

***INJECT Enterprise and Establishing of  
Saratov Regional Centre of  
Commercialization of Research Results in  
the Field of Microelectronics, Photonics,  
Nanotechnologies and Laser  
Technologies***

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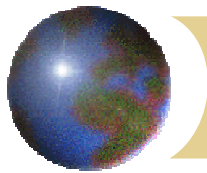
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***Regional laser centers: opportunities for international cooperation***

***November 22, 2006 Berlin***



**Saratov Region**



# *Saratov Region*



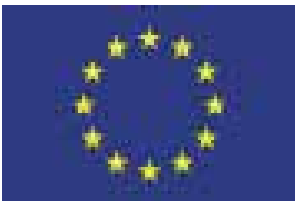
*Regional laser centers: opportunities for international cooperation*

*November 22, 2006 Berlin*



# *Presentation Outline*

- ***Introduction.*** Initiative project of INJECT Enterprise - Saratov Provincial Chamber of Trade and Commerce «Establishing of Centre of Commercialization of Research Results in the Field of Microelectronics, Photonics, Nanotechnologies and Laser Technologies».
- **PHOTONICS – the critical industrial technology of XXI century.**
- **What is an industrial cluster and what is its effect?**
- **Providing of future production in Europe. The EU project – *MANUFUTURE.***
- **Prospective partners of Saratov cluster project and main trends of its realization.**



This project is financed by  
the European Union

## **Initiative Project of INJECT Enterprise and Saratov Provincial Chamber of Trade and Commerce**

### **«Establishing of Saratov Regional Centre of Commercialization of Research Results in the Field of Microelectronics, Photonics and Nanotechnologies»**

**in October 2005 has got a status of the associated  
participant in the program EC TACIS -  
«Science and Commercialization of Technologies»**



# Main Partners of the Project

**Ministry of Industry and Energy of Saratov Province**

**Laser Association (Moscow)**

**P.N. Lebedev Physical Institute of RAS (Moscow)**

**Institute of Applied Physics of RAS (N.Novgorod)**

**Institute of Physics of Microstructures of RAS  
(N.Novgorod)**

**Saratov Research Centre of RAS**

**Far East Centre of RAS (Vladivostok)**

**Saratov State University**

**Saratov State Technical University**

**Saratov State Economic University**

# **INJECT Enterprise Saratov, Russia**

**One of Russian leading designers and manufacturers of serially produced optoelectronic components - more than 30 types of semiconductor laser diodes, superluminescent diodes, photodiodes etc. Activity of INJECT Enterprise began in 1973.**

**The research & production base of INJECT Enterprise comprises five labs and a production line with a complete cycle of manufacturing of laser semiconductor emitters beginning from manufacturing of semiconductor wafers. The production cycle includes epitaxial growing of semiconductor structures, followed by a planar technological cycle of die structure formation, deposition of the ohmic contacts and optic coatings, die assembling and device packaging.**

# **INJECT Enterprise Saratov, Russia**

- **Today our customers are research centres and industrial companies in Russia and abroad**
- **More than 25% of INJECT products are exported abroad in UK, USA, Israel, South Korea, Germany, Australia and other world countries.**

## **Application areas of INJECT produced optoelectronic components.**

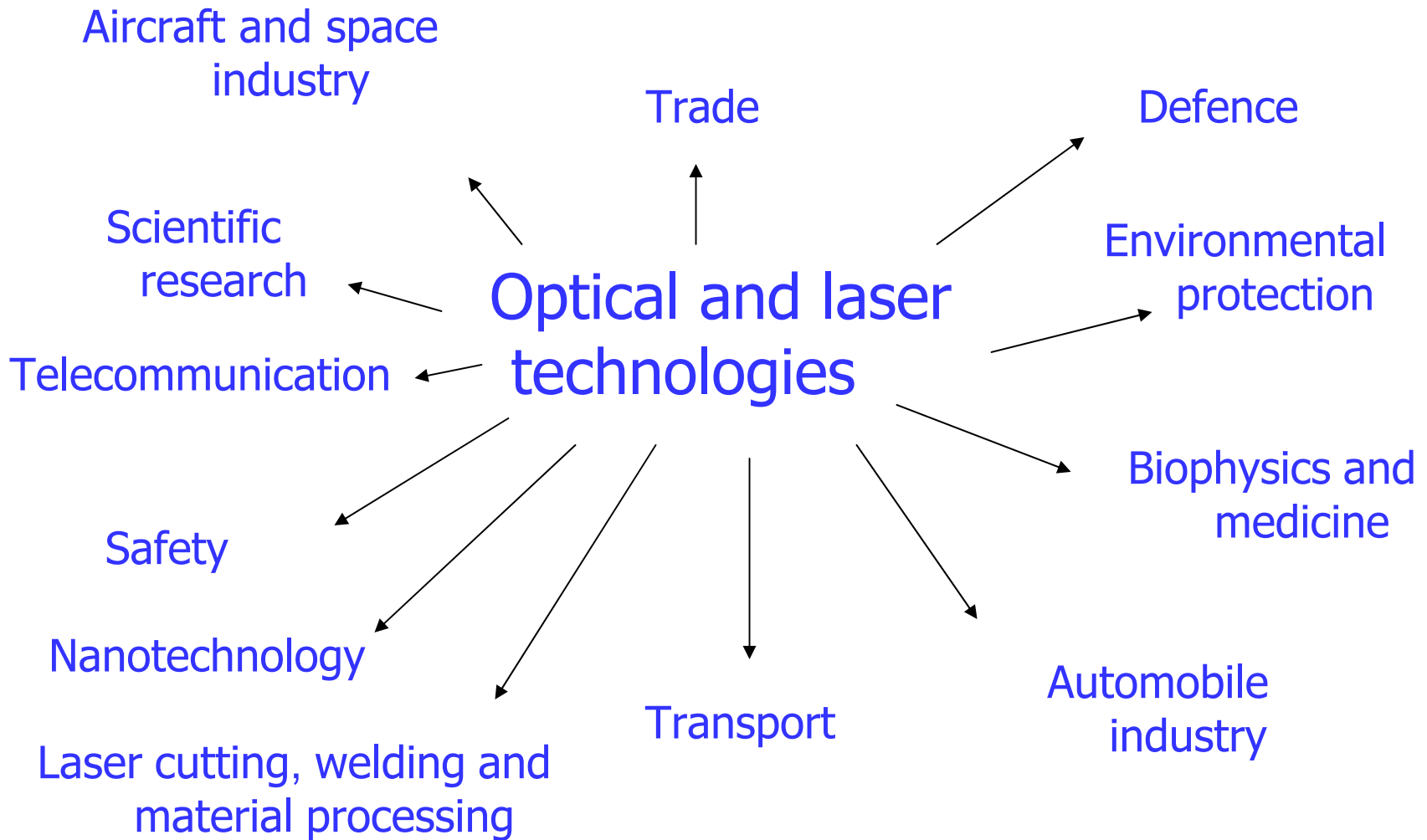
- **fiber optic sensors and gyros**
- **laser rangefinders**
- **systems of diode-laser pumping of solid-state lasers**
- **systems for illumination of night vision devices and CCTV**
- **optoelectronic sensors and security systems**
- **fiber optic communication & data transmission lines**
- **free space wireless optic communication**
- **magneto-laser therapy, photodynamic therapy (PDT), oxymeters**
- **optical low coherence tomography**

# **Application areas of INJECT produced optoelectronic components:**

- **biometrics (authentication), biochemical analysis, DNA sequencing**
- **optic measuring equipment**
- **intelligent transport systems, car navigation**
- **machine vision**
- **solid state illuminating system for plant growth and optical steering photo for plant growth and photo synthetically active radiation (PAR)**
- **light emitters for chemical reactor and nano-particles treatment and nano-medicine**
- **research**

OPTICS (PHOTONICS) - optoelectronics, optical and laser technologies – the rapidly emerging field of scientific, technological, and industrial activity with wide-ranging applications becomes a critical industrial technology of XXI century.

