at: jointly located at the University of East Anglia and the John Innes Centre (JIC)



Liliya graduated from the Al-Faraby Kazakh State University in Almaty, Kazakhstan as a plant physiologist and biochemist. Upon completion of her PhD, Liliya spent 6 years at the Institute of General Botany, University of Hamburg on development of genetic engineering methods for creation of double-haploid plants in barley. The next six years were spent working at the Sainsbury Laboratory, John Innes Centre in Norwich researching on molecular mechanisms of plant signalling upon pathogen attack. A developing interest in technology transfer and

commercial application of research outputs resulted in Liliya and colleagues winning the 2004 the national Biotechnology YES (Young Entrepreneurs Scheme), funded by Research Councils and biotech companies to raise awareness of the commercialisation of bioscience ideas.

Since then Liliya built up practical experience in science commercialisation and contacts within the UK knowledge transfer sector leading to her joining the InCrops Enterprise Hub in March 2009. As the InCrops lead on biopolymers and bioplastics, Liliya is a member of the UK Renewable Packaging Group led by NNFCC and a member of the DEFRA stakeholder group for biopolymers. She is a member of the UK group mirroring the work of the Working Group 209 of the CEN (European Committee for Standardization), which is developing EU standardisation for bio-based products. Liliya is also leading on InCrops strategic developments in the area of nanotechnology, building links with Biosciences for Business Knowledge Transfer Network (KTN) Materials KTN, Technology Strategy Board, National Non-Food Crops Centre, and regional Chambers of Commerce.

Business Innovation Manager Dr Beatrix Schlarb Ridley

b.schlarb-ridley@uea.ac.uk 0777 898 3612

Specialising in: Bioenergy, Biorefineries, Biopharming and Oleochemicals

Based at: Department of Plant Sciences, University of Cambridge



Beatrix studied Biochemistry at the University of Tübingen in Germany, then moved to Cambridge to obtain her MPhil and PhD in photosynthesis research from the Department of Biochemistry there. Before joining the InCrops team in May 2009, her research – mostly carried out in Cambridge, with intervals in Spain, the Netherlands, and the US – had focused on developing applications for photosynthetic components and processes for pharmaceutical and energy uses. Beatrix provides the link to the BBSRC Sustainable Bioenergy Centre, the Cambridge Bioenergy Initiative, the Cambridge Partnership for Plant Sciences, the Centre for Entrepreneurial Learning and London Technology Network. “I am delighted to be able to contribute to a Project which makes the great academic expertise of the region more accessible to SMEs, and accelerates transition to a low-carbon economy.”

Business Innovation Manager Dr Mark Coleman

m.coleman@uea.ac.uk 07977 263 640

Specialising in: natural fibres, composites, functional food and bioenergy sectors

Based at: jointly located at the University of East Anglia and the Institute for Food Research (IFR)



Mark is a member of faculty in the School of Biological Sciences, University of East Anglia, currently seconded (0.8 fte) to the InCrops project. Mark obtained his first degree, a BSc in Biochemistry, from Imperial College, London, in 1983. He obtained a PhD in the area of plant-microbe interactions from the same institution in 1990 and has over twenty years research experience in plant genetics, plant molecular genetics and biochemistry. He continues his interest in plant biology and has research interests in the development of biofuels from feedstocks that do not conflict with food production. He has close links across the Norwich Research Park and is a member of the NRP-based British Bioalcohols Group.

Agri-Business Officer Dr Carlos Gonzalez-Esquivel

c.gonzalez-esquivel@uea.ac.uk 0777 645 4204



Carlos has a degree in Animal Production from the University of the State of Mexico and a Ph.D. in sustainable agriculture from Wye College London, and has worked since 1994 in the evaluation of agroecosystem sustainability using indicators. He has also directed participatory, on-farm research on forage crops, organic horticulture, integrated aquaculture and biological pest control. His role at InCrops is to promote alternative crops and uses amongst farmers and small and medium enterprises. As part of the project Carlos is conducting experimental and demonstration trials at Easton College where he is based and other locations in the East of England.

Project Administrator

Penny Wright

penny.wright@uea.ac.uk 01603 597184



Penny Wright is based at the head office in Norwich at the University of East Anglia. With a background in business and financial management Penny handles all the office and project administrative systems. Penny's career has ranged from working in start-up internet companies through to developing regional creative learning programmes for a national public sector organisation. Outside work Penny has a keen interest in environmental issues and sustainability, including organic vegetable growing and permaculture.

