Engineers :
Ready for the management of the future ?
An industrial point of view.

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SOLVAY S.A.

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SOLVAY

ENGINEERS

“Job Description”

Engineers research and develop solutions

- **to technical problems**
- **by applying the theories and principles of science and mathematics.**

Career of an engineer
Step I – the start

Most of the time ,“ young” engineers are hired for

- their technical competencies

- their ability to manage technical projects .

Examples of employment offers

Young Research Engineer for an exciting , young and fast growing company in **high tech solutions**.

Main tasks: use analytical and problem solving skills to contribute to the quality of the products; work closely with other engineers in other departments, locally as well as internationally

Language : fluent English Flemish French

origin : Belgium

Examples of employment offers

Recherche ingénieur civil / électromécanicien / chimiste Pour notre service de Recherche & Développement
- pas d'expérience requise

Mission :
-**Développer les procédés et équipements relatifs** aux traitements chimiques d' effluents liquides.

Connaissances :
-Anglais lu, parlé et écrit
- CAO / DAO - connaissances en conception

Origin : France

Civil engineer with experience for a position of Project Manager Automation Engineering for a top player in ICT.

Mission: automation Software Design on a conceptual, execution and commissioning level for industrial installations.

Wide technical knowledge in Automation, Simatic S7, Win CC, C++,..

5 years min in a similar position.

Fluent English

Origin Italy

As young engineers, they need to demonstrate

- good technical background, skills and competencies
- knowledge of international language
- oral and written communication skills
- organizational ability

« engineer » education

- capability to work in a team
- good « personal » relationship and interpersonal skills
- common sense !

individual skills

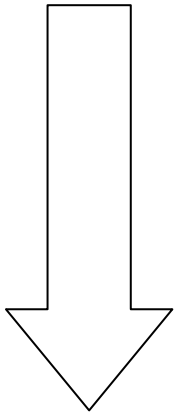
Career of an engineer
Step II – the development

After a few years in an position, questions appear

Company :
« do we see a future for this engineer ? »

Engineer
« am I going to progress in my career, how , when ? »

Engineers Career development



project engineer

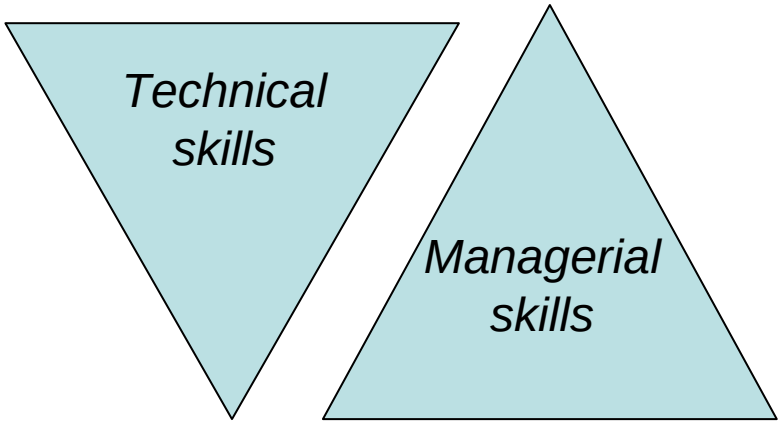
project manager

projects coordinator

manager

….

….



Speed and opportunities of development depend on

- **the domain of activity : raw materials / IT**
- **the company size and kind**
  - **in small/medium size company : multi tasks jobs are frequent**
  - **in large size companies virtually all categories of positions are possible : specialists as well as multi functional activities**

Career of an engineer
Step II – the development

To prepare / educate the engineers to face their development with the appropriate skills and competencies, it is necessary to take into account key factors of the evolution of the industrial and business activities.

Factors of the evolution of the industrial and business activities.