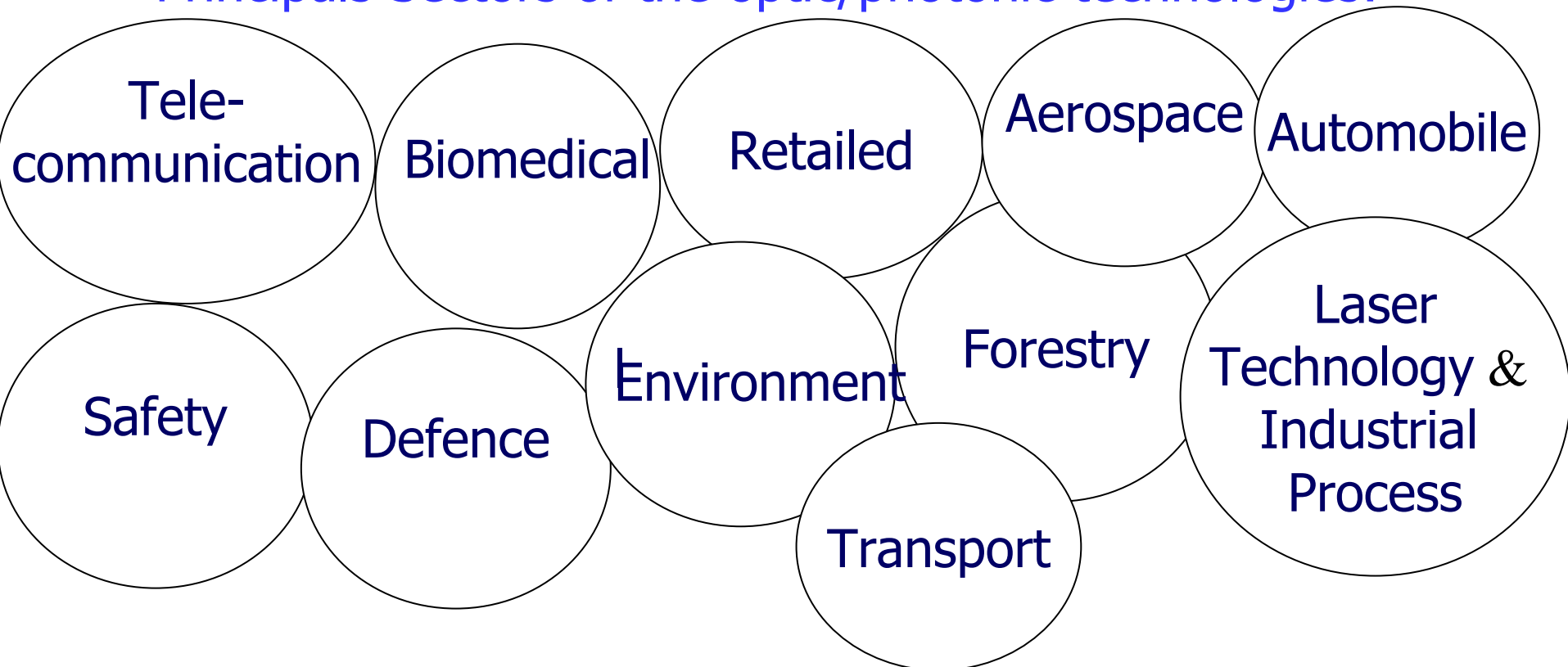
# Main Application Fields of Optical and Laser Technologies:



# Optics World Introduction

Optics/Photonics (also known simply as optics) is a rapidly emerging field of scientific, technological, and industrial activity with wide-ranging applications. Optics has to do with the production, manipulation, transmission, and detection of photons, fundamental components of light composed of waves and energy particles.

\*Principals Sectors of the optic/photonic technologies:



# How Russian Industrial Enterprises Can Survive in Conditions of World Market and What to Do for Acceleration of the Economic Growth?

## Principle problems:

- Strategic need of accelerated quick raising of the product realization volume and increase of «stability» of the enterprise at the world and national markets
- Necessity of accomplishment of continuous technical improvement of production processes and performance of serially produced products
- Necessity of carrying out of exploring and application R&D work at the expense of the enterprise own resources
- Lack of funds for performing technical reconstruction of production facilities

# Search of Partners

- Deficient demand at RF industrial market
- Main problem challenging today industrial enterprises is not only development and effective application of novel technologies, but search of such technologies which could insure production of new commercially successful goods and their dynamic promotion at the market

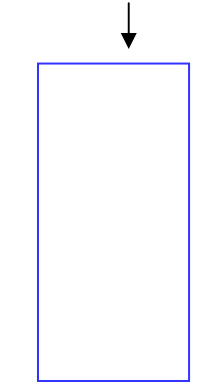
# Why Companies are Interested in Using New Technologies and Innovations?

- **Most companies apply production technologies far from optimal ones**
- **Legislation (safety, environmental protection) causes the need of modifications in production and technology processes**
- **Customers make raising demands to cost and technical level of products**
- **New products provide competitive strength to a company at the market**
- **Small scale enterprises frequently have no sufficient resources for conducting R&D work, and consequently production processes do not improve but degrade.**

# Modification of the Model of Industrial Production

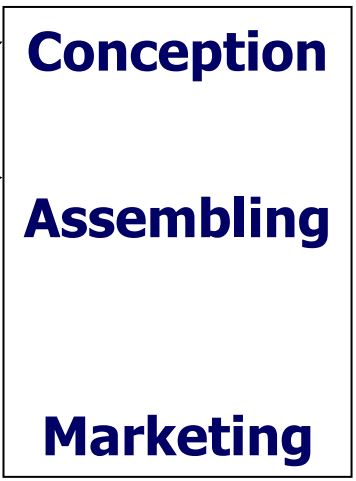
## Vertical Integration

Raw materials, materials



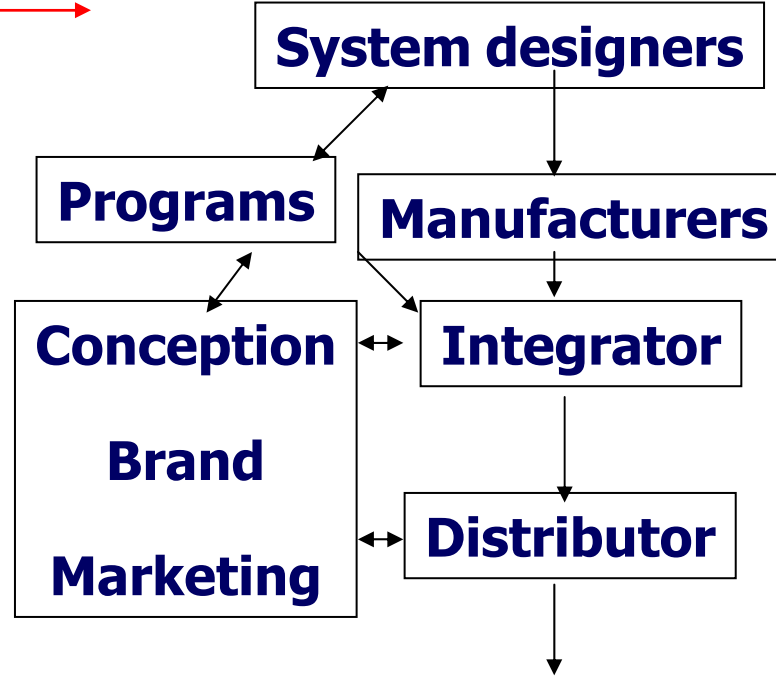
TV sets

Design  
Motor  
Car body  
Parts



## Automobile industry

## Virtual company



# Priority Developments of Industrial Technologies

**Electronic Industry**

**Super-precision production**

## Miniaturizations

**Consumer electronics**  
**Computer equipment**  
**Tools**  
**Telecommunication equipment**  
**Instrumentation**

**Emerging production technologies**

- **Optical and laser technologies**
- **Micro-production**
- **Cutting/Shaping**
- **Manipulators/Assembling**
- **Welding**
- **Modifications/Control**
- **New materials**

