Learn Chemistry

Commercial Skills for Chemists: Feasibility

Student Pack

Developed by Professor Colin Pulham, University of Edinburgh and Kevin Parker, KKI Associates Ltd

This resource was produced as part of the National HE STEM Programme

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Student Pack

Feasibility Studies and a ‘Project Pitch’

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Feasibility Studies and ‘Project Pitch’

- Overview
- Task Briefing
- Lecture Resources
- Other Materials

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Feasibility Studies – Task Briefing

- You are a group of technologists working for *Mega Chemicals plc*. Your work is to evaluate new technologies and recommend which ones *MegaChem* might wish to take to market. 5 new projects that *MegaChem* are interested in can be found on the following slides
- Their team task will be to produce feasibility Studies for two of the 5 new projects, and a presentation of a funding proposal for the preferred project. The feasibility studies should systematically address:
  - A list of the targets that the project must meet to be considered a success
  - An assessment of the main risks in the project, and what would cause you to cancel or stop it
- To help with your task you have access to lecture material, academic papers, a book, and a short video. There will also be a team training exercise that you should attend as a group

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The New Projects…

Here are the 5 projects MegaChem are interested in…..

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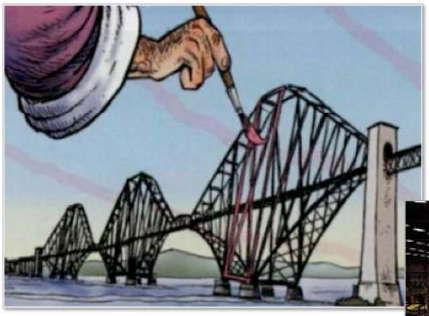
Project 1 Anti-corrosive pigment



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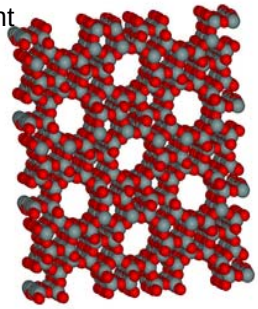
Project 1 – Anti-Corrosion Pigment

- We have discovered a better anti-corrosion pigment using zeolite to encage zinc chromate
- Corrosion costs $1trn in US alone!
- Zinc chromate is a well known effective anti-corrosive that is restricted in use because Cr^{VI} is toxic in the environment
- Because our pigment encages chromate anions, it provides the anti-corrosive benefits without the toxicity issues
- We recommend reviewing the opportunities for developing and commercialising this pigment



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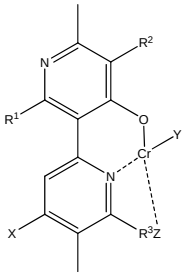
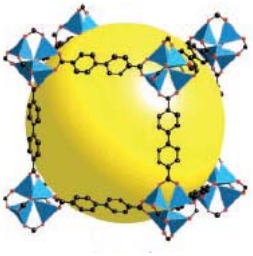
Project 2 Methane Oxidation Catalyst



Catalyst Facts:
Turn over Number:
15Million
Turn over Frequency:
1.5kat
Synthetic Cost:
18000$/kg



8.8x10^7 m^3 methane

1.2x10^5 T methanol

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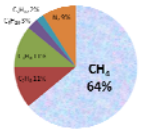
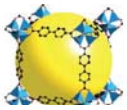
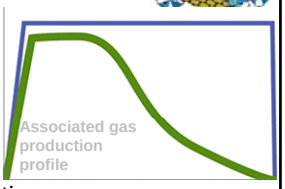
Project 2 – Methane Oxidation Catalyst

- We have a chromium catalyst that can convert methane t methanol at mild conditions
- Methane (natural gas) is difficult and expensive to transport over long distances, while methanol liquid is much cheaper and easier to move
- Commercial Opportunities could include
  - Major methane gas fields around the world
  - Potential to reduce flaring of associated gas
  - Exploit methane hydrates in arctic waters
- We need to assess and prioritise these opportunities