1. Evolution of technologies

1. Evolution of technologies

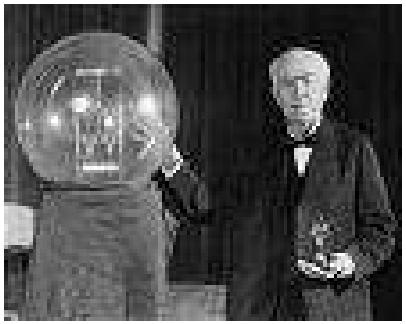
Technologies more and more
- **evolve rapidly**
- **are challenged by alternatives**
- **become complex**

Need for the engineers

> <u>frequent and large updates</u> of
- **the so called “basic knowledge”**
- **the new technologies that evolve very rapidly at their start**

! high skills specialists could become quickly “outpaced” if they don’t update their knowledge

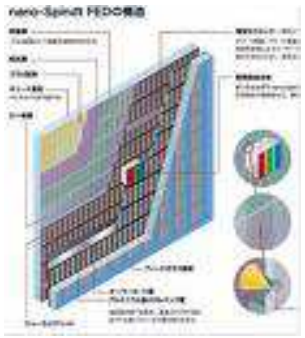
1. Evolution of technologies



Examples

Lighting :

- **1879 : Thomas Edison builds a lamp with a bamboo filament.**
- **1900 : Incandescence lamps will use a carbon filament for a long period**
- **1950 : “ Modern ” lamps use a tungsten filament**
- **2000 : Lighting elements are made of electroluminescent diodes**



<u>120 years of step by step changes</u>

1. Evolution of technologies

Examples:

Computers:

- **1937 : J Atanasoff's first « computer »**
- **1945 : first computer language**
- **1948 : first transistor**
- **1954 : Fortran language**
- **1964 : IBM 360 first multitasks computer**
- **1980 : IBM personnal computers**
- **mid'80 : electronic mails :**
- **1989 : Internet public acces**
- **2005 : blackberry**

in less than <u>70 years …9 major revolutions</u> in computers design and uses

1. Evolution of technologies

Examples

Medical device for investigation : scanner (tomodensitometry or axial tomography) : 3D image of organic tissues based on screening by X rays

- **Technology known from the 30's**
- **Calculation made by computers allowed it in the late 70's**
- **Nobel Prize in 1979**
- **2000 : common investigation methodology**

<u>20 years</u> to create a brand new investigation methodology in a traditionally "non engineering " domain of activity : medicine

