KEMENTERIAN TENAGA, SAINS, TEKNOLOGI, ALAM SEKITAR DAN PERUBAHAN IKLIM
MINISTRY OF ENERGY, SCIENCE, TECHNOLOGY, ENVIRONMENT, & CLIMATE CHANGE

Malaysian Science and Technology Information Centre (MASTIC)
Ministry of Energy, Science, Technology, Environment and Climate Change

Session 1:
Understanding R&D in the Frascati Manual

February 2019

NATIONAL SURVEY OF RESEARCH AND DEVELOPMENT (R&D) IN MALAYSIA 2017

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Outline – Understanding R&D, the Frascati Manual Definition

WHAT IS R&D?

1. Introduction to National R&D Survey
2. Definition of R&D
3. Five core criteria of R&D
4. Types of R&D activities – Basic, Applied, Experimental Development

IDENTIFICATION OF R&D ACTIVITIES & KEY INDICATORS

1. Identification of R&D activities – Example for different sectors
2. Measurement of R&D expenditures
3. Measurement of R&D personnel

R&D VS INNOVATION

1. Difference between R&D and Innovation
2. Types of Innovation & Example

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WHAT IS R&D?

1. **Introduction to National R&D Survey**
2. Definition of R&D
3. Five core criteria of R&D
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Introduction to National R&D Survey

- This survey is undertaken by the Malaysian Science and Technology Information Centre (MASTIC) under the auspices of the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC) in collaboration with Economic Planning Unit (EPU), Prime Minister's Office and Department of Statistics Malaysia (DOSM).

- PE Research Sdn. Bhd. is appointed by the Government to carry out this survey.

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WHAT IS R&D?

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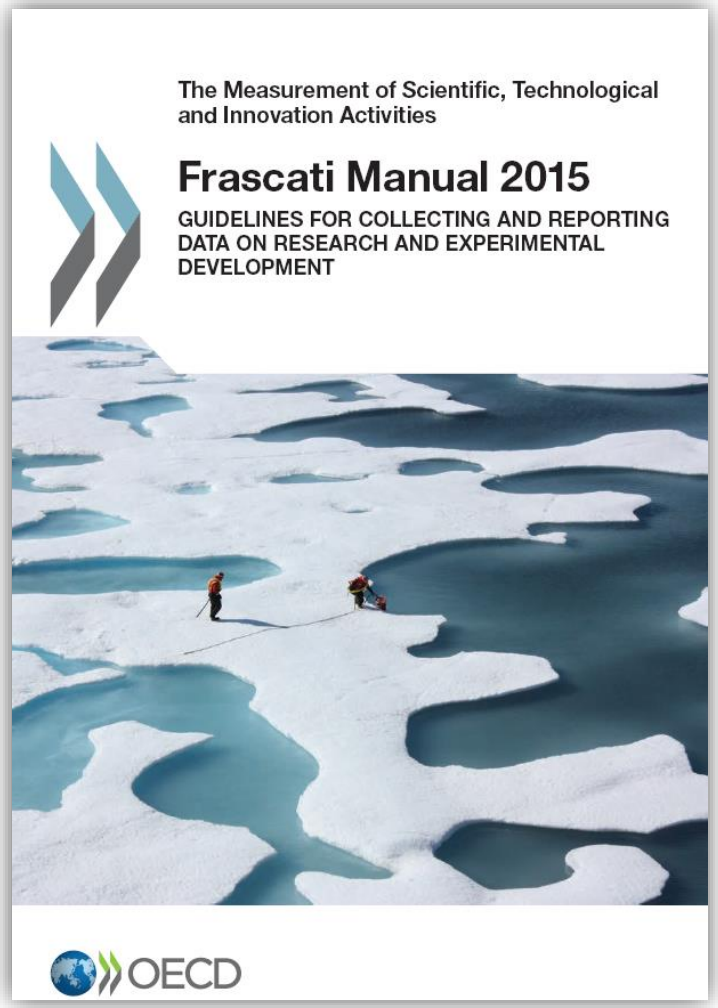
Concepts of R&D

This survey follows the **Frascati Manual 2015** developed by the Organisation for Economic Cooperation and Development (OECD) for conducting surveys on the inputs to R&D.



In order to produce internationally comparable R&D statistics, it is essential to use standard R&D definitions.

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What is R&D?

2.2. Definition of research and experimental development (R&D)

2.5 **Research and experimental development (R&D) comprise creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge.**

Source: Frascati Manual 2015 © OECD 2015 (Page 44)