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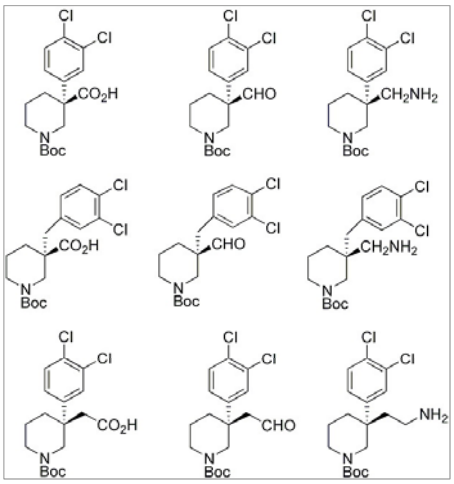
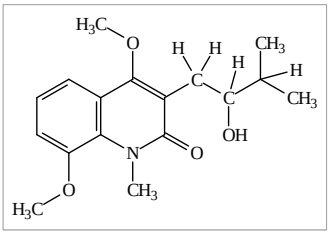
Project 3 New antibacterial synthesis





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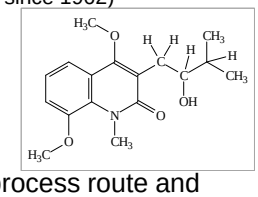
Project 3 New antibacterial synthesis

- We have a new route to synthesizing specific enantiomers of intermediates and drug candidate molecules
- Using specific enantiomers avoids some major potential side effects caused in drug trials by the presence of the opposite enantiomer
  - See 'thalidomide'
- In particular, we have a route to an enantiomer of lunacridine, which has potential anti-bacterial activity
  - Lunacridine could be the precursor of a whole new family of antibiotics, the first major discovery since 2000 (which was the first since 1962)
  - Constant demand for new antibiotics
  - World market around $15bn pa



- We would like to determine the value of the process route and the new antibiotic candidate

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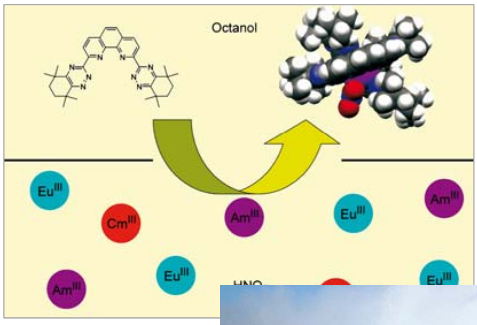
Project 4 New Separation Technique



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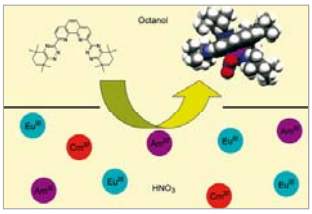
Project 4 New Separation Technique

- Lanthanides ('rare earths') and actinides are chemically similar and hard to separate
  - Lanthanide fission products are a problem in nuclear waste
  - Thorium is a contaminant in lanthanide mining
  - Lanthanides have interesting magnetic properties and important industrial uses
- We have discovered a new phenanthroline-derived ligand that can separate actinides (Th, Am, etc) from chemically similar lanthanides
- We plan to explore opportunities in both nuclear waste decontamination and clean-up of rare earth mines



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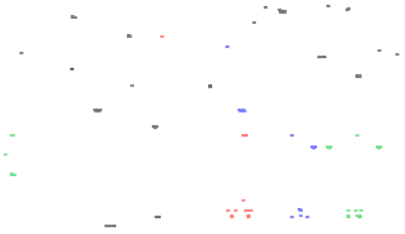
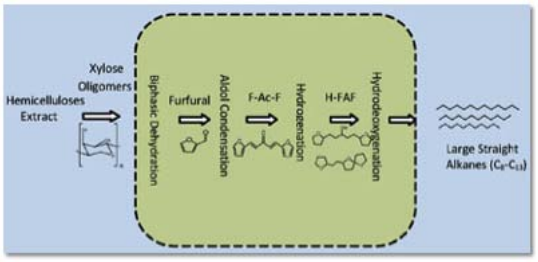
Project 5 Bio-diesel from Lignin





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Project 5 Bio-diesel from Lignin

- There are few current processes for making Jet Fuel from Biomass sources
  - Demand for Jet fuel around 5million barrels/day
- We have a multiple step process that converts lignin hemicellulose to C_8-C_{12} paraffins suitable for Jet Fuel
  - Lignins are major constituents in certain tropical and temperate plants
  - Other biomass process tend to make lighter paraffins not C_8-C_{12}
- We recommend further study of the economic and logistics of this process

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Lecture Resource – Feasibility Studies

- The following slides are from a 1 hour lecture on feasibility studies given to STEM students at a UK University in 2011
- You may read or use as much of this material as you like, working through the exercises if need be, to help you produce your assignments
- Part of this lecture is available on video at http://www.youtube.com/watch?v=eEnPp-6iMU4&feature=youtu.be

