Doctoral Human Resource Profiling Project

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1. Outline of the project

In Japan, about 15,000 people receive a doctorate degree every year and start their careers in various fields as major contributors to science and technology innovation and as highly skilled workers. However, it is known that building a highly specialized career is becoming difficult due to escalating competition in research and the recent poor employment situation. To that end, the National Institute of Science and Technology Policy (NISTEP) of the Ministry of Education, Culture, Sports, Science and Technology is conducting the following two activities to continuously gather information on doctorate recipients for their employment status, living conditions, etc., for the purpose of building a database used in policy research that contributes to improvement of the postdoctoral environment.