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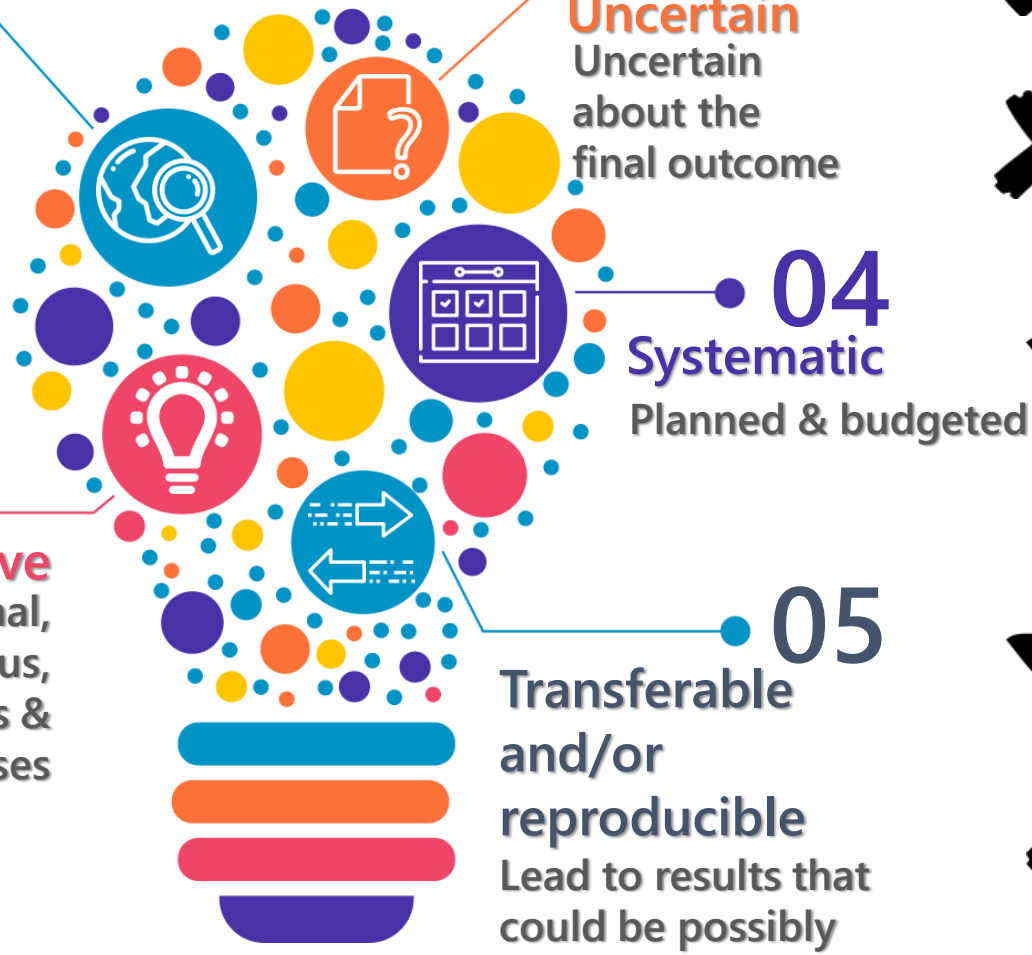
FIVE CORE CRITERIA that R&D activities must satisfy, at least in principle



01 Novel
Aimed at new findings

- **Produce new findings** to business & not already in use in the industry
- **Focus on new knowledge** & not on the new or significantly improved products or process

- Activities such as **copying, imitating or reverse engineering as a means of gaining knowledge**

02 Creative
Based on original, not obvious, concepts & hypotheses

- **New concepts or ideas that improve on existing knowledge**

- Routine work, data processing, vocational training

03 Uncertain
Uncertain about the final outcome

- **Possibility of not achieving the intended results**
  E.g., uncertainty about the costs & time needed to achieve the expected results

- Non-R&D prototyping, i.e., pre-production units used to obtain technical or legal certification

04 Systematic
Planned & budgeted

- **R&D is conducted in a planned manner with records kept of both the process & the outcome**

05 Transferable and/or reproducible
Lead to results that could be possibly reproduced

- **Transfer of the new knowledge & allowing other researchers to reproduce the results as part of their own R&D activities**

- R&D is to increase of the existing stock of knowledge, the **results cannot remain tacit**

Source: Frascati Manual 2015 © OECD 2015 (Page 46-48)

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R&D ACTIVITIES are classified as basic research, applied research & experimental development

Basic Research

Experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena & observable facts, without any particular application or use in view.

Applied Research

Original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific, practical aim or objective.

Experimental Development

Systematic work, drawing on knowledge gained from research & practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes

Source: Frascati Manual 2015 © OECD 2015 (Page 50-52)

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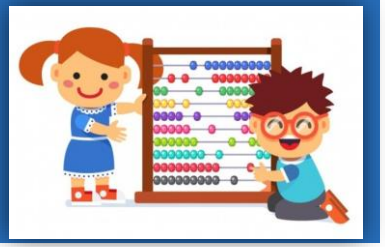
How types of R&D can be differentiated in Education?

Example

Education

BASIC RESEARCH

The investigation of the effect of different types of manipulatives on the way first graders learn mathematical strategy and then measuring what students have learned through standardised instruments



APPLIED RESEARCH

The study by researchers of a specific math curriculum to determine what teachers needed to know to implement the curriculum successfully

EXPERIMENTAL DEVELOPMENT

The development and testing (in a classroom) of software and support tools, based on fieldwork, to improve mathematics cognition for student special education.

Source: Frascati Manual 2015 © OECD 2015

How types of R&D can be differentiated in computer & information sciences?