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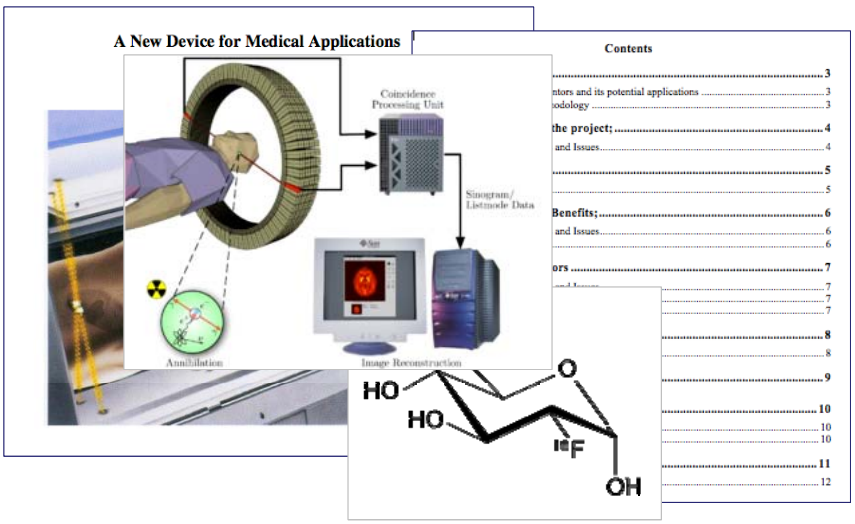
Feasibility Studies



for chemists (and other scientists)
Kevin Parker, KKI Associates

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New Project Process

- Many commercial organisations divide their new projects into 3 stages
- Idea generation and assessment
  - concept test
- 'Sanity check' or risk assess the idea
  - feasibility study
- Full project
  - PM process (eg PRINCE2)

- The feasibility study is a key decision point in deciding whether to progress a project

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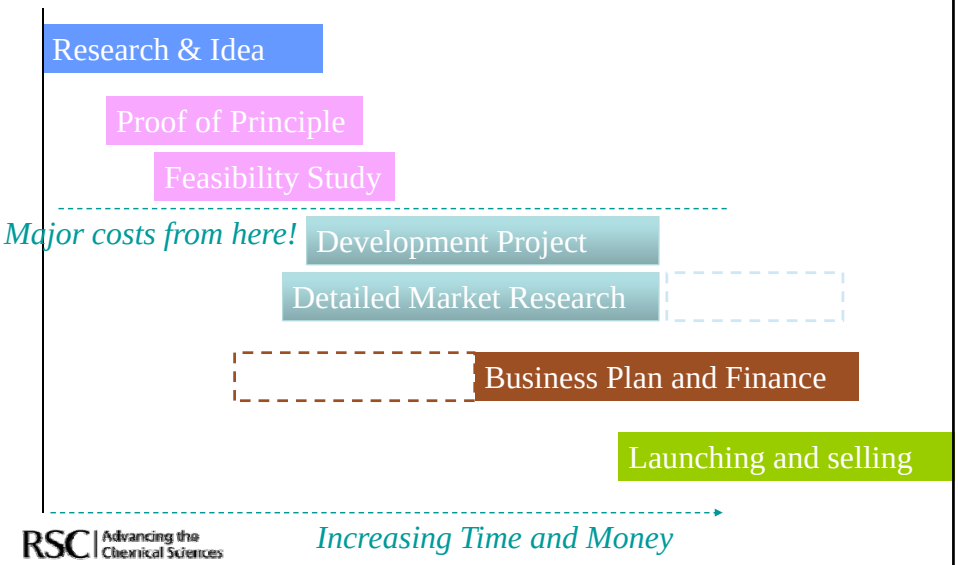
New Project Process



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Feasibility Study

Feasibility Study

- Try to find all the potential problems/failure factors – 'devil's advocate' study
- Technical, commercial, regulatory
- Should generate set of targets, major risks and project flow chart

- Progress approved to technical development & market research if project still looks
  - Interesting/profitable legal/achievable etc

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What should be in your Feasibility Study

- Concept statement - (Who are users? What do they use now? What benefits or advantages do they get from our technology?)
- What are we going to sell - product, service, know-how?
- How will we protect our IP?
- Competitors
- What can we afford to spend on the development?
- What are the main technical targets of the development?
- Can we make the product, or deliver the service?
- Ergonomics and human factors
- What would stop the project?
- Any spin-off potential?