**Aircraft and space**  
**Automobile**  
**Tool-making**  
**Machine-building**

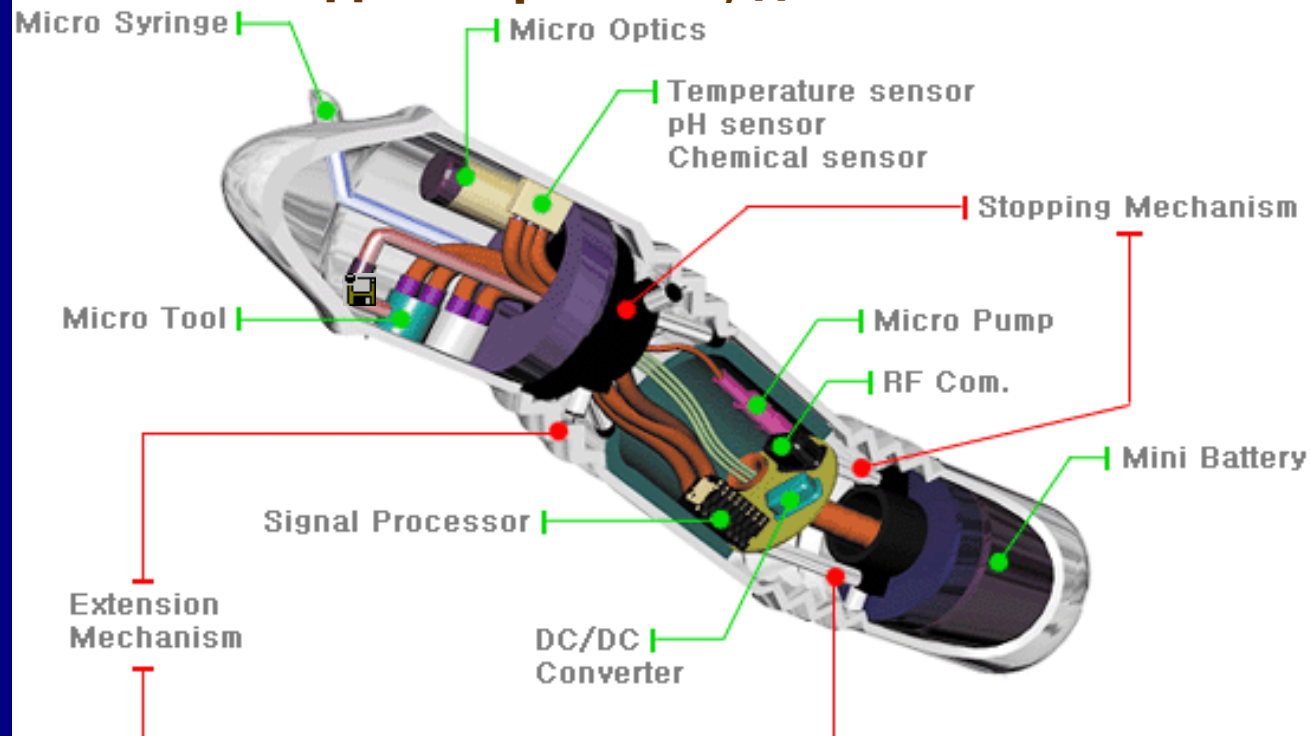
# Пример вновь создаваемых комплексных технологий и систем

## Основные используемые технологии:

- Системная интеграция
- Механизм движения: вперед, назад, остановка, фиксация
- Датчики био-сигналов: ускорения, pH, давления
- Высокоскоростная телеметрическая система с высокой надежностью
- ТВ камера и осветитель
- Энергия: высокая плотность энергии и беспроводная передача данных
- Контроль расположения

## Эндоскопическая микрокапсула

Диаметр - 10мм, длина - 20мм



Источник: Intelligent Microsystems Centre, KIST, Korea

# What are clusters?

“Clusters are groups of inter-related industries. They have two key elements.

Firstly, firms in the cluster must be linked.

Secondly, groups of inter-linked companies locate in close proximity to one other.”

# Perspectives on Innovative Regions

The firm/cluster perspective:

“Clusters of related and supporting industries operating as geographically concentrated collections of interrelated firms in which local sophisticated and demanding customers and strong competition with other firms in the same industry drive the innovation process”

(M.Porter “Competition”, 1998)

# The Importance of Clusters

- **A cluster is a group of interrelated companies, organizations, associations, academic institutions, suppliers, service providers, etc. of a particular field located in the same geographical area**
- **Clusters promote regional economic and knowledge growth**
- **Benefits of clusters:**
  - **Accelerate the pace of innovation**
  - **Attract investment**
  - **Stimulate job creation**
  - **Generate wealth**

# Competitive Advantage of the Cluster:

- **Excellent access to special sources reducing business outlay**
- **Specially trained and experienced staff**
- **Large market of manpower resources**
- **Diverse specialization – based on basic references and increased versatility**
- **Improved ability of introduction of innovations based on knowledge accessibility**
- **Stimulation of the process of setting-up of new companies and affiliate enterprises**

# *Key cluster indicators*

## *Flows, dynamics*

### *• Inflows*

- *Capital*
  - *VC, Foreign Direct Investment, Merger & Acquisitions*
- *People*
  - *Stars, post-docs*
  - *Talent (other highly skilled labour)*

### *Outflows*

- *Products (goods, services) to world markets*

### *Knowledge/learning: embodied, other –*

- *IP (licensing; other codified forms)*

# ***Key cluster indicators***

## ***Local social dynamics***

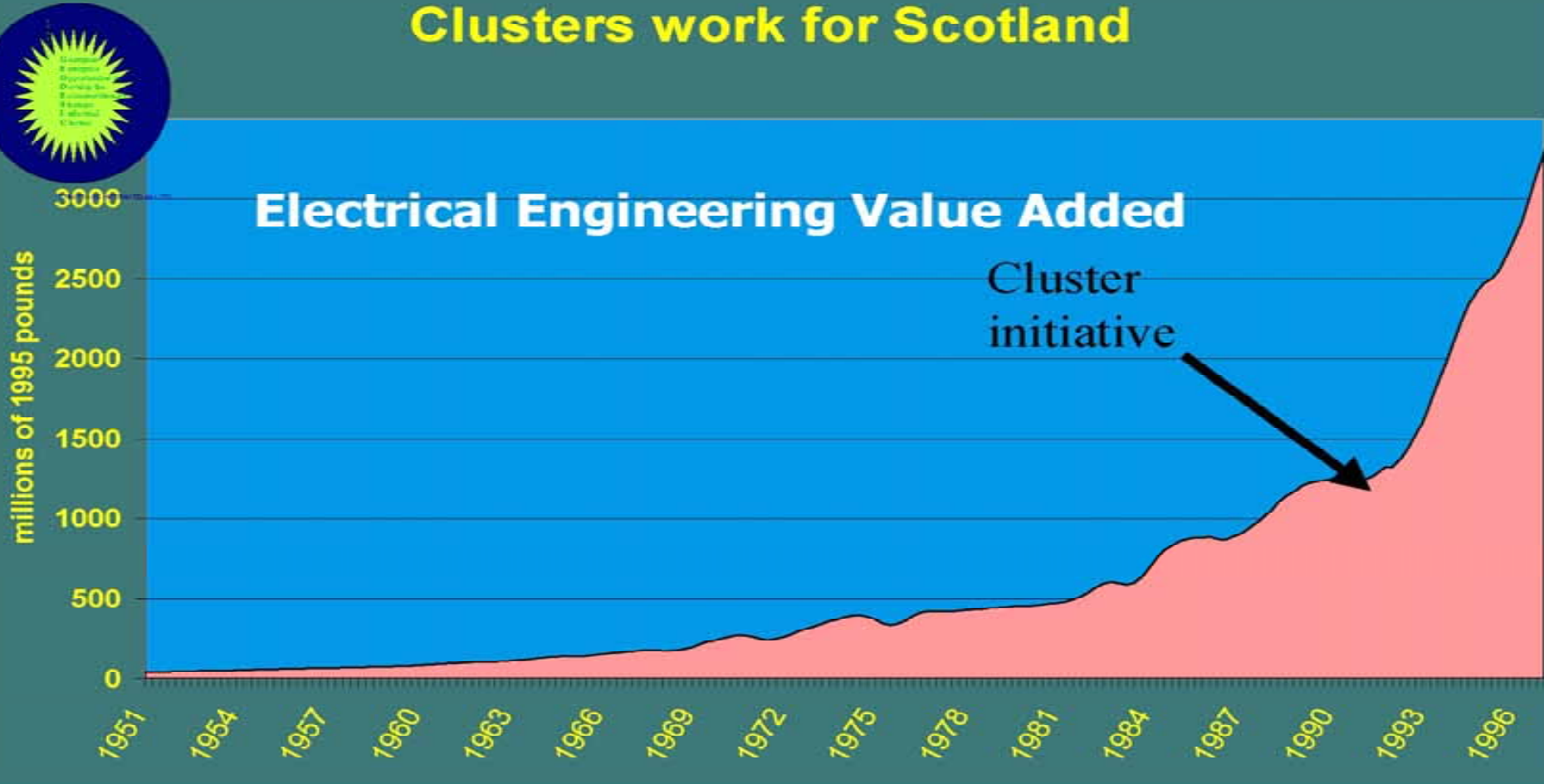
- ***Co-operation, networks***
- ***Competition***
- ***Circulation of labour, entrepreneurs***
- ***Community-level associative governance***
- ***Key elements, assets, drivers:***  
***“what is it that anchors this industry in this region?”***

# *Key cluster indicators*

## *History and path dynamics*

- *Discontinuities, shocks*
- *Resilience, robustness*
- *Adaptation, evolution*
- *Learning from success – spinoffs, demonstration effects*
- *Learning from failure – release of surplus assets: key to next wave of prosperity*