Events Co-ordinator

Julia O'Rourke

j.orourke@uea.ac.uk 01603 591765

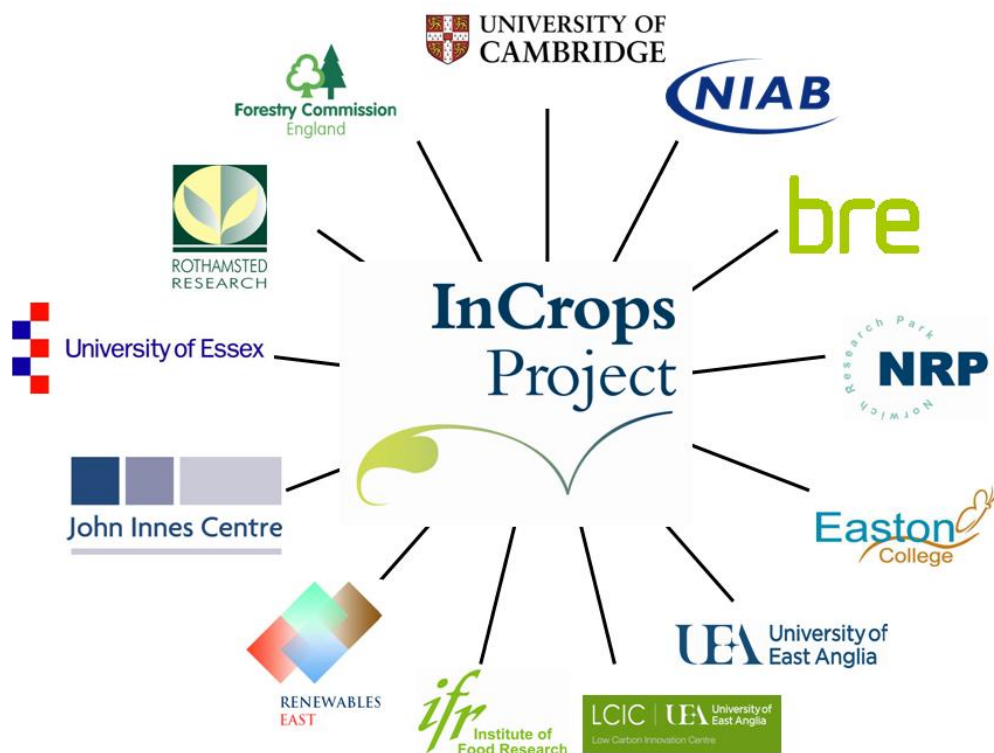


Julia O'Rourke joined the InCrops team in August 2009. With a background in events and marketing Julia has worked in both the private and public sector. She supports the full schedule of business support and other events programmed for around the region including the Eco-furniture competition.

With a background in events and marketing, Julia has worked in a wide range of organisations, including working for six years as part of the communications team at EEDA. Prior to joining InCrops Julia was the event co-ordinator at Prowess, the UK association of organisations and individuals who support the growth of women's business ownership. At Prowess Julia managed the organisation of a range of business support events across the country, a national award programme and supported the organisation of an annual national conference. Julia is a UEA graduate.

Working collaboratively

The InCrops partnership



NIAB - Based in Cambridge, the National Institute for Agricultural Botany has over 80 years experience in the agricultural and food sectors, specialising on plant variety and seeds characterisation, evaluation, quality control and knowledge transfer. NIAB has a working group on novel crops, currently collaborating with InCrops over varietal development of alternative and non-food crops and demonstration field trials. NIAB is collaborating with InCrops on the varietal development of alternative and non food crops and demonstration field trials.

University of East Anglia - UEA hosts InCrops Ltd, the not for profit operating company that runs the Enterprise Hub. The School of Biological Sciences is also a partner in the project. Dr Mark Coleman is seconded from the School and is working with research groups in the BioMedical Research Centre to support InCrops clients in the functional foods sector. InCrops is collaborating with the School in establishing a GC-MS-based small molecule analysis facility, a facility that will benefit both the School, InCrops clients and InCrops strategic initiatives.

LCIC - The Low Carbon Innovation Centre is a UEA subsidiary company which includes the CRED Carbon Reduction programme that is actively working with InCrops to develop low carbon strategies for supply chains in the East of England with particular emphasis upon low carbon strategy development, life cycle analysis tools.

