

## 基礎研究の意義に係る記述

- 第三期科学技術基本計画(平成 18 年 3 月 28 日閣議決定)【抜粋】
- 科学技術研究調査(平成 20 年 12 月 18 日総務省)における「用語の定義」【抜粋】
- Frascati Manual 2002 (OECD) 【抜粋】
- 基礎研究についての産業界の期待と責務【ブレイクスルーに向けてのアプローチ】  
(2008 年 2 月 25 日 産業競争力懇談会(COCN)最終報告)【抜粋】

(参考①) Donald E.Stokes が 1997 年の著書

"Pasteur's Quadrant -Basic Science and Technological Innovation-"で提示した二次元モデル

(参考②) Frascati Manual 2002 (OECD) 4.2 Type of R&D

### ● 第三期科学技術基本計画 (平成 18 年 3 月 28 日閣議決定) 【抜粋】

#### 第 2 章 科学技術の戦略的重点化

##### 1. 基礎研究の推進

多様な知と革新をもたらす基礎研究については、一定の資源を確保して着実に進める。

人類の英知を生み知の源泉となる基礎研究は、全ての研究開発活動の中で最も不確実性が高いものである。その多くは、当初のねらいどおりに成果が出るものではなく、地道で真摯な真理探求と試行錯誤の蓄積の上に実現されるものである。また、既存の知の枠組みとは異質な発見・発明こそが飛躍知につながるものであり、革新性を育む姿勢が重要である。

基礎研究には、人文・社会科学を含め、研究者の自由な発想に基づく研究と、政策に基づき将来の応用を目指す基礎研究があり、それぞれ、意義を踏まえて推進する。すなわち、前者については、新しい知を生み続ける重厚な知的蓄積(多様性の苗床)を形成することを目指し、萌芽段階からの多様な研究や時流に流されない普遍的な知の探求を長期的視点の下で推進する。一方、後者については、次項以下に述べる政策課題対応型研究開発の一部と位置付けられるものであり、次項 2. に基づく重点化を図りつつ、政策目標の達成に向け、経済・社会の変革につながる非連続的なイノベーションの源泉となる知識の創出を目指して進める。

## ●科学技術研究調査（平成20年12月18日総務省）における「用語の定義」【抜粋】

### （3）性格別研究（基礎、応用、開発）

企業等，非営利団体・公的機関及び大学等が社内（内部）で使用した研究費のうち，自然科学（理学，工学，農学及び保健）に使用した研究費を「基礎」，「応用」及び「開発」に区分している。

なお，この性格別研究費総額を「自然科学に使用した研究費」としている。

#### ①基礎研究

特別な応用，用途を直接に考慮することなく，仮説や理論を形成するため，又は現象や観察可能な事実に関して新しい知識を得るために行われる理論的又は実験的研究をいう。

#### ②応用研究

基礎研究によって発見された知識を利用して，特定の目標を定めて実用化の可能性を確かめる研究や，既に実用化されている方法に関して，新たな応用方法を探索する研究をいう。

#### ③開発研究

基礎研究，応用研究及び実際の経験から得た知識の利用であり，新しい材料，装置，製品，システム，工程等の導入又は既存のこれらのものの改良をねらいとする研究をいう。

## ●Frascati Manual 2002 (OECD) 【抜粋】 (※)

### Basic research

240. Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

※フラスカチ・マニュアル2002は、OECDが研究開発に関する国際標準を定めるものであり、総務省の「科学技術研究調査」における研究費等の用語もこれに沿って定義されている。

## ●基礎研究についての産業界の期待と責務【ブレイクスルーに向けてのアプローチ】

【エグゼクティブサマリー抜粋】 (2008年2月25日 産業競争力懇談会(COCON)中間報告)

### 3. 産業界から見た基礎研究の位置づけ

#### 【基礎研究の定義】

全ての研究活動は明確な目的を持ち、社会に対して義務を負う。この認識の下、本プロジェクトでは、研究をその目的によって「学術指向研究」と「技術指向研究」に分類し、それらを、更に、実施される研究の内容から区分することとした(表1)。基礎研究は、学術指向研究と、技術指向研究の内の「革新研究」を合わせたものとして定義される。この定義に基づき、学術指向研究、革新研究のそれぞれに対し、ブレイクスルー創出に向けた役割と、あり方、とるべき施策について検討した。