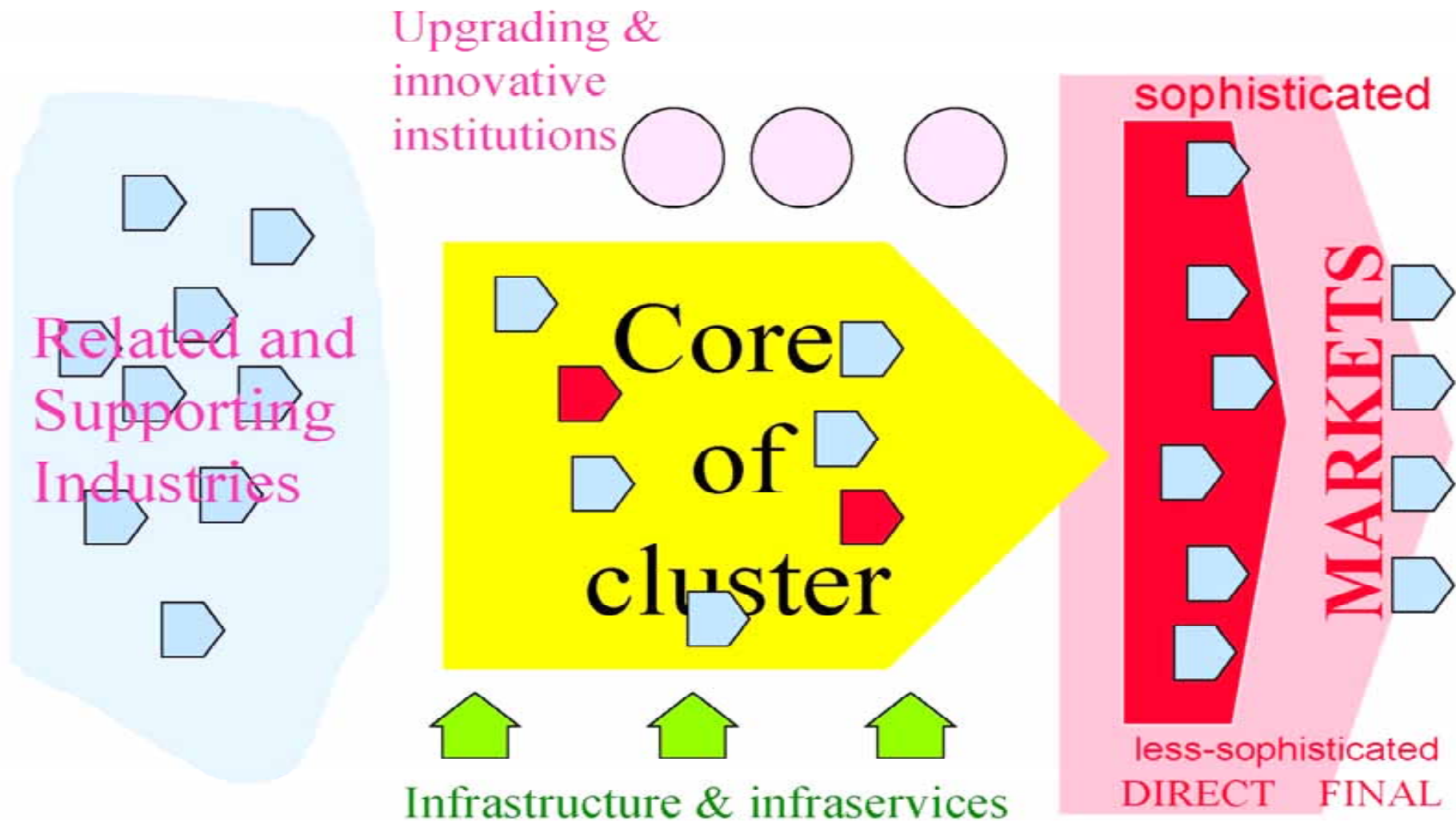
## Clusters work for Scotland



**FIRST CLUSTER INITIATIVE PAID OFF  
AT LEAST A HUNDRED FOLD**

**Hervey Gibson "Britain catches up with clusters"  
Cogentsi and Glasgow Caledonian University, UK**

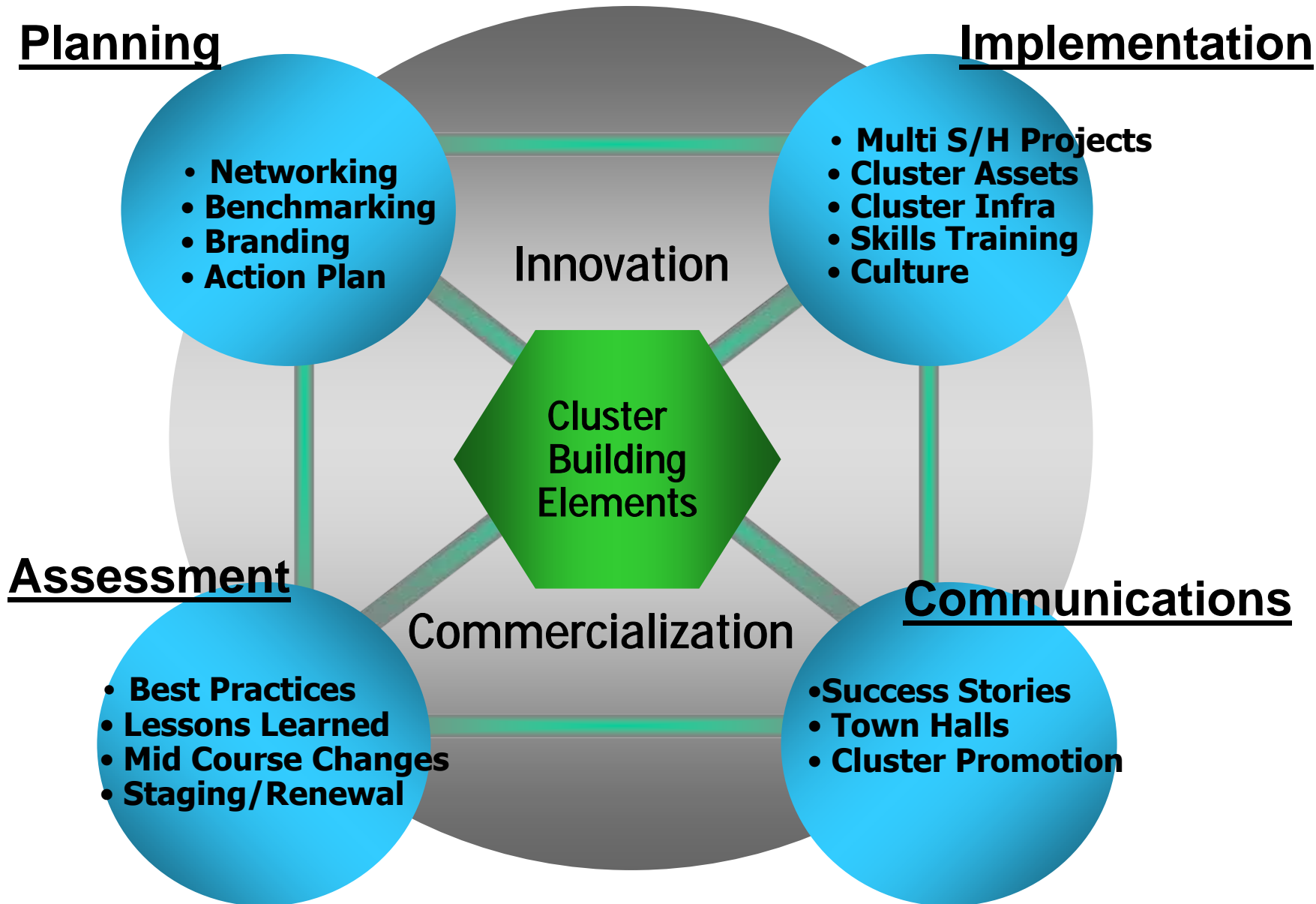
# Generic cluster map



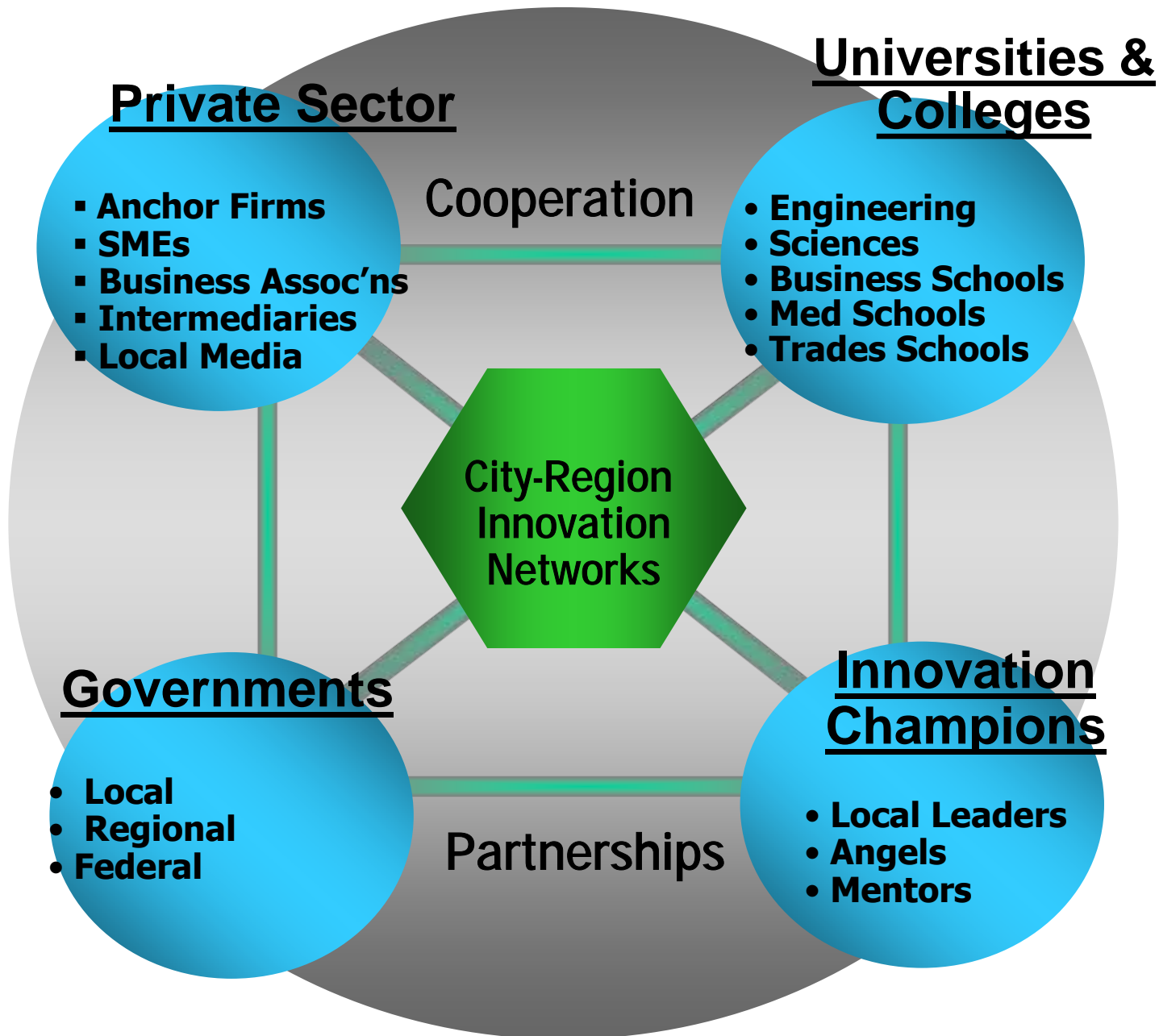
**Hervey Gibson "Britain catches up with clusters"**

**Cogentsi and Glasgow Caledonian University, UK**

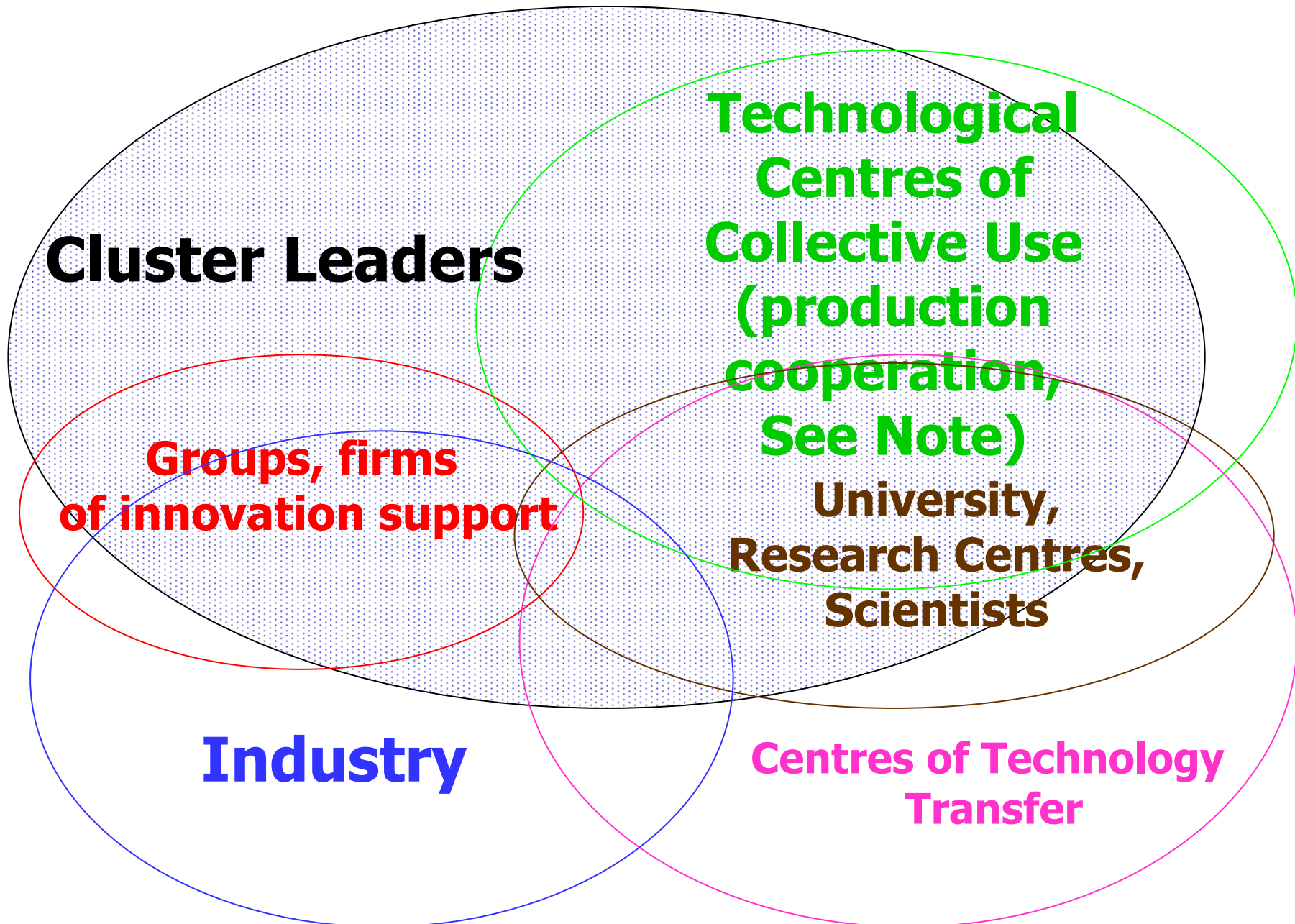
# Cluster Development Process



# Cluster Players



# Scheme of the Regional Innovation Cluster



# **3 Strategic Directions in Planning of Activity of our Industrial Cluster**

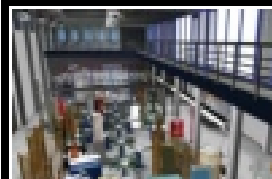
- Technological roadmaps
- Conceptions of new goods and services
- Global co-operation

# MANUFUTURE – программа обеспечения будущего производства в Европе

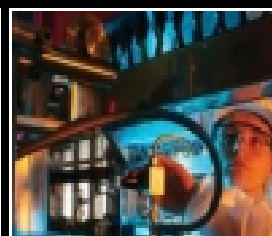
M a n u f u t u r e P l a t f o r m



- About the Platform ◀
- Strategic Research Agenda ◀
- Documents ◀
- Conferences ◀
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Manufuture: assuring the future  
of manufacturing in Europe



[www.manufuture.org](http://www.manufuture.org)

# New Added-Value Products and Product/Services

[www.manufuture.org](http://www.manufuture.org)

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Francesco Jovane, *MANUFUTURE*, *Assuring the future of manufacturing in Europe*, 3rd HLG Meeting of the *MANUFUTURE* Platform Brussels, November 17<sup>th</sup>, 2005