University of Cambridge, Department of Plant Sciences – one of the last remaining departments in the UK dedicated to training the next generation of Plant Scientists hosts the InCrops appointment of Dr Beatrix Schlarb-Ridley, and is involved in InCrops initiatives on algal biotechnology and biochar. A strong

cooperation exists with the Cambridge Bioenergy Initiative, which also spans the Departments of Biochemistry, Engineering, Chemical Engineering and Biotechnology; further collaborators include the Dept of Pharmacology on verification of Traditional Chinese Medicines, the Nanoscience Centre on nanomaterials in biocomposites, and the Centre for Entrepreneurial Learning on encouraging the formation of spin-out companies.

Forestry Commission - The Forestry Commission is the government department responsible for the protection and expansion of Britain's forests and woodlands. Its East of England office is responsible for managing over 25,000 ha.s of woodland. Staff at the Thetford Forest office are working closely with InCrops on alternative tree species with disease resistance and economic potential, as well as developing new timber based supply chains for the construction sector to meet the increasing demand for renewable materials.

Institute of Food Research (IFR) - IFR is collaborating in developing co-products from waste and novel aquatic crop plant species, including bioalcohols from lignocellulose, over the development of Life Cycle Analysis tools for use by SMEs, and in the area of functional foods. Dr Mark Coleman is hosted at IFR and has close links with the Sustainability of the Food Chain Exploitation Platform.

Rothamsted Research - Rothamsted Research is probably the oldest agricultural research station in the world, laying the foundations of modern scientific agriculture, experimental statistics and crop nutrition. Rothamsted hosts the national willow collection and is working closely with InCrops on strategies to adapt to climate change and maximise the productivity of alternative and novel crops.

Renewables East - The agency for renewable energy in the East of England exists to drive forward the agenda of a full range of low carbon energy solutions into the East of England economy, whilst ensuring the region exploits the best economic benefit and delivers jobs in an emerging and exciting global market. It works jointly with InCrops to deliver the East of England Advanced Biofuels Hub and the development of new algal products and processes.

BRE - is collaborating over the development of new construction supply chains using natural plant derived products into the built environment. InCrops has developed a wide range of new initiatives with BRE including 'Low impact structures', and ecohousing review, the East of England timber supply chain project and jointly developed an exhibition on fibre crops which was launched at the Natural Fibres 09 international conference hosted by the Institute of Materials, Minerals and Mining in London in December.

NRP - co-ordinates the research expertise of the Norwich Research Park partners and is working with InCrops to maximise the flow of technology transfer from NRP to InCrops business clients. This interface is of particular value to InCrops given the need to navigate the expertise base that exists on the NRP and make this accessible to businesses.

Easton College - Easton is Norfolk's agricultural and land-based studies College, focusing mainly on vocational courses. Long-term development objectives include strengthening its research capabilities and working jointly with the UEA in the establishment of the Centre for Contemporary Agriculture. Easton hosts the Demonstration Trials unit and the appointment of Agri-business Officer Dr Carlos Gonzalez-Esquivel.

John Innes Centre (JIC) – JIC is an independent, international centre of excellence in plant science and microbiology, contributing over £170M annually to the UK economy, demonstrating the impact and relevance of their scientific research. JIC hosts the appointment of Dr Liliya Serazetdinova and is collaborating over the development of a germplasm bank for lesser known crops and also the utilisation of plant based chemicals into new materials.

The University of Essex – colleagues in the School of Biological sciences are actively involved in work looking into the exploitation of algae and also drought tolerance in a range of crops together with

international work in the field of sustainable agriculture. Developmental areas of work also include biobased materials in sport and the testing of such materials

InCrops international

Interreg

The Interreg programme is a financial instrument of the European Union's Cohesion Policy. It funds projects which support transnational cooperation. The aim is to find innovative ways to make the most of territorial assets and tackle shared problems of Member States, regions and other authorities. Priorities for the Interreg North-West Europe (NEW) Programme (<http://www.nweurope.org/>) include developing the NWE knowledge-based economy by capitalising on our capacity for innovation, and sustainable management of natural resources and of natural and technological risks. Interreg NEW have announced a Strategic Initiative on 'Energetic Algae', and InCrops has been a key partner in shaping the maturation of a project proposal to be submitted to the EU in 2010. The proposal, if successful, would give companies in the region access to Algal Pilot Plants and to a bespoke Decision Making Tool to assess suitability of algal technologies for particular scenarios. InCrops clients would be invited as stakeholders to all dissemination meetings of the Project, and would have free access to the European network of players in the field of algal technologies brought together through the Interreg Programme.