Example

Computer & information sciences

BASIC RESEARCH

Research on the general properties of algorithms for handling large amounts of real-time data.

APPLIED RESEARCH

Research to find ways to reduce the amount of spam by understanding the whole structure or business model of spam, what spammers do, and their motivations in spamming.

EXPERIMENTAL DEVELOPMENT

A start-up company takes code developed by researchers & develops resulting software product for improved on-line marketing.

Source: Frascati Manual 2015 © OECD 2015

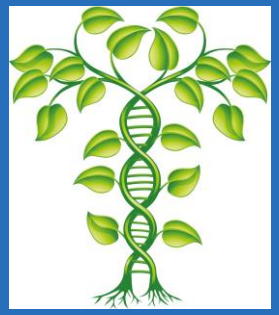
How types of R&D can be differentiated in Agricultural sciences & forestry?

Example

Agricultural sciences & forestry

BASIC RESEARCH

Researchers investigate the genetics of plant species in an attempt to understand natural controls for disease or pest resistance



APPLIED RESEARCH

Researchers alter the spacing & alignment of trees to reduce the spread of disease while ensuring the optimum arrangement for maximum yield.

EXPERIMENTAL DEVELOPMENT

Researchers use specific plant species to create a plan for improving its forests to achieve a specific goal.

Source: Frascati Manual 2015 © OECD 2015

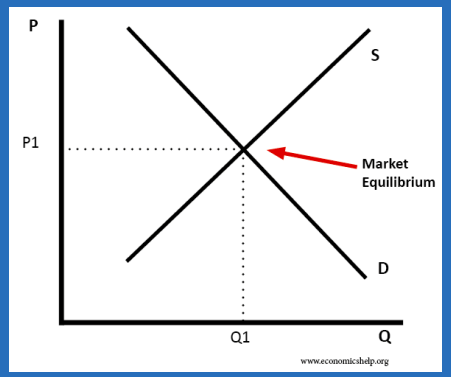
How types of R&D can be differentiated in Economics and business?

Example

Economics and business

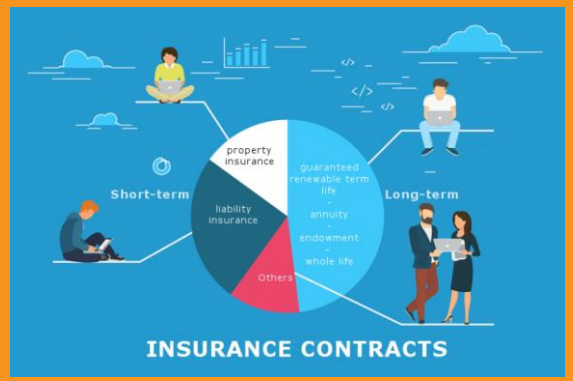
BASIC RESEARCH

Economists conduct research on whether a natural equilibrium exists in a market economy.



APPLIED RESEARCH

The investigation of new types of insurance contracts to cover new market risks or new types of savings instruments.



EXPERIMENTAL DEVELOPMENT

The development of a new method to manage an investment fund is experimental development as long as there is sufficient evidence of novelty.

Source: Frascati Manual 2015 © OECD 2015

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1. **Identification of R&D activities – Example for different sectors**
2. Measurement of R&D expenditures
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How to identify R&D activities?

We will now look through several examples in the next few slides.

Try to identify from the examples which of the five criteria are fulfilled and ascertain whether they R&D or not.

R&D ? … not R&D?...

Medicine

Criteria	N	C	U	S	T
1 - Routine autopsy to determine cause of death	✗	✗	✗	✓	✓
2 - Special investigation of certain deaths to see potential side effects of certain cancer treatments	✓	✓	✓	✓	✓
3 - Blood test for medical check	✗	✗	✗	✓	✓
4 - Blood test for patients trying a new drug/treatment	✓	✓	✓	✓	✓

N=Novel; C=Creative; U=Uncertain; S=Systematic & T=Transferable and/or reproducible

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Meteorology

Criteria	N	C	U	S	T
1 - Routine measurements of rainfall and atmospheric pressure	✗	✗	✗	✓	✓
2 - Exploring new methods to measure atmospheric pressure	✓	✓	✓	✓	✓
3 - Developing new mathematical models to predict weather	✓	✓	✓	✓	✓

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Manufacturing and Mechanical Engineering

Criteria	N	C	U	S	T
1 - Calculations, drawings, operating instructions to allow product standardisation or promote product sales	✗	✓	✗	✓	✓
2 - Running prototypes of new devices or running a pilot plant	✓	✓	✓	✓	✓
3 - Investing in constructing capacities for graphene (a type of new material) that currently has no direct applications in the market yet	✓	✓	✓	✓	✓
4 - Testing the replacement of one type of material with a new material in superconductors	✓	✓	✓	✓	✓

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Manufacturing and Mechanical Engineering (cont.)