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Raising and Discussing Issues

- A feasibility study should *identify* an issue affecting the project
  - 'secondary tumours can be as small as 1mm'
  - 'can we reliably get enough FDG to them to detect them?'
- Should *assess* the impact of the issue
  - 'Oncologists say they wouldn't use PET unless the sensitivity was good enough to reduce false negatives to 1 in 100,000'
- Should *propose* some actions to address the issue
  - 'we have two potential technical solutions and will set up two technical sub-projects testing them'

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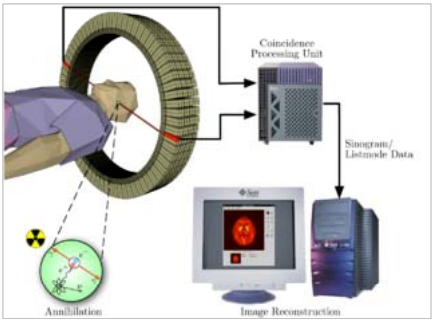
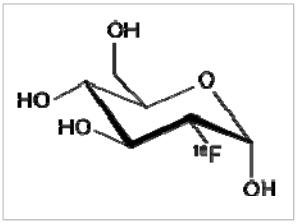
Chemicals for positron tomography





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Chemicals for positron tomography

- Positron tomography non-invasive medical imaging technique, related to (MRI) and (CT)
- As well as imagining organs can tell how they are metabolising - healthy, dying or cancerous
- Has potential to replace diagnostic surgery for some patients – e.g. detecting secondaries from breast cancer in lymph nodes in shoulder
- Technique has been limited by availability of short half life radio-chemicals – especially fluorodeoxyglucose (^{18}F) - FDG
- We have a potential way of safely synthesising FDG on site, which is expected to greatly increase the uptake of PET in cancer diagnosis
- We'd like to start a project to commercialise this process
- What kind of issues should our feasibility study address?
  - There are some examples in the next few slides

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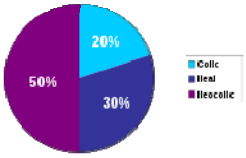
Market Information

- How many hospitals and others have PET?
- How much FDG do they consume?
- How much might they use if it was easier to make?
- Who buys the FDG at the moment?
- What do cancer charities think about PET as a detection method?
- Are there large cost savings in not doing diagnostic surgery?



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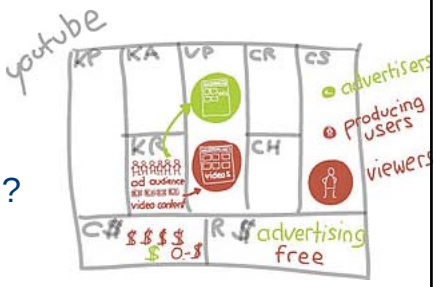
Business Model

- Do we sell chemical precursors?
- Do we sell kits for making precursors?
- Do we offer an onsite service making FDG for customers?
- Do we sell direct to a hospital?
- Do we sell to third parties offering MRI/PET scanning services?
- Do we partner/license with PET equipment makers?



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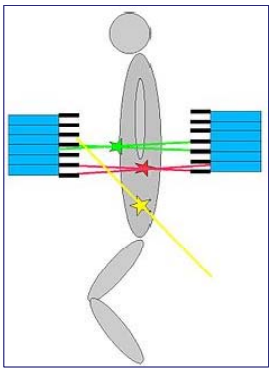
Technical Targets

- How small are the tumours we might be asked to detect?
- How reliable does the device need to be before oncologists accept the results?
- What about noise, vibration tests?
- Who approves our device/procedure?
- How pure should the FDG be?
- What radiation hazards do we need to address?



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Process/Product Cost targets

- What should the revenue cost of performing a diagnosis be?
- What should the capital cost of our equipment/test kit be?
- How much should our consumables cost?
- In our customers, who can approve such sums?

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Project Costs

- What is the most money we could ever make if all the hospitals using PET bought from us?
  - What about if only 10% did?
- What is the likely cost (in money or person-days) of our whole development project?
- How much equipment/lab space do we need?
- How long might it take us to break even?