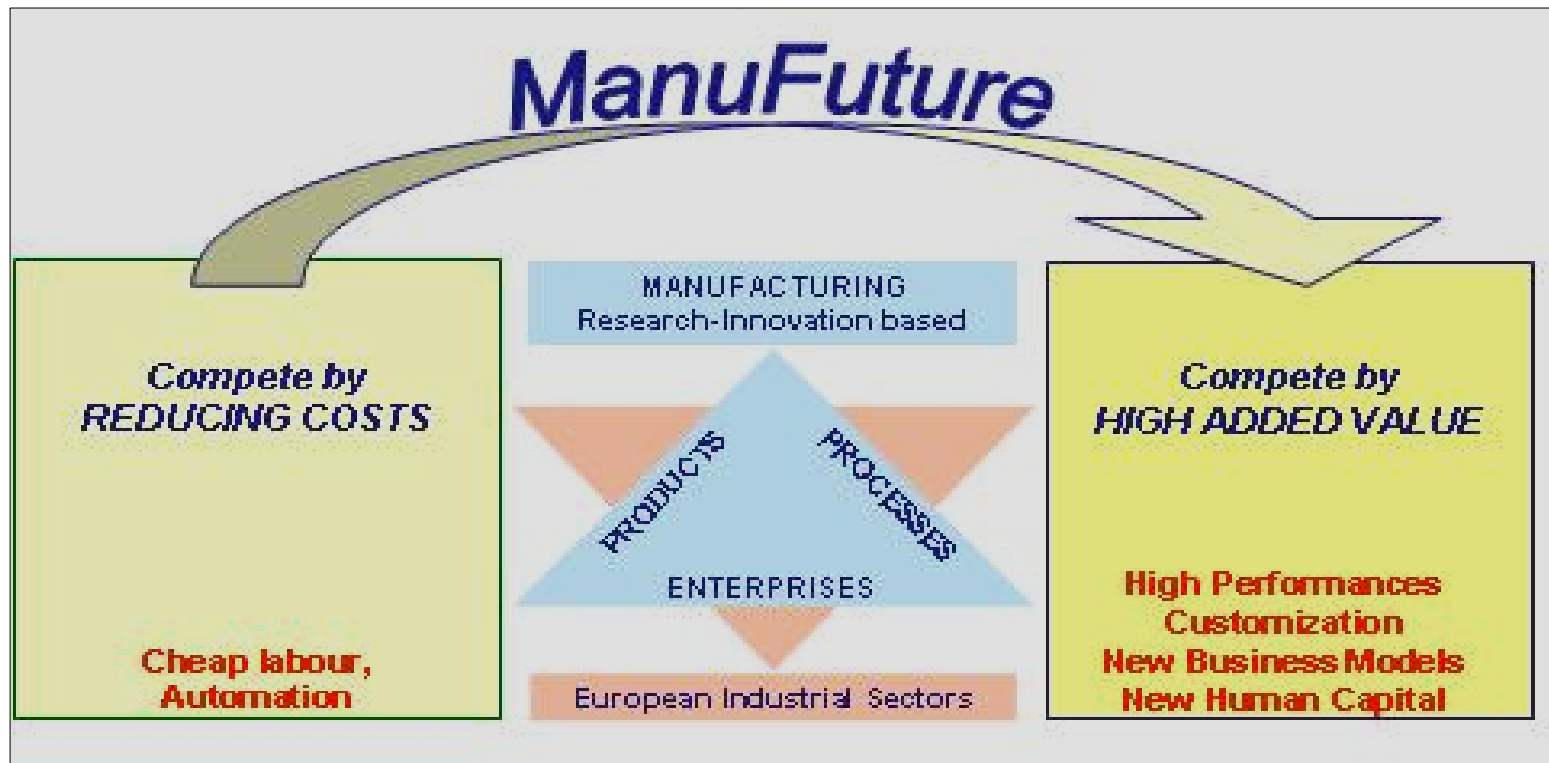
# European leading position on products

- ❖ Traditionally, European products are associated with high quality, appealing design and cutting-edge technology; in many industrial sectors they continue to compete successfully in the marketplace.
- ❖ Competing on cost, quality and delivery alone will not provide a viable solution – therefore European products must evolve into high-added-value product/services.
- ❖ While the importance of high-added-value products is indisputable, it must be emphasised that continuous innovation in manufacturing processes as well as in products will be central to tomorrow's dynamic businesses.

# The changing nature of Global Competitive Environment

## *Knowledge-based manufacturing*

### The new HVA European Industrial Paradigm



# HVA Products strategic goal

European industries achieve business leadership through continuous innovation of new products.

The concept of a product encompasses components, consumer goods and capital goods – and extends to the provision of entire production facilities.

High added value and superior quality result from exploitation of world-leading developments from European RTD in enabling technologies such as materials, nanotechnologies, ICT and mechatronics.

Focus increasingly shifts from 'product delivery' to sophisticated provision of product-based functions and services.

## Товары с высокой добавленной стоимостью – стратегическая цель

Европейская промышленность достигла лидерства в бизнесе постоянно предлагая новые инновационные товаров

Эта концепция осуществляется в компонентах, потребительских товарах, средствах производства и расширяется – до обеспечения их производственных фондов в целом

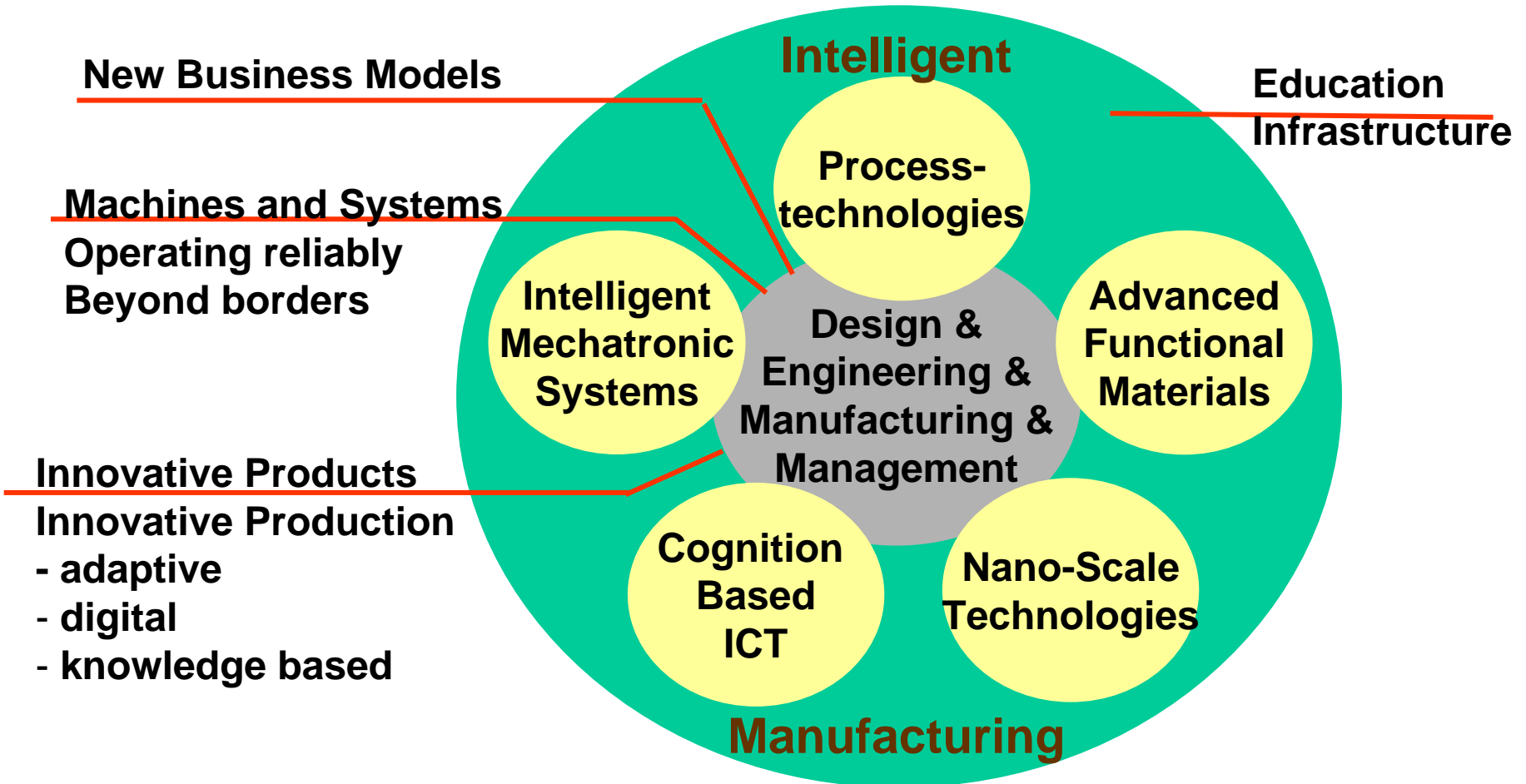
Высокая добавленная стоимость и превосходное качество основано на использовании результатов самых передовых НИОКР в мире из европейской системы исследований и разработок (RTD) и обеспечивающих технологий, таких как, материалы, нанотехнологии, интеллектуальные ИТ и механотроника

Центральный вопрос значительно сдвигается от «поставки продукта» к сложному обеспечению деятельности основанной на данном продукте и обслуживании