Criteria	N	C	U	S	T
5 - Developing a new car	✓	✓	✓	✓	✓
6 - Operational trials of a new product	✗	✗	✓	✓	✓
7 - Solving problems raised from trial and more development activities needed	✓	✓	✓	✓	✓

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Software

Criteria	N	C	U	S	T
1 - The design and implementation of new search engines based on original technologies	✓	✓	✓	✓	✓
2 - The creation of new or more efficient algorithms based on new techniques	✓	✓	✓	✓	✓
3 - The creation of new websites or software using existing tools	✗	✗	✓	✓	✓
4 - The development of business application software using known methods and existing software tools	✗	✗	✗	✓	✓

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Education and Training

Criteria	N	C	U	S	T
1 - Routine vocational training	✗	✗	✗	✓	✓
2 - Developing of new methods to deliver training	✓	✓	✓	✓	✓
3 - Study of the implementation of a specific math curriculum to determine what teachers needed to know to implement the curriculum successfully	✓	✓	✓	✓	✓
4 - The development of tests (never been used) for selecting which educational programme should be used for children with specific needs	✓	✓	✓	✓	✓

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Economics and Business

Criteria	N	C	U	S	T
1 - Investigation of new types of insurance contracts to cover new market risks or new types of savings instrument	✓	✓	✓	✓	✓
2 - Developing of new risk theories	✓	✓	✓	✓	✓
3 - The development of a method that already is used by other organisations-to manage an investment fund	✗	✗	✗	✓	✓

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Banking and Insurance

Criteria	N	C	U	S	T
1 - Developing of risk models for credit policy used by other countries	✗	✗	✓	✓	✓
2 - Experimental development of new software for home banking	✓	✓	✓	✓	✓
3 - Identify new risks or new characteristics of risk that need to be taken into consideration in insurance contract	✓	✓	✓	✓	✓
4 - Research on social phenomena with an impact on new types of insurance (health, retirement, etc.), such as on insurance coverage for non-smoker	✓	✓	✓	✓	✓

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Arts and Humanities

Criteria	N	C	U	S	T
1 - Developing to produce new electronic musical instruments to suit the needs of a group of performers	✓	✓	✓	✓	✓
2 - Produce new pedagogical (education) materials based on new discoveries in neuroscience that change our understanding of how humans process new sounds and information	✓	✓	✓	✓	✓
3 - Create musical instruments using historical records	✗	✗	✗	✓	✓

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IDENTIFICATION OF R&D ACTIVITIES & KEY INDICATORS

1. Identification of R&D activities – Example for different sectors
2. **Measurement of R&D expenditures**
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Why measure R&D expenditures?

R&D expenditures

USED TO MEASURE

The amount of money spent on research and experimental development (R&D expenditure) is of considerable interest to national and international policy makers.

01 Who Conducts R&D

02 Who funds R&D

03 Where it takes place

04 Level & purpose of such activities

05 Interactions & collaborations between institutions & sectors

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GROSS DOMESTIC EXPENDITURE ON R&D (GERD)

Gross R&D Expenditure (GERD)
All expenditures spent on R&D in a country during a reference period

- It is the primary indicator for R&D activities of a country.
- It measures both **current & capital expenditures in R&D** and includes **foreign funded R&D activities** but excludes R&D activities that take place overseas.

Performer

USED TO IDENTIFY

GERD should be **based on performer reports** and not on information from the source of R&D funds.

01 How funds effectively used?

02 Year which R&D took place

03 Immediate R&D source of fund

Current R&D expenditures are composed of labour costs of R&D personnel & other current costs used in R&D

- Services and items (including equipment) used and consumed within one year are current expenditures.
- Annual fees or rents for the use of fixed assets should be included in current expenditures.

Labour costs of R&D personnel

- Comprise **compensation for employed R&D personnel** (internal R&D personnel)
- **Include only labour costs for employed persons when they make a direct contribution to R&D.**
- Exclude the costs associated with engaging persons not employed in the statistical unit but who provide direct services that are an integral part of the statistical unit's **R&D** projects or activities.

Other current R&D costs

- **Operating Cost** - Such as consumables, repairs, maintenance, purchasing of materials, prototypes, subscription to reference databases and commissioned work.
- Comprise **non-capital purchases of materials, supplies, equipment and services to support R&D** in the reference year.
- Include royalties or licences for the use of patents & other intellectual property rights, the lease of capital goods (machinery and equipment, etc.) and the rental of buildings to support R&D in the reference year.
- **Costs for computer software** that is used in the performance of R&D for **one year or less**.
- **Other Recurrent Cost** - Include costs associated with engaging persons who are not employed in the statistical unit but provide direct services that are integrated into the statistical unit's R&D activities.

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Capital R&D expenditures - annual gross amount paid for more than one year to buy fixed assets that are used repeatedly or continuously in the performance of R&D

- **Should be reported in full for the period when they took place**, whether developed in-house or acquired, and should not be registered as an element of depreciation.
- Capital expenditures for R&D **focuses on traceable transactions for capital used in R&D** rather than the economic cost of owning and using assets for R&D.