Nova Institut and the European Industrial Hemp Association



The Nova Institut is an independent organisation based in Germany using and creating expert knowledge and innovative technologies to advance and develop the use of renewable energy and materials. Initial contact with managing director Michael Carus was made at the European Industrial Hemp Association Conference in May 2009. Michael was then invited to speak at the Fibre Crops Open Day in September. As an outcome of the visit, further collaboration was agreed, including organising an international event on natural fibres/materials and working on joint bids for EU projects.

Other useful contacts from the EIHA Conference include hemp breeders from Poland, Hungary and Canada, which are now supplying seeds for the InCrops trials.

Nova Institut Director Michael Carus demonstrates a hemp fibre composite case

Lisavenko Research Institute

The Lisavenko State Research Institute of Siberian Horticulture, part of the Siberian branch of the Russian Academy of Agricultural Sciences, in the Altai region of Siberia, is the world leading institution for sea buckthorn breeding. Formal breeding programs started in the 1930s and studies of processing and biochemistry began in the 1950s. More than forty varieties have been state registered and these have greatly improved properties. These properties include increased yield, removal of thorns, increased ease of harvest, high berry sugar levels, high oil and carotenoid levels, drought and pest resistance. Following a visit to the Institute for the International Sea Buckthorn Conference in September 2009, InCrops has been developing a collaboration with researchers there to further our knowledge of sea buckthorn and to import varieties to trial in the East of England.



Delegates at the 4th International Sea Buckthorn Conference Altai Region, Siberia August 2009

India

InCrops has developed relationships with a cluster of Indian companies seeking to collaborate with businesses in the UK, mainly in the medicinal herbs sector and the fibre into construction sector.

InCrops has also developed a collaborative partnership with Tamil Nadu Agricultural University, the top Indian University in this sector. The collaboration is supporting new near market work in Biochar, Biofuels, medicinal herbs and Indian temperate crops from the Kodai area.

China

Collaborations with Chinese companies and research institutes are being developed through Dr Tai Ping Fan, based at the Department of Pharmacology at the University of Cambridge, on verification of traditional Chinese medicines, and through Link China Pharma Solutions Ltd, on encouraging spin-ins from Chinese companies (from pharmaceutical and energy sectors) into the East of England. InCrops activity in the traditional medicine and functional food sectors is also being supported through the China-UK Sustainable Agriculture Innovation Network (SAIN) led by UEA based Dr Yueli Lu.

InCrops Ltd – Board of Directors

InCrops Ltd Board of Directors is the operating company that takes responsibility for the delivery of the InCrops Enterprise Hub.

Directors

Prof Trevor Davies, Pro Vice Chancellor, UEA

Dr John French, Managing Director, InCrops

Prof David Richardson, Dean of Science, UEA

Ian McCormick, Director of Research, Enterprise & Engagement Office, UEA

The Senior Industry Consultative Group is advisory to the Board and is chaired by Nitin Dahad, Managing Director of Techspark Ltd

The Strategy Group is advisory to the Board and is made up of representatives from the InCrops Partners. It is chaired by John French, Managing Director. The members of the strategy group are:

Partner organisation	Representative
NIAB	Lydia Smith
University of Cambridge, Dept of Plant Sciences	Alison Smith
Forestry Commission England	Steve Scott
Rothamsted Research	Stephen James
BRE	Anthony Heywood
Easton College	David Lawrence
UEA School of Biological Sciences	John Turner
LCIC	Simon Gerrard
IFR	Keith Waldron
Renewables East	Richard Parker
NRPe	Robin Daniels
John Innes Centre	Jon Clarke
University of Essex	Paul Thomas



InCrops Strategy Group - inaugural meeting December 2008

APPENDIX 1

Accounts 2008/2009

INCROPS LIMITED

DIRECTORS AND ADVISERS

Directors

T D Davies

H J French

I D McCormick

D J Richardson

Company secretary S Donaldson

Registered office The Registry, University of East Anglia, Norwich Norfolk NR4 7TJ

Independent auditors PricewaterhouseCoopers LLP, Chartered Accountants and Statutory Auditors, The Atrium, St Georges Street, Norwich Norfolk NR3 1AG

DIRECTORS' REPORT

for the period ended 31 July 2009

The directors present their report and the financial statements for the 346 day period ended 31 July 2009.