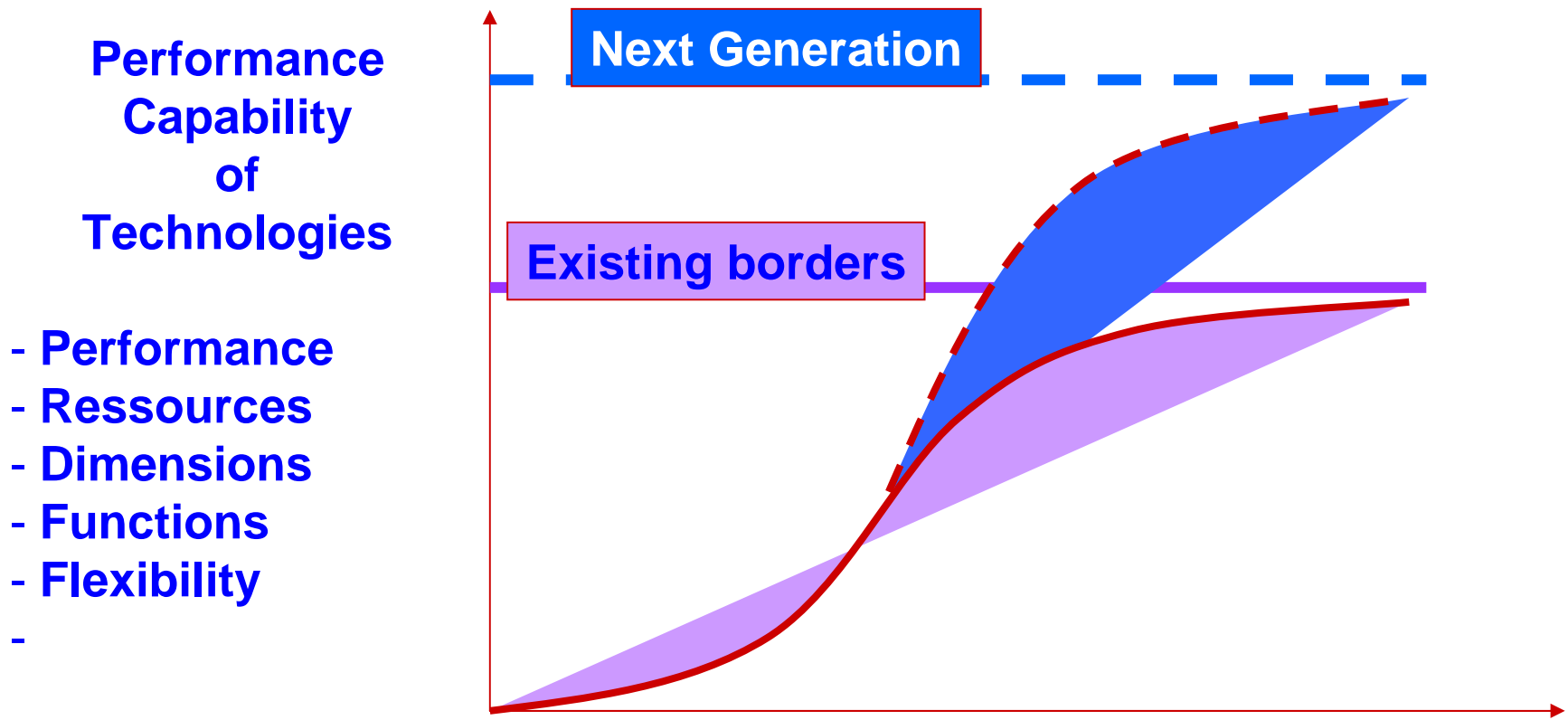
# **Main Problems with New Added-Value Products and Product/Services**

- ❖ **Design**
- ❖ **Supporting Technologies**
- ❖ **Focus on Customer**
- ❖ **Focus on Product Lifetime**

# Technologies for Emergent Manufacturing



# Technologies Beyond Borders



Improvement of performance in scientific and technical engineering and processes through removal of existing scientific and technical barriers

Time

# Technologies beyond Borders

## Miniaturisation

### Objectives of R&D:

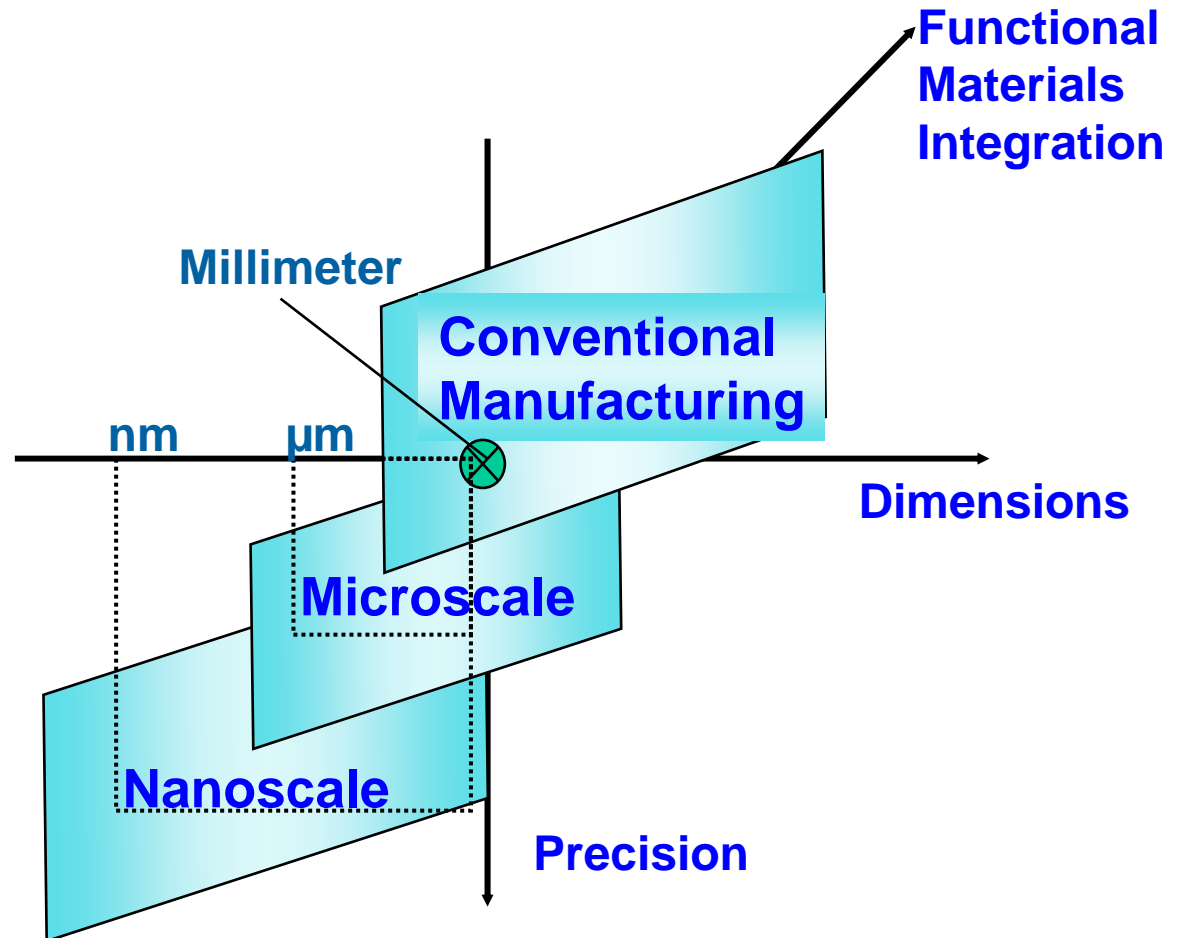
- Reproducibility
- Profitable manufacturing
- Flexibility
  