Land and buildings

- Includes **land acquired for R&D use** (e.g. testing grounds, sites for laboratories and pilot plants) and **buildings constructed or purchased for R&D use**, including major improvements, modifications and repairs.
- R&D expenditures for **land and for buildings should be separately identified** whenever possible

Machinery and equipment

- Covers major (i.e. capitalised) machinery and equipment acquired for use in the performance of R&D.
- Should be identified by more detailed breakdowns:
  - Information and communications equipment
  - Transportation equipment
  - Other machinery and equipment

Capitalised computer software

- Costs of computer software that is **used in the performance of R&D for more than one year.**
- Includes long-term licences or the acquisition of separately identifiable computer software, including program descriptions and supporting materials for both systems and applications software.
- The production costs (e.g. labour and materials) of internally produced software should be reported.

Other intellectual property products

- Costs for **purchased patents, long-term licences,** or **other intangible assets that are used in R&D** and which are in **use for more than one year.**

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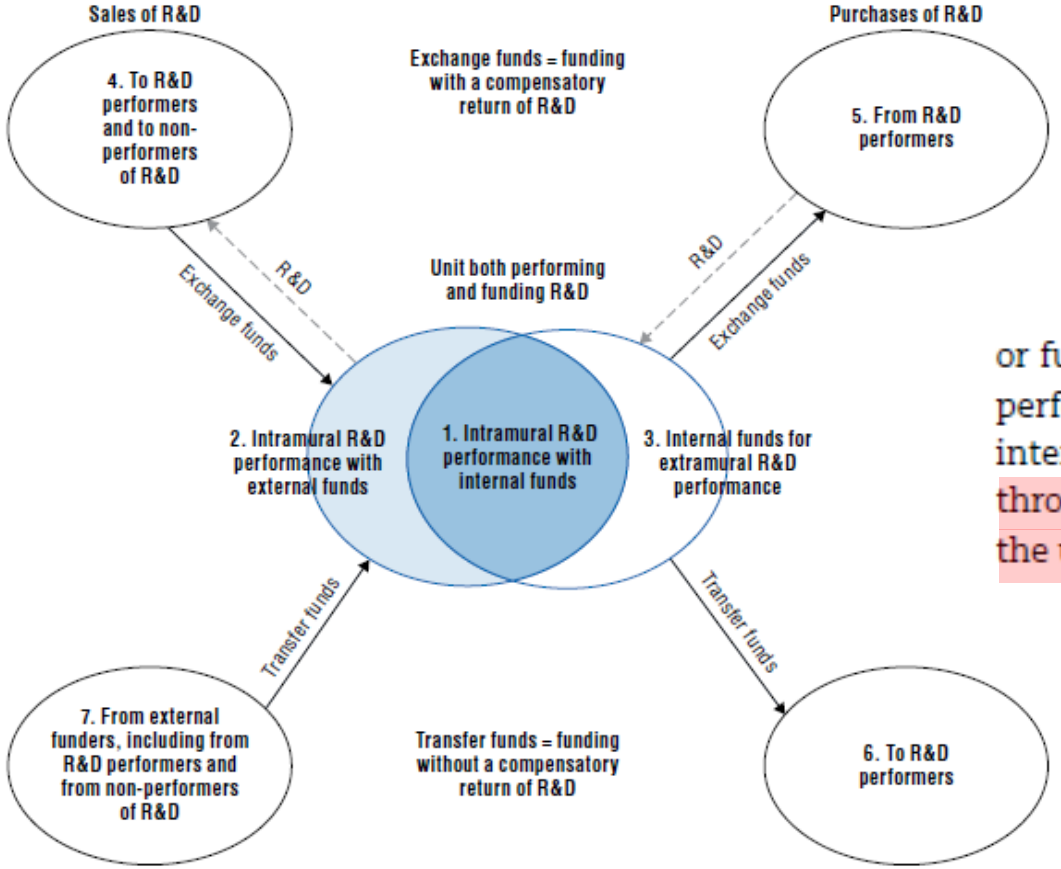
Funding of R&D - R&D funds pay for either the costs of R&D performance within the statistical unit or the costs of R&D performance outside of the statistical unit

- There can be a flow of R&D funds between statistical units either with (exchange) or without (transfer) compensatory return flows of R&D from the performer.



4.87 In order to avoid double counting (either in terms of R&D performance or funding totals), it is important to determine that funding by the unit for R&D performance by others (extramural R&D performance) includes only the unit's internal funds. External funds that the unit receives and are subsequently passed through or subcontracted to others should not be included as R&D funding by the unit. This determination can be challenging.

Source: Frascati Manual 2015 © OECD 2015 (Page 129)

Internal funds - The amount of money spent on R&D that originates within the control of and at the discretion of a reporting statistical unit

Business enterprise	Higher education	Other	Not Included
• **Reserve or retained earnings** (i.e. profits that have not been redistributed as dividends) • **Sales** of the unit's ordinary products (other than R&D) • **Raising capital** in the form of equity, debt or other hybrid instruments (e.g. funds raised on financial markets, loans from banks, venture capital, etc.) • **Deductions from income tax liability** arising as a result of government incentives for R&D carried out in the past are also internal funds, as they need not be used to fund R&D in the current reference period	• Receipts from **student enrolment charges** • Income from endowments • Income from life-long learning and the provision of other services	• Receipts from royalties and profits from the sales of goods and services – *For Research institute* • Gifts and philanthropy received with no requirement or expectation that any of the funds are necessarily to be used for R&D, being used for R&D – *For Private non-profit*	• R&D funds received from other statistical units explicitly for intramural R&D • Public general university funds (GUF) (i.e. a type of government funding to higher education institutions) – *For higher education*