PROFIT AND LOSS ACCOUNT

for the period ended 31 July 2009

346 days
ended 31
July 2009
£

Turnover

Grants and donations receivable

401,106

Research and development expenditure incurred

(381,062)

Depreciation

(20,044)

Operating profit

-

Profit on ordinary activities before taxation

-

Tax on profit on ordinary activities

-

Profit for the financial period

-

All items dealt within the profit and loss account above relate to continuing operations, which commenced on 8 October 2008.

The company has no recognised gains or losses other than those included in the results above, and therefore no separate statement of total recognised gains and losses has been presented.

BALANCE SHEET
as at 31 July 2009

	2009
	£
Fixed assets	
Tangible assets	85,679
Current assets	
Debtors	94,273
Creditors: amounts falling due within one year	(179,952)
Net current liabilities	(85,679)
Total assets less current liabilities	-
Net assets	-
Capital and reserves	
Profit and loss account	-
Total shareholders' funds	-

The financial statements on these pages were approved by the Board on 19 January 2010 and signed on its behalf by:

T Davies
Director

OPERATING PROFIT

Operating profit is stated after charging:

346 days ended 31 July 2009
£

Auditors' remuneration	
- for audit services	2,500
Depreciation	20,044

EMPLOYEE INFORMATION

The company paid no remuneration to its directors and had no other employees during the period.

TAXATION

(i) Analysis of tax charge for the period

	346 days ended 31 July 2009 £
Current tax	
UK Corporation tax on profits of the period	-
Total current tax	-
Tax on profit on ordinary activities	-

(ii) Factors affecting the taxation charge for the year

The tax charge assessed for the period is £nil:

	346 days ended 31 July 2009 £
Profit on ordinary activities before tax	-
Profit on ordinary activities multiplied by the small companies' rate of corporation tax in the UK 21%	-
Current taxation charge for the year	-

(iii) Factors affecting future tax charges

Significant differences between the statutory and effective rates are not foreseen.

TANGIBLE FIXED ASSETS

	Plant and machinery £
Cost	
Additions	<u>105,723</u>
As at 31 July 2009	<u>105,723</u>
Depreciation	
Charge for period	20,044
As at 31 July 2009	<u>20,044</u>
Net book value at 31 July 2009	<u>85,679</u>

DEBTORS

	2009 £
Other debtors and accrued income	<u>94,273</u>

CREDITORS: AMOUNTS FALLING DUE WITHIN ONE YEAR

	2009 £
Amounts due to parent undertaking	72,860
Accruals and deferred income	<u>107,092</u>
	<u>179,952</u>

The amounts due to parent undertaking are interest free, unsecured and have no fixed repayment date.

Within accruals and deferred income is deferred income of £85,679 representing net capital grants £9,543 represents an accrual for timing differences arising on EEDA and ERDF grant claims being made on an accruals basis and cash basis respectively. The remaining £11,870 represents accruals for expenses incurred in period relating to post period end claims.

PROFIT AND LOSS ACCOUNT

	Profit & loss account £
Profit for the financial period	-
At 31 July 2009	-

MEMBERS' CAPITAL

The company has no share capital as it is limited by guarantee. University of East Anglia, the sole member of the company, undertakes to contribute such an amount as is required, not exceeding £10, to the assets of the company should it be wound up whilst they are a member or within one year after they cease to be a member.

ULTIMATE PARENT UNDERTAKING

The ultimate parent undertaking and controlling party is University of East Anglia. University of East Anglia is the parent undertaking of the smallest and largest group of which the company is a member and for which group accounts are prepared. Copies of the group financial statements for University of East Anglia are available from University Plain, Norwich, NR4 7TJ.