1. Evolution of technologies

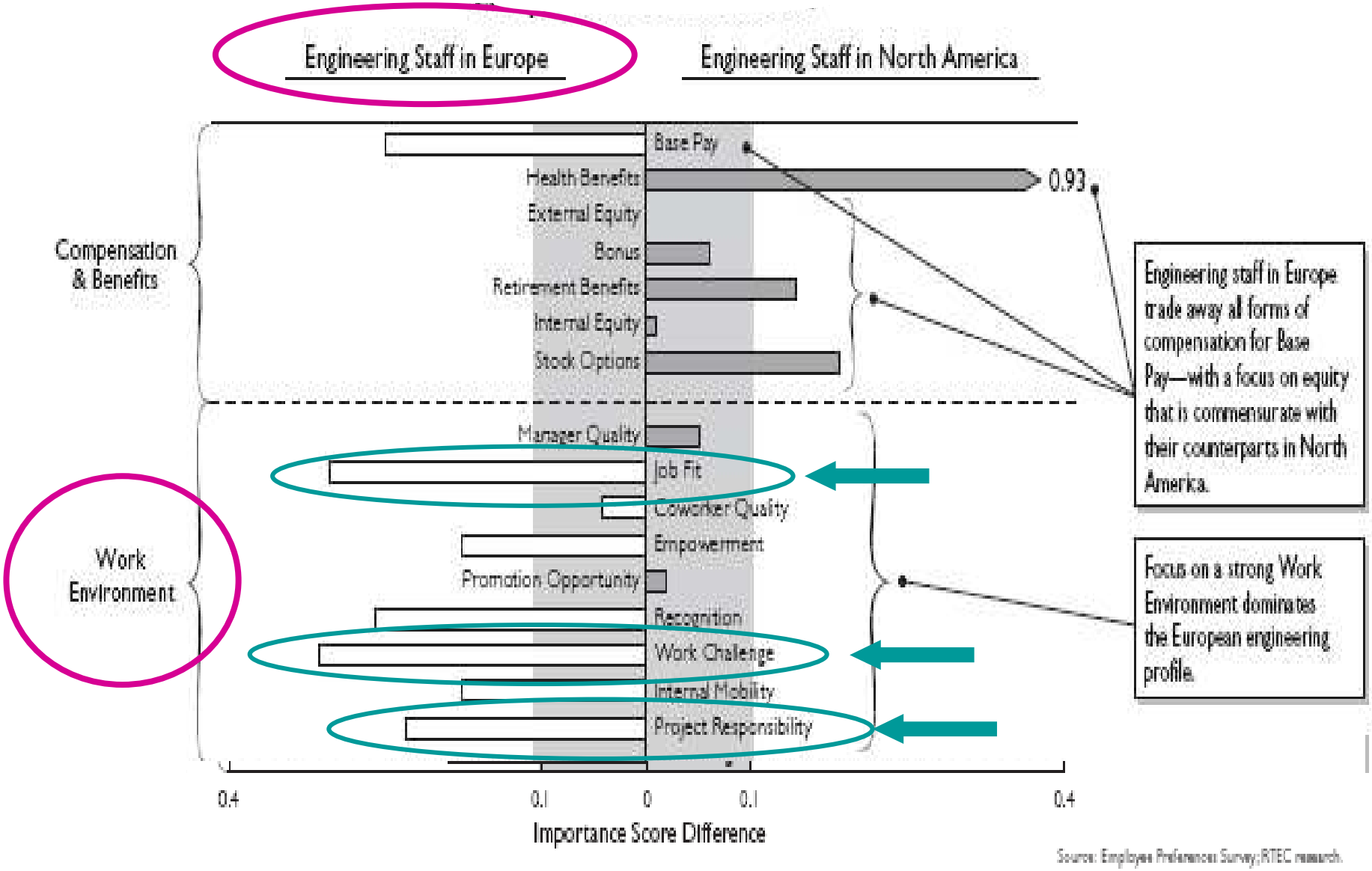
Engineers education should teach to

… continuously learn

- to be allow engineers to preserve and expend their knowledge ,
- to enlarge their scope of activities.
…

AND
- to keep motivation and satisfaction of personnel development avoiding frustration to be over passed and … disappointment .

Engineers expression of interest in their jobs



Factors of the evolution of the industrial and business activities.

1. Evolution of technologies
2. Complexity of projects

2. Complexity of projects

Successful management of more and more complex projects in due time and with adequate profitability implies to combine and aggregate a lot of competencies (not only technical competencies).

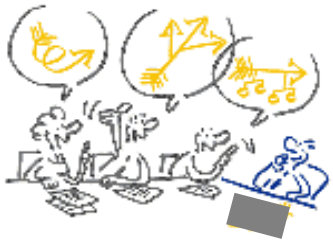
> Need for the engineers

- **to expend competencies in new areas of activities and to learn new disciplines even not engineers disciplines (education : teach to learn)**

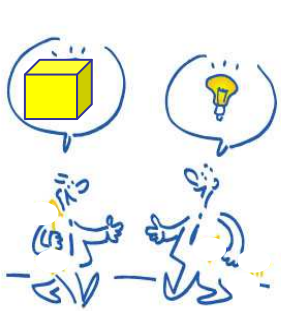
- **to be able to understand the gaps between the disciplines, to interface them and to build the bridges**

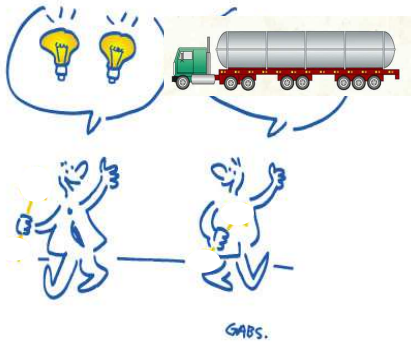
2. Complexity of projects

Engineers education should learn :