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External funds - The amount of money spent on R&D that originates from outside the control of a reporting unit

Business enterprise

- R&D funds received by a member of a business enterprise group from other members of the same business enterprise group

Higher education

- General university funds (GUF)

Private non-profit

- Grants, gifts and philanthropy received explicitly for R&D - The amount should be **reported for the period when expended on R&D** (which may cover multiple reporting periods) and **not when the grant/gift/philanthropy was received.**
- R&D philanthropy from individual donors (includes individuals)

Not Included

- Funds received from other statistical units for the funding of R&D performed during earlier periods, or for the funding of R&D not yet started

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Tax incentives for encouraging R&D

- Some governments, principally at the central/federal level but also sometimes at the regional/local level, provide dedicated forms of tax relief with the aim of encouraging the funding or performance of R&D, particularly in business enterprises.

- While such **tax relief** is a form of public financial support for R&D, the quantification of such support **should not be included in the reported government source of funds** for R&D performance totals but to **report them as internal funds**.

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Coverage and definition of R&D personnel

5.6 **R&D personnel in a statistical unit include all persons engaged directly in R&D, whether employed by the statistical unit or external contributors fully integrated into the statistical unit's R&D activities, as well as those providing direct services for the R&D activities (such as R&D managers, administrators, technicians and clerical staff).**

Source: Frascati Manual 2015 © OECD 2015 (Page 151)

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R&D personnel broadly include all persons who work in or for a statistical unit, whether full-time or part-time, and who contribute to intramural R&D

- Two main groups of individuals who potentially contribute to the R&D activities can be identified:

Internal R&D personnel	External R&D personnel
• Persons **employed** by the statistical unit who contribute to the unit's intramural R&D activities	• Persons who are **not employed** in the reporting statistical unit but who provide direct services that are an integral part of the statistical unit's R&D projects or activities

Source: Frascati Manual 2015 © OECD 2015 (Page 151-152)

Reporting of R&D Personnel and Categories of R&D Expenditures

Classification	Employment status	Description	Reporting of R&D expenditures
Internal R&D personnel	Person employed	Employees	**Labour costs** (payroll data)
		Working proprietors, unpaid family workers, etc	**Not reported** because they do not receive remuneration
External R&D personnel: employees	Self-employed consultants	Contributors to the intramural R&D of their customers on a contractual basis	**Other current costs** (external R&D personnel)
	Employees of other units hired as R&D consultants	Contributors to the intramural R&D of their employers' customer on a salary basis	**Other current costs** (external R&D personnel)
External R&D personnel: special cases	Doctoral/Master's students		**Other current costs** external R&D personnel
	R&D grant holders		
	Volunteers		**Not reported** because they do not receive remuneration
	Professors emeritus (similar to volunteers)		

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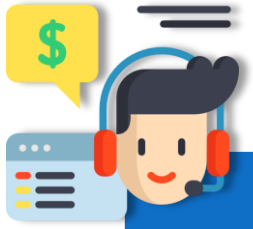
R&D personnel classified according to their R&D function: researchers, technicians and other supporting staff

Researcher

- Researchers are professionals engaged in the ***conception or creation of new knowledge***.
- They ***conduct research and improve or develop concepts, theories, models, techniques instrumentation, software or operational methods***.

Technicians and equivalent staff

- Technicians & equivalent staff are persons whose main tasks require ***technical knowledge*** and experience in one or more fields of engineering, the physical and life sciences, or the social sciences, humanities and the arts.
- They participate in R&D by ***performing scientific and technical tasks*** involving the application of concepts and operational methods and the use of research equipment, normally under the supervision of researchers



Other supporting staff

- Other supporting staff includes skilled and unskilled craftsmen, and administrative, secretarial and clerical staff participating in R&D projects or directly associated with such projects.

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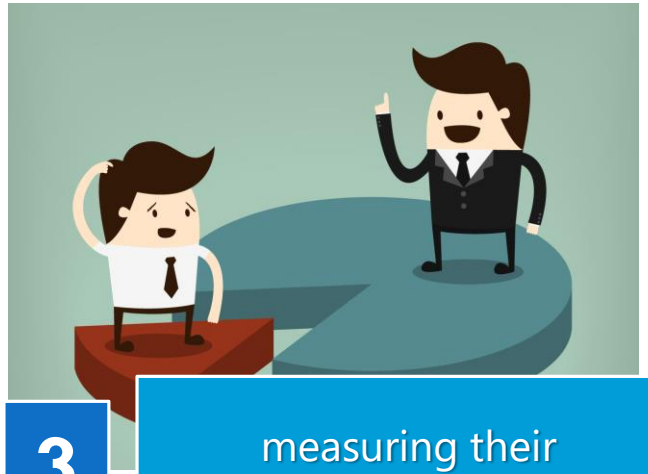
Measurement of R&D personnel

- Three measures of R&D personnel (both internal and external R&D personnel) are as follow:

1 measuring their **headcount (HC)**

2 measuring their **R&D activities** in **full-time equivalent (FTE)** or person-years



3 measuring their **characteristics**

HEADCOUNT (HC) OF R&D PERSONNEL

- The headcount (HC) of R&D personnel is defined as the **total number of individuals contributing to intramural R&D**, at the level of a statistical unit or at an aggregate level, during a specific reference period (usually a calendar year).