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Ergonomics and human factors

- What kind of people will be operating our product or using our test kit?
- Do we need to write very clear instructions, and do we need to make the interface a certain design?
- What happens if they?
  - Drop it
  - Spill something on it
  - Leave it plugged in during an electrical storm
  - Put it near a patient with a pacemaker

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Our Team

- Have we got access to the skills and experience we need?
  - Development chemists
  - Radiochemists
  - Medical testing/approval specialists
  - Medical purchasing/sales
  - Oncologists and patient groups
- Are any of these critical or in short supply?

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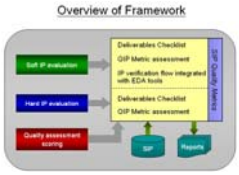
Intellectual Property

- Does anyone else have patents in this area?
  - Do they stop us developing our product/process
  - Do they show that we have powerful competition?
- Will we be able to get good patent protection?
  - In which countries?



- Are there other forms of IP that could help us?

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Types of IP Protection

- Secrecy
- Copyright
- Registered or unregistered design rights
- Trademarks
- Plant breeders rights
- Patents

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What you must know about Intellectual Property

- Protect your invention by copyright, trademarks, patents
- Get Advice from experts various advisors/lawyers/patent agents
  - Make sure you know who owns it!
- Keep good documentation
  - Lab books and NDA's
- DON'T PUBLISH BEFORE PATENTING!

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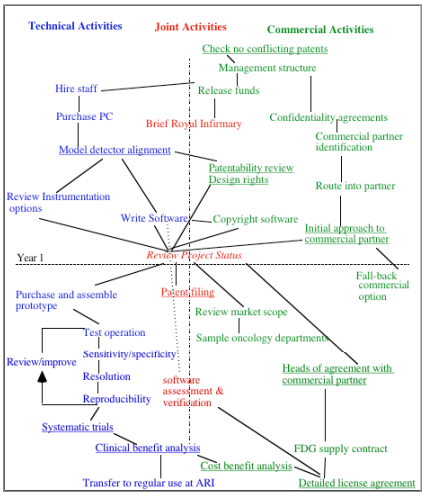
Project Outline and process

- Can we draw a sensible and realistic flow chart of the whole project?
- Does it look a difficult project or relatively simple?
- How long is the whole thing likely to take?
- Do we know what would cause us to stop the project?



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Classic Risks in Projects

- Medical technology - time for development and regulatory approval
- Environmental/renewables - who benefits and who pays
- 'We're in competition with Microsoft/BASF/Novartis and they have 200+ people working on the project'
- Someone's published it and we can't patent
- 'Time to sell' to big customers
  - Finding the right person to approach!
  - Long lead time for chemical plant etc, decision making 5 years out

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What should be in your Feasibility Study

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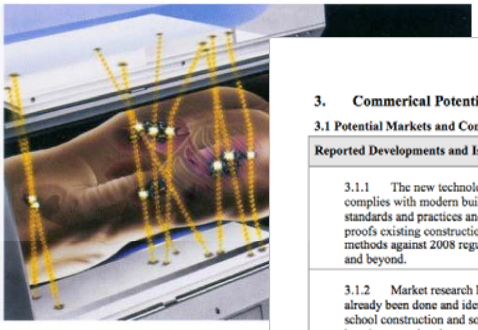
Feasibility Study Template

A New Device for Medical Applications



Environmental Building Partnership Ltd (EBP)

3. Commerical Potential of the Project

3.1 Potential Markets and Competition

Reported Developments and Issues	Action required & likely impact on project – Good, Bad or Critical?
3.1.1 The new technology complies with modern building standards and practices and proofs existing construction methods against 2008 regulations and beyond.	Good – The technology meets safety and practical requirements. (The "chicken-gun" test)
3.1.2 Market research has already been done and identified school construction and social housing as early adopters of the new technology.	Good – EBP has successfully secured demonstration projects with a house builder and a local authority to help them access these market segments.
3.1.3 EBP is partnering with a major engineering consultancy on PFI school projects.	Good – By partnering with an established company EBP has instant access to a number of project contracts in their target market. This will help them attract more business and also provide initial income.