- **to <u>combine</u> expertises (not glue)**
- **to enhance analytical skills to close the gaps**
- **to create new ways of thinking by promoting solutions “out of the game” : innovation**

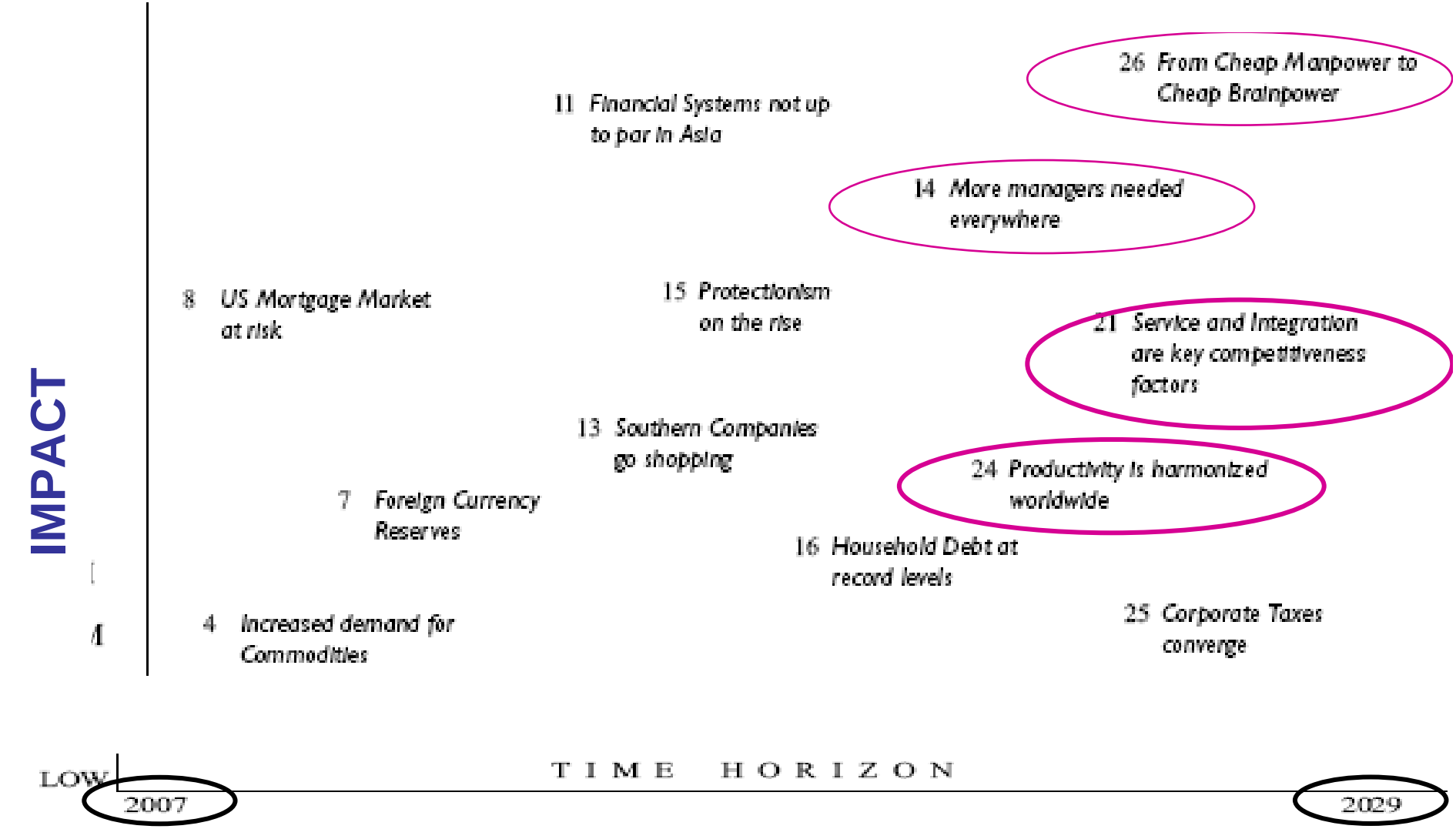




Factors of the evolution of the industrial and business activities.