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FULL-TIME EQUIVALENTS (FTES) OF R&D PERSONNEL

- The Full-time equivalent (FTE) of R&D personnel is defined as the **ratio of working hours actually spent on R&D** during a specific reference period (usually a calendar year) divided by the total number of hours conventionally worked in the same period by an individual or by a group

- Total R&D personnel in FTE terms includes the R&D performance, on an annual basis, by all individuals – **internal R&D personnel and external R&D personnel, including volunteers** – who contribute to the intramural R&D of a statistical unit, an institutional sector or a country

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Examples indicate how the calculation of FTE totals:

Calculation By Percentage

Effort (%)	FTE
10	0.1
20	0.2
30	0.3
40	0.4
50	0.5
60	0.6
70	0.7
80	0.8
90	0.9
100	1

If four (4) employees are engaged in R&D work:

- **one works solely** on R&D projects,
- **one works 50%** of his working time,
- **one works 30%** of his working time and
- **one devotes only 20%** of his working time

Then the FTE is estimated as follows:

FTE = 1 + 0.5 + 0.3 +0.2 = 2

Calculation By Month

Effort (month)	FTE
1	0.08
2	0.17
3	0.25
4	0.33
5	0.42
6	0.5
7	0.58
8	0.67
9	0.75
10	0.83
11	0.92
12	1

If four (4) employees are engaged in R&D work,

- **one works solely** on R&D projects,
- **one works 6 months** of his working time
- remaining **two** devote only **3 months** of their working time

Then the FTE is estimated as follows:

FTE = 1 + 0.5 + 2(0.25) = 2

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R&D VS INNOVATION

1. **Definition**
2. Difference between R&D and Innovation
3. R&D and non-R&D activities in innovation

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Definition

Innovation

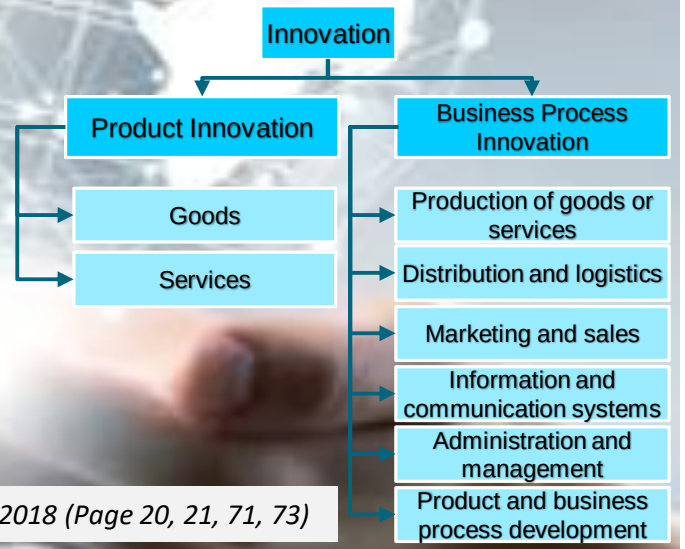
A new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process).
(*Oslo Manual 2018 © OECD 2018, Page 20)*

Research and experimental development (R&D)

Comprise creative & systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge.
(Frascati Manual 2015 © OECD 2015, Page 44)

- While all R&D is an innovation activity (*Oslo Manual 2018 © OECD 2018, page 92*), it is only one of a number of innovation activities, and it may or may not be part of the activity of innovation (*Frascati Manual 2015 © OECD 2015, page 60*).
- Innovation activities that are used by firms to develop innovations (*Oslo Manual 2018 © OECD 2018, page 87*):
  - R&D, engineering, design and other creative activities; marketing and brand equity activities, IP-related activities, employee training activities, software development and database activities, activities related to the acquisition or lease of tangible assets, and innovation management activities

Types of Innovation



Source: Oslo Manual 2018 © OECD 2018 (Page 20, 21, 71, 73)

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Difference between R&D and Innovation

R&D	INNOVATION
Must result in findings that are **new to the business and not already in use in the industry**. Excluded from R&D are activities undertaken to copy, imitate or reverse engineer as a means of gaining knowledge, as this knowledge is not novel.	Minimum requirement: The product or business process must have one or more characteristics that are significantly different from those contained in the products or business processes **previously offered by or used by the firm**.
An input to innovation	Include R&D that is not directly related to the development of a specific innovation
Only the institutions that **meet the conditions of R&D performance explained in Frascati Manual** should be identified as possible statistical units for the R&D measurement	The sample for innovation can **include industries (and small units) that are not usually included in R&D surveys**

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R&D and non-R&D activities in innovation: Prototypes

Example: Development of a pump for corrosive liquids

N Novelty in exploring the potential of new devices (pump)

C Emerging in the design of new devices (pump) to be produced

U Testing could yield unexpected results

S Detailed organisation of the project can be identified behind the technical activities

T Produce technical documentation to translate the results of testing in information to be used at the product development stage

ACTIVITIES INVOLVED

Design, construction and testing of prototypes

Any necessary modifications to the prototype(s) have been made and testing has been satisfactorily completed - the manufacturing start-up phase may begin

Construction of several copies of a prototype to meet a temporary commercial, military or medical need after successful testing of the original

Not R&D - The primary objective is no longer to make further improvements but to start the production process.