- Micro factory
- Micro tools
- Micro Engineering

### Technologies

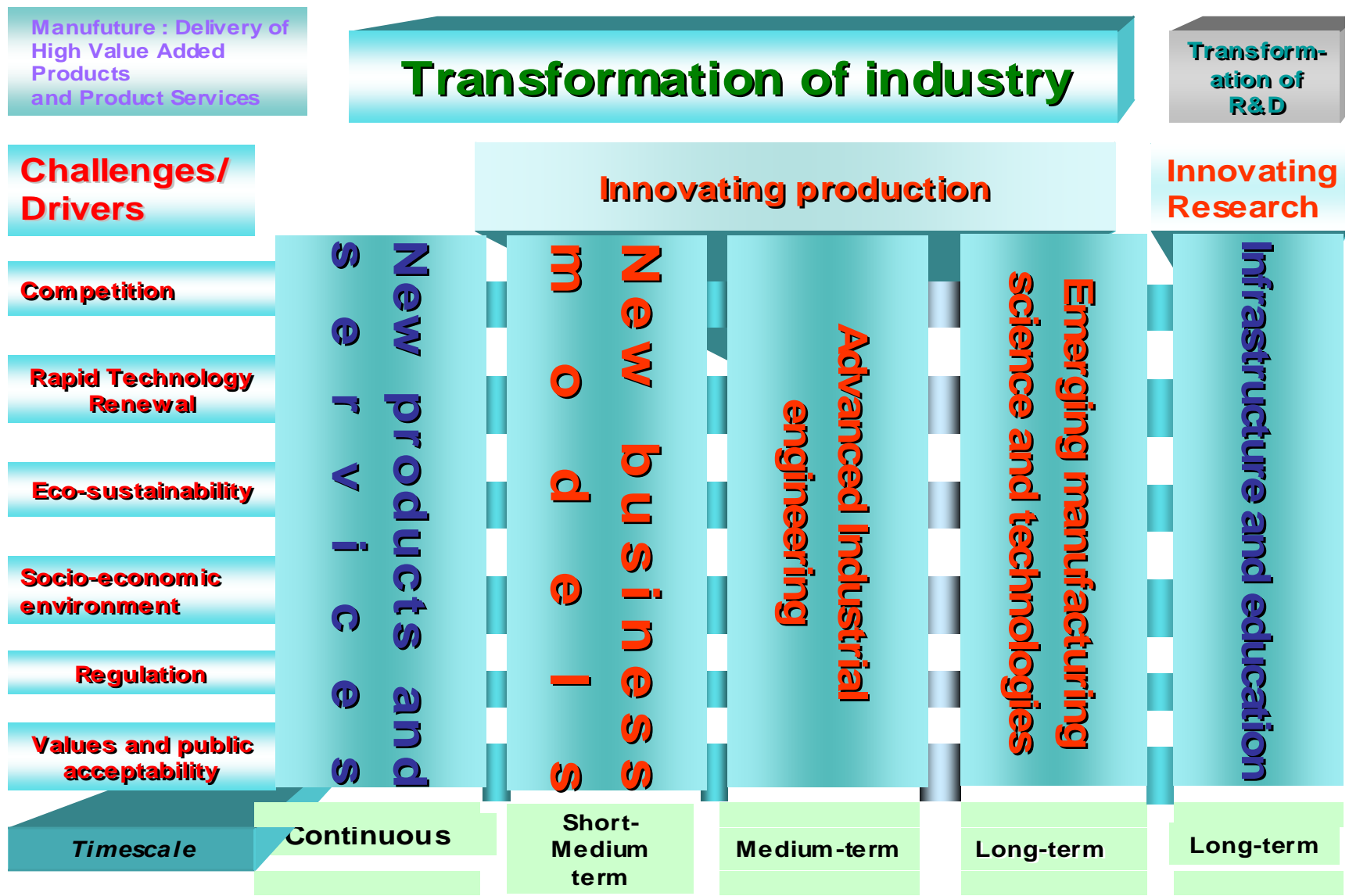
- Surface technologies
- functional Materials

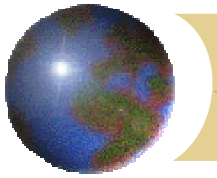
### Process Models

- processes
- simulation



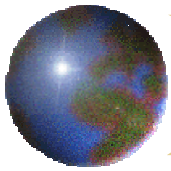
# Industrial Transformation Reference Model





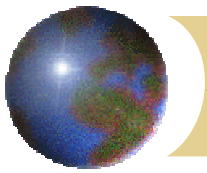
# ***From the National to the Regional***

- **Focus shifts from the national to the regional level:**
  - **Recognition that spatial proximity facilitates the sharing of tacit knowledge and capacity for localized learning;**
  - **Firms clustered in a region share a common regional culture that facilitates learning;**
  - **Localized learning is facilitated by a common set of regional institutions**
  
- **Regional Innovation System:**
  - **“The set of economic, political and institutional relationships occurring in a given geographic area which generates a collective learning process leading to the rapid diffusion of knowledge and best practice”  
(Nauwelaers and Reid)**



# ***Saratov Regional Economy Strategic Sectors – Prospective Clusters***

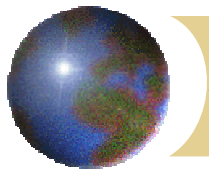
- Fuel and energy complex ~ 35.5% of regional GDP
- Chemical industry ~ 14.2 % of GDP
- Production and advanced technologies in High-Tech Industry  
aero-space, electronic industry – photonics, microwave  
electronics, instrument-building, machine-building,  
biotechnology, **transport** etc. ~ 19.0 of GDP
- Agricultural production and food industry
- Construction industry
- Forestry and woodworking



***Saratov Regional volume of gross  
domestic innovation product:***

***2001 ~ US\$ 30.0 M***

***2004 ~ US\$ 120.0 M***



## ***Saratov Regional Main Investments***

- Robert Bosch - Marx factory:***
- car engine electric patch cords manufacturing, 2006 ~ US\$ 30.0 M***
- TNK-BP (British Petroleum) US\$ 30.0 M***
- Lukoil – NaCN manufacturing ~ US\$ 30.0 M***

# **Маркетинговая программа «Инжект»**

## **ОПТИКОЭЛЕКТРОННЫЕ КОМПОНЕНТЫ –**

**полупроводниковые лазеры и излучатели, суперлюминесцентные диоды, фотодиоды, источники питания, установки измерения параметров и испытаний**

- **Суперлюминесцентные диоды для волоконно-оптические датчиков и гироскопов, низкокогерентной оптической томографии и оптоэлектронных датчиков**
- **Лазерные диодные линейки и наборные решетки для систем оптической накачки мощных твердотельных лазеров, нанотехнологий**
- **Лазерные излучатели для системы подсветки приборов ночного видения**
- **Лазерные излучатели для систем машинного видения и контроля качества лакокрасочных, электрохимических покрытий и стеклянных изделий**
- **Лазерные диоды и фотодиоды для оптоэлектронных датчиков и охранных систем**
- **Лазерные диоды и фотодиоды волоконно-оптические линии связи и беспроводной оптической связи в свободном пространстве**
- **Лазерные диоды для медицинские системы лазерной и магнито-лазерной терапии, фотодинамической терапии, оксиметрии**
- **Микрочип лазеры с диодной накачкой для биохимического анализа; приборов для определения числа и последовательности ДНК и спектроскопии**

# **Перспективная маркетинговая программа**

## **ОАО НПП «НПП «Инжект»— ЛАЗЕРНЫЕ СИСТЕМЫ**

- Системы освещения на основе полупроводниковых твердотельных приборов – высокоэффективные светоизлучающие и лазерные диоды, излучающие в видимом диапазоне спектра**
- Лазерные технологические установки сварки, резки, наплавки, упрочнения на полупроводниковых лазерах**
- Новое поколения мощных твердотельных лазеров с диодной накачкой, волоконные лазеры и микрочип-лазеры**
- Лазерные осветители для систем безопасности (видеонаблюдения), машинного видения, оптических приборов и нано-технологий**
- Лазерные медицинские приборы**

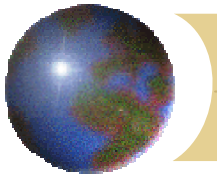
# Перспективная маркетинговая программа

## ОАО «НПП «Инжект»— ЛАЗЕРНЫЕ СИСТЕМЫ

- Приемно-передающие модули для волоконно-оптических и беспроводных оптических линий связи и систем активных фазированных антенных решеток (АФАР)
- Системы подсветки приборов ночного видения и интеллектуальные системы управления транспортными средствами в ночных условиях
- Лазерные дальномеры
- Лазерные интеллектуальные системы предупреждения столкновения самолетов и беспилотных летательных аппаратов
- Оптико-электронные системы борьбы с террористическими угрозами на транспорте, контроля безопасности и движения транспортных средств

# Организации – перспективные партнеры Саратовского кластерного проекта

1. ЗАО "Биоамид" - разработка и производство биотехнологических препаратов, экспорт акриламида.
2. ЗАО "Нита-Фарм" - разработка и производство антигельминтиков, антибиотиков.
3. ООО "НТЦ "Авангард" - разработка и производство ЭСУД - электронных система управления двигателями внутреннего сгорания.
4. ООО "Алмус" - разработка и производство аналитических приборов - измерения уровня меланина и др.
4. ООО "Оптолинк" - разработка и производство волоконно-оптических гироскопов и безинерциальных навигационных систем на их основе.
5. ЗАО "Ламинированное стекло" - разработка и производство огнестойкого стекла, антипиренов.
6. ЗАО "Экспо-ПУЛ" - разработка и производство вакуумных электронных приборов - приемно-усилительных ламп.
7. ЗАО «Восход»- разработка и производство хлебопекарных печей "Муссон".
8. ООО «Торэкс»-разработка и производство изделий для систем безопасности - металлических сейфов, дверей, а также транспортных средств - аэросани-амфибия.
9. ЗАО «Рубеж» - разработка и производство систем противопожарной и охранной сигнализации и безопасности.
10. ООО "ОКТОН" - разработка и производство уникальных растяжимых решетчатых конструкций и промышленных установок для их производства.
11. ООО "Наноструктурная Технология Стекла" - разработка технологии и производство уникальных прецизионных изделий из стекла - труб, капилляров, микроканальных пластин для приборов ночного видения, световодов и уникальных фотонных кристаллов и промышленных установок для их производства.
12. ЗАО "Юникайсис" - разработка радиоэлектронной аппаратуры, заказных СБИС с разрешением до 0,18 мкм



*Спасибо за внимание!*  
*Thank you!*



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