1. Evolution of technologies
2. Complexity of projects
3. **Competitiveness in the worldwide environment**

COMPETITIVENESS SCOREBOARD KEY FACTORS



3. Competitiveness in the worldwide environment

A. Production costs of products and services

Production costs in countries with low costs profile - in or outside the European Community - may significantly influence future of companies exposed to worldwide competition (except companies that have local market and impact).

Examples

- pumps : rotors in China , shells in Poland ….
final assembly in Italy

- chemical reactors , furnaces : Russia, China, Korea

3. Competitiveness in the worldwide environment

A. Production costs of products and services

> Need for the engineers

Cooperation with worldwide partners could be needed or is unavoidable, namely to produce low costs products

3. Competitiveness in the worldwide environment

Engineers education should include

- **<u>extensive costs evaluation training</u>**
  from variables costs, fixed costs…
  to logistic and marketing costs!

- **sensitization to the importance of the <u>terms of contracts</u> (delays/ penalties…)**

- **bases of <u>Intellectual Property Protection (patents, licences …)</u>**

3. Competitiveness in the worldwide environment

B. Competencies and management

> Need for engineers :

Work teams with worldwide partners to use lower costs intellectual resources in some regions

Examples

- **basic engineering projects developed in India , China supported by the evolution of telecommunications**

- **Support Call centres : India, Morocco, Ireland**

3. Competitiveness in the worldwide environment

AND also

“competition” between European engineers and engineers from other regions than Europe

- 2006 in France 30 000 engineers
- Chine , India : 700 000 engineers …..each year,
  ……for internal needs but also active in countries with high development level !

3. Competitiveness in the worldwide environment

Need of differentiation of the European engineers education

- to develop profiles able to manage complex multidisciplinary projects in a worldwide environment

- to educate specialists of new technologies in cooperation with multi cultural and worldwide environment to enlarge scope and experience

Key factors of the evolution of industrial and business activities :

1. Evolution of technologies
2. Complexity of projects
3. Competitiveness in the worldwide environment
4. **Growing regulatory and legislative pressure**

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**To protect persons, companies, activities…
regulatory bodies develop more and more laws, regulations, directives, recommendations
at European, national, regional, local levels.**

All activities are impacted by those requirements and their implementation requires to adapt projects adequately.

Consequences of non compliance could be dramatic both for companies and for individuals (licence to operate not valid, suits, claims, …)

4. Growing regulatory and legislative pressure

Examples of financial consequences of non compliance :

Asbestos cases lawsuits

- **$37 million verdict — 2 asbestos lung cancer plaintiffs**
- **$14 million consolidated verdict — 5 asbestos-related cancer suits: shipyards/powerhouses/construction**