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What we should produce

A New Device for Medical Applications

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Contents

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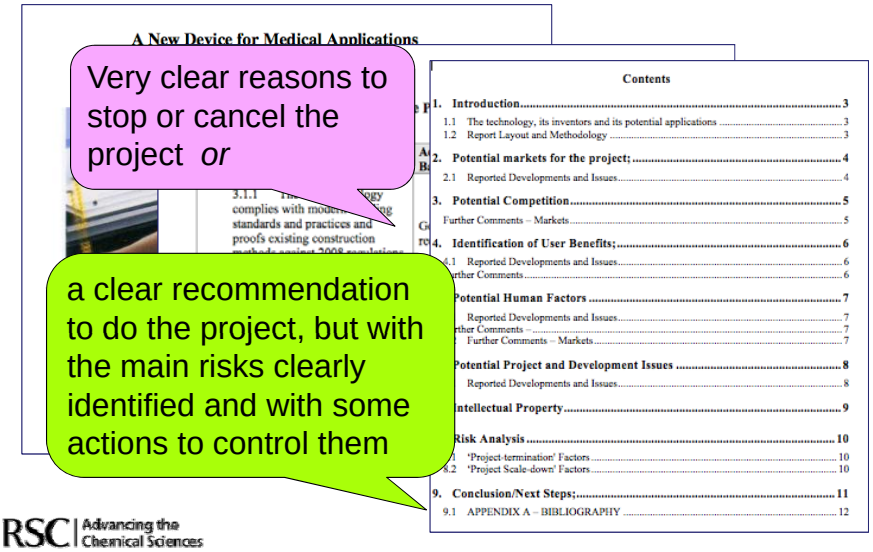
What we should produce



Very clear reasons to stop or cancel the project *or*

a clear recommendation to do the project, but with the main risks clearly identified and with some actions to control them

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Writing your Feasibility Study

- Write feasibility studies analysing two of the projects in the introduction.
- **We have provided a template for a feasibility study,** that more or less forces you to write something about each of the key areas discussed above
- You may modify the template to suit your needs
- You are encouraged to insert useful diagrams
- The total study should aim to be less than 1000 words
- **At the end of each study, you should decide which one to recommend to progress to a full development project**

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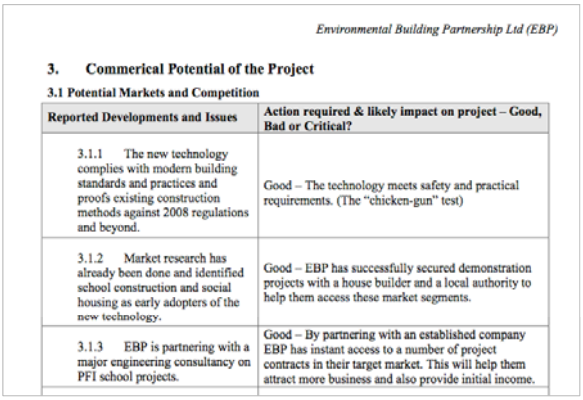
Feasibility Study Template



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Is available as a component in Feasibility module:
Click HERE

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Presenting your Preferred Project

Your whole team should devise and deliver a 15 minute presentation outlining the main reasons for choosing to progress one project

Suggested Structure:

- Slides 1-2 background to the technology and its benefits
- Slides 3-5 Business model, markets technical targets
- Slides 6-7 validation (technical and markets)
- Slides 8-9 Plans and milestones
- Slide 10-11 Money and main risks
- Slide 12 Summary

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Feasibility Studies – Other Resources

- Video: *A great 2 minute 'elevator pitch'*
  - http://www.youtube.com/watch?v=zq_XY9oU_Kc

- Video: *Biotechnology YES scheme Business Presentations*
  - http://www.youtube.com/watch?v=nClc9iTOi8s

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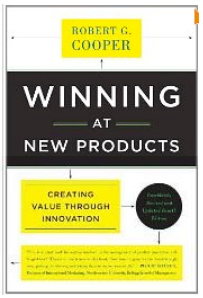
Feasibility Studies – Other Resources

- Paper: Great Mistakes in Technology Commercialisation
  - *Journal of Strategic Change, Volume 10, Number 7, pages 383-390, John Wiley & Sons, (November 2001)*
  - Download here: http://www.rsc.org/learn-chemistry/content/filerepository/CMP/00/001/419/Great%20Mistakes.pdf

- Book: Winning at New Products, Robert G Cooper
  - Basic Books; 4th edition (28 July 2011)
  - ISBN-13: 978-0465025787



- Feasibility Study Template:
  - Is available as a component in Feasibility module: Download here: http://www.rsc.org/learn-chemistry/content/filerepository/CMP/00/001/424/Feasibilitytemplate.doc
- Specimen Feasibility Study 'Environmental Building Partnership' See next pages!

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