表1. 本プロジェクトにおける研究活動の分類

学術指向研究	飛躍知の研究	全く新しい知の体系を切り開く研究
	融合知の研究	既存学術領域を融合し、新たな知や技術の体系を構築する研究
	基盤知の研究	既存の知や技術の体系を深化・拡充・継承する研究
技術指向研究	革新研究	将来の応用における重要課題を構想し、根源に遡って解決法を探索する研究
	応用研究	特定の目標に対し、既存の知識、技術を適用して、その実現を図る研究
	開発研究	新規材料・工程の導入や既存技術の改良により新たな製品・サービスを実現する研究

(参考①) Donald E. Stokes が 1997 年の著書

「"Pasteur's Quadrant -Basic Science and Technological Innovation-"」で提示した二次元モデル

Research is inspired by:		Considerations of use?	
		No	Yes
Quest for fundamental understanding?	Yes	Pure basic Research (Bohr)	Use-inspired basic research (Pasteur)
	No		Pure applied research (Edison)

(参考②)

## Frascati Manual 2002 (OECD)

### 4.2. Type of R&D

#### 4.2.1. Use of distribution by type of R&D

238. Breakdown by type of R&D is currently recommended for use in all four national sectors of performance. It is usually more easily applied to R&D in the natural sciences and engineering (NSE) than in the social sciences and humanities (SSH). For the purposes of international comparison, the breakdown should be based on current expenditures only. It may be applied at project level, but some R&D projects may have to be subdivided among activities.

#### 4.2.2. The distribution list

239. Three types of R&D may be distinguished:

- Basic research.
- Applied research.
- Experimental development.

#### *Basic research*

240.

Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

241. Basic research analyses properties, structures and relationships with a view to formulating and testing hypotheses, theories or laws. The reference to no “particular application in view” in the definition of basic research is crucial, as the performer may not know about actual applications when doing the research or responding to survey questionnaires. The results of basic research are not generally sold but are usually published in scientific journals or circulated to interested colleagues. Occasionally, basic research may be “classified” for security reasons.

242. In basic research, scientists have some freedom to set their own goals. Such research is usually performed in the higher education sector but also to some extent in the government sector. Basic research can be oriented or directed towards some broad fields of general interest, with the explicit goal of a broad range of applications in the future. One example is the public research

programmes on nanotechnology which several countries have decided on. Firms in the private sector may also undertake basic research, with a view to preparing for the next generation of technology. Research on fuel cell technology is a case in point. Such research is basic according to the above definition as it does not have a *particular* use in view. It is defined in the *Frascati Manual* as “oriented basic research”.

243. Oriented basic research may be distinguished from pure basic research as follows:

- Pure basic research is carried out for the advancement of knowledge, without seeking long-term economic or social benefits or making any effort to apply the results to practical problems or to transfer the results to sectors responsible for their application.
- Oriented basic research is carried out with the expectation that it will produce a broad base of knowledge likely to form the basis of the solution to recognised or expected, current or future problems or possibilities.

244. The separate identification of oriented basic research may provide some assistance towards identifying “strategic research”, a broad notion often referred to in policy making.

#### *Applied research*

245.

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

246. Applied research is undertaken either to determine possible uses for the findings of basic research or to determine new methods or ways of achieving specific and predetermined objectives. It involves considering the available knowledge and its extension in order to solve particular problems. In the business enterprise sector, the distinction between basic and applied research is often marked by the creation of a new project to explore promising results of a basic research programme.

247. The results of applied research are intended primarily to be valid for a single or limited number of products, operations, methods or systems. Applied research gives operational form to ideas. The knowledge or information derived from it is often patented but may be kept secret.

248. It is recognised that an element of applied research can be described as strategic research, but the lack of an agreed approach in member countries to its separate identification prevents making a recommendation.

*Experimental development*

249.

Experimental development is systematic work, drawing on knowledge gained from research and practical experience, that is directed to producing new materials, products and devices; to installing new processes, systems and services; or to improving substantially those already produced or installed.

250. In the social sciences, experimental development may be defined as the process of translating knowledge gained through research into operational programmes, including demonstration projects undertaken for testing and evaluation purposes. The category has little or no meaning for the humanities.

**4.2.3. Criteria for distinguishing between types of R&D**

251. There are many conceptual and operational problems associated with these categories. They seem to imply a sequence and a separation which rarely exist in reality. The three types of R&D may sometimes be carried out in the same centre by essentially the same staff. Moreover, there may be movement in both directions. When an R&D project is at the applied research/experimental development stage, for example, some funds may have to be spent on additional experimental or theoretical work in order to acquire more knowledge of the underlying foundations of relevant phenomena before further progress can be made. Moreover, some research projects may genuinely straddle categories. For instance, study of the variables affecting the educational attainment of children drawn from different social and ethnic groups may involve both basic and applied research.