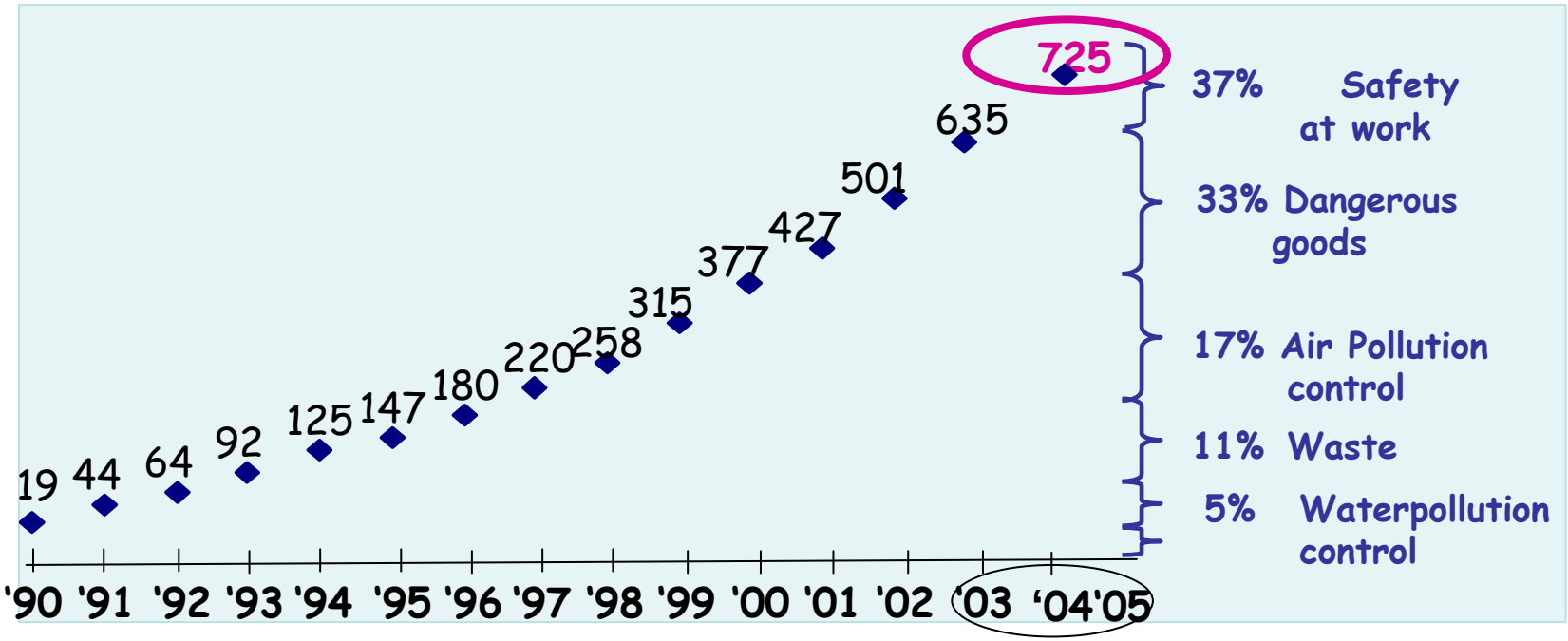
Safety at work lawsuits

- **€ 5 million verdict — iron workers who were injured because of unsafe working conditions**
- **$ 750,000 settlement — defective construction equipment resulted in serious injury to worker**

4. Growing regulatory and legislative pressure

Examples of <u>legislative pressure</u>:

European directives, regulations, recommandations… evolution for health, safety and environmental topics



4. Growing regulatory and legislative pressure

Examples of legislation impact on managers responsibility :

Safety of industrial plants

Germany / Italy : technical entity managers - together with the company - are "ad personam" responsible in case of accident and as such may be involved in a lawsuit.

4. Growing regulatory and legislative pressure

Engineers education should be <u>sensitized</u>

- to the importance of legal framework and its CONSEQUENCES for individuals and for companies

Key factors of the evolution of industrial and business activities :

1. Evolution of technologies
2. Complexity of projects
3. Competitiveness in the worldwide environment
4. Growing regulatory and legislative pressure
5. **Human resources management**

5. Human resources management

Successful management of projects implies to create teams that are effective, not only based on technical expertise and competencies.

> Need for engineers :

- **to be able to manage "human" profiles taking into account experience, capabilities…. culture**
- **to know management global framework : company culture, unions relations, ..**
- **to adapt work conditions**

5. Human resources management

Engineers education should be sensitized

- **to respect for people**
- **empowerment**
- **importance of local cultures**

Conclusion

During their career, engineers will be faced to

- rapid evolution of the technologies
- need to combine disciplines
- growing legislative pressures
- worldwide market trends and competitiveness
- human resources challenges

Conclusion

To be prepared for all those challenges, engineers should not only be specialists with a high level of technical background .

Education should also teach them

- to continuously learn, update, expend their knowledge and competencies

- to combine expertise to be able to create new ways of thinking for complex projects

- to include global costs management in their projects

Conclusion

Education should also sensitize them to :

- legislative pressure and their consequences

- contracts management, Intellectual property protection

AND human resources management !

Thank you !