Innovation – Acceptance of a prototype often means that the experimental development phase ends and the next phase of the innovation process begin.

R&D

Not R&D

N=Novel; C=Creative; U=Uncertain; S=Systematic & T=Transferable and/or reproducible

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R&D and non-R&D activities in innovation: Tooling Up & Industrial Engineering

Example: Tooling up for manufacturing process

ACTIVITIES INVOLVED

- **N** – Novelty in exploring the potential of new device/method/standard
- **C** – Emerging in the design of new device/method/standard to be produced
- **U** – Testing could yield unexpected results
- **S** – Detailed organisation of the project can be identified behind the technical activities
- **T** – Produce technical documentation to translate the results of testing in information to be used at the product development stage

Improvements in the production of machinery and tools or changes to the production and quality control procedures or the development of new methods and standards

"Feedback" R&D

("Feedback" R&D - After a new product or process has been turned over to production units, there will still be technical problems to be solved, some of which may demand further R&D)

The first-time use of components (including the use of components resulting from R&D efforts)

The initial tooling of equipment for mass production

Installing equipment linked with the start of mass production

Not R&D – The primary objective is no longer to make further improvements but to <u>start the production process</u>.

Innovation – Experimental development phase ends and the next phase of the innovation process begin.

R&D

Not R&D

N=Novel; C=Creative; U=Uncertain; S=Systematic & T=Transferable and/or reproducible

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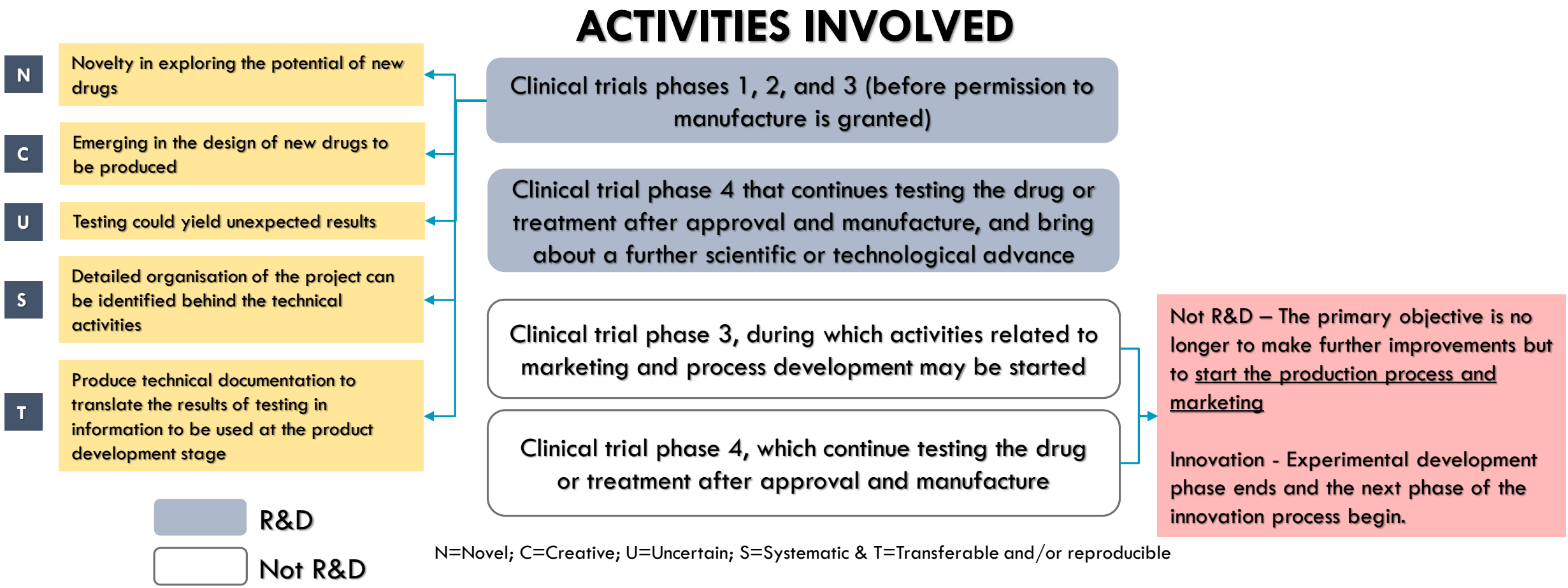
R&D and non-R&D activities in innovation: Clinical trials

Example: Introduction of new drugs



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End of Session 1

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