APPENDIX 2

Milestone	original forecast date	date achieved	date forecast to be achieved	Notes
Operating company formed and cycle of Company and Strategy Board meetings established	Sept 2008	Oct 2008		Date of registration was August 2009. Strategy Group and Bard have been meeting since autumn 2009. Minutes of both available. The University appointed Mills and Reeve to provide legal and company advice and it appointed PWC for taxation advice in relation to funding and income streams.
Low carbon monitoring and evaluation function established	Sep 2008	Feb 2009		In conjunction with LCIC the project set up the facility to have LCAs conducted for supply chains or products. Active partners in this project are IFR and BRE.
First business support seminars and business Innovation Network formalised	Nov 2008	Jan 2009		Continuing the previous project format new seminars have been running since January 2009. The first of these was at UCS. All contacts that attend seminars are entered into the InCrops database and are circulated information as a BIN.
Year 2 Plan finalised with monitoring and reporting cycle embedded	Nov 2008	March 2009		The InCrops office appointed a project administrator who co-ordinates all activity to support businesses, strategy group, team activity. This has been embedded into a planning structure by the administrator who started in post in March 2009.
InCrops Launch Conference (First of a series)	Dec 2008	June 2009		When the project was submitted for appraisal the intended start date was Jan 2008. Due to approval process delays the project actually started in September 2009. This delay and the availability of key note speakers resulted in the launch event taking place in June 2009.
InCrops research and development plan finalised	Jan 2009	March 2009		This is a committee paper that was approved by the Strategy Group and the Board of Directors that sets out the basis on which InCrops engages with research and development.

Milestone	original forecast date	date achieved	date forecast to be achieved	Notes
GVA and CO2 benchmarking exercise completed	Jan 2009	March 2009		The project grant included a requirement for a baseline study to review economic and low carbon impact of the project. This was conducted by Collison & Associates. It highlighted the difficulty associated with monitoring programme level and regional impacts. This is therefore an ongoing process and occurs later in the project life.
Partner based exploitation platforms become live and research and commercialisation animateurs in post	Jan 2009	May 2009		The InCrops project includes 5 Business Innovation Managers who are all located with partners and manage their own platform of commercialisation activities. Four of these and the Agri Business Officer were all appointed on time and activated their platforms of activity: Easton, IFR, JIC, Cambridge, BRE
Applied research infrastructure becomes operational including demonstration facility	Mar 2009	April 2009		This relates to the operational impact of the research and development strategy and the way in which this is utilised. An IPR protocol was developed by Mills & Reeve
08/09 capital spend completed	March 2009	March 2009		This capital spend enabled the field trials at Easton College to be operated during 2009.
Public prospectuses of business development and exploitation opportunities	June 2009	June 2009		This is the sector distribution sheets that was made available at the Launch event and makes explicit the areas of commercial development opportunity and the role of the BIMs in providing support

Appendix 3

Project Targets – outputs and results

This table summarises the project targets for both the EEDA and ERDF funded activity and the results that have been reported to 31 December 2009 .

	2009 2009/10 for EEDA	2010 2010/11 for EEDA	2011 2011/12 for EEDA	2012 2012/13 for EEDA	2013	2014	Total
O1.1 No. of startups receiving Priority 1 assistance		10	20	20	20		70 ERDF
O1.2 No of SMEs receiving Priority 1 assistance - innovation	2 Achieved 2	12	20	20	16		70 ERDF
O 1.3 No of SMEs receiving Priority 1 assistance - non-innovation	1 Achieved 1	5	6	10	8		30 ERDF
EEDA No of businesses assisted in their performance	65 Achieved 29	55	50	50	50		270 EEDA
O 1.6 No of businesses engaged in new collaboration with the new knowledge base	2 Achieved 2 60 EEDA Achieved 29	12 45 EEDA	20 45 EEDA	20 45 EEDA	16 25 EEDA		70 ERDF 220 EEDA
R1 No of jobs created (FTE/by gender)		20 EEDA	10 15 EEDA	20 15 EEDA	20 20 EEDA	20	70 ERDF 70 EEDA
R1 (F) No of jobs created (Female 55% of R1)			5	10	12	11	38 ERDF

	2009 2009/10 for EEDA	2010 2010/11 for EEDA	2011 2011/12 for EEDA	2012 2012/13 for EEDA	2013	2014	Total
R3 No of successful innovation related initiatives in SMEs		5	10	10	10	15	50 ERDF
R4 No of successful non innovation related initiatives in SMEs		2	3	5	5	5	20 ERDF
R5 No of successful environmental relation initiatives in SMEs				5	10	10	25 ERDF
R6 No of successful start up businesses (EEDA number of businesses created and demonstrating growth)		9 EEDA	15 7 EEDA	15 7 EEDA	15 7 EEDA	5	50 ERDF 30 EEDA
R7 Leverage of private sector funding €m							1.5 ERDF
R8 Leverage of public sector funding €m							1.5 ERDF
R13 No of businesses integrating new products, processes or services			10	20	20	20	70 ERDF