252. The following examples illustrate general differences between basic and applied research and experimental development in the natural sciences and engineering and in the social sciences and humanities.

253. Examples from the natural sciences and engineering:

- The study of a given class of polymerisation reactions under various conditions, of the yield of products and of their chemical and physical properties is basic research. The attempt to optimise one of these reactions with respect to the production of polymers with given physical or mechanical properties (making it of particular utility) is applied research. Experimental development then consists of “scaling up” the process which has been optimised at the laboratory level and investigating and evaluating possible methods of producing the polymer and perhaps articles to be made from it.

- The study of a crystal's absorption of electromagnetic radiation to obtain information on its electron band structure is basic research. The study of the absorption of electromagnetic radiation by this material under varying conditions (for instance temperature, impurities, concentration, etc.) to obtain given properties of radiation detection (sensitivity, rapidity, etc.) is applied research. The preparation of a device using this material to obtain better detectors of radiation than those already existing (in the spectral range considered) is experimental development.
- The determination of the amino acid sequence of an antibody molecule is basic research. Investigations undertaken in an effort to distinguish between antibodies for various diseases is applied research. Experimental development then consists of devising a method for synthesising the antibody for a particular disease on the basis of knowledge of its structure and clinically testing the effectiveness of the synthesised antibody on patients who have agreed to accept experimental advanced treatment.

254. Examples from the social sciences and humanities:

- Theoretical investigation of the factors determining regional variations in economic growth is basic research; however, such investigation performed for the purpose of developing government policy is applied research. The development of operational models, based upon laws revealed through research and aimed at modifying regional disparities, is experimental development.
- Analysis of the environmental determinants of learning ability is basic research. Analysis of the environmental determinants of learning ability for the purpose of evaluating education programmes designed to compensate for environmental handicaps is applied research. The development of means of determining which educational programme to use for particular classes of children is experimental development.
- The development of new risk theories is basic research. Investigation of new types of insurance contracts to cover new market risks is applied research. Investigation of new types of savings instruments is applied research. Development of a new method to manage an investment fund is experimental development.
- The study of a hitherto unknown language to establish its structure and grammar is basic research. Analysis of regional or other variations in the use of a language to determine the influence of geographical or social variables on the development of a language is applied research. No meaningful examples of experimental development have been found in the humanities.

255. Table 4.2 gives further examples of the distinctions between the three types of research in the social sciences.

Table 4.2. **The three types of research in the social sciences and humanities**

Basic research	Applied research	Experimental development
Study of the causal relations between economic conditions and social development	Study of the economic and social causes of the drift of agricultural workers from rural districts to towns, for the purpose of preparing a programme to halt this development in order to support agriculture and prevent social conflicts in industrial areas	Development and testing of a programme of financial assistance to prevent rural migration to large cities
Study of the social structure and the socio-occupational mobility of a society, <i>i.e.</i> its composition and changes in socio-occupational strata, social classes, etc.	Development of a model using the data obtained in order to foresee future consequences of recent trends in social mobility	Development and testing of a programme to stimulate upward mobility among certain social and ethnic groups
Study of the role of the family in different civilisations past and present	Study of the role and position of the family in a specific country or a specific region at the present time for the purpose of preparing relevant social measures	Development and testing of a programme to maintain family structure in low-income working groups
Study of the reading process in adults and children, <i>i.e.</i> investigating how human visual systems work to acquire information from symbols such as words, pictures and diagrams	Study of the reading process for the purpose of developing a new method of teaching children and adults to read	Development and testing of a special reading programme among immigrant children
Study of the international factors influencing national economic development	Study of the specific international factors determining the economic development of a country in a given period with a view to formulating an operational model for modifying government foreign trade policy	–
Study of specific aspects of a particular language (or of several languages compared with each other) such as syntax, semantics, phonetics, phonology, regional or social variations, etc.	Study of the different aspects of a language for the purpose of devising a new method of teaching that language or of translating from or into that language	–
Study of the historical development of a language	–	–
Study of sources of all kinds (manuscripts, documents, monuments, works of art, buildings, etc.) in order to better comprehend historical phenomena (political, social, cultural development of a country, biography of an individual, etc.)	–	–

Source: UNESCO (1984b), "Manual for Statistics on Scientific and Technological Activities".



256. Examples from software development:

- Search for alternative methods of computation, such as quantum computation and quantum information theory, is basic research.
- Investigation into the application of information processing in new fields or in new ways (e.g. developing a new programming language, new operating systems, programme generators, etc.) and investigation into the application of information processing to develop tools such as geographical information and expert systems are applied research.
- Development of new applications software, substantial improvements to operating systems and application programmes, etc., are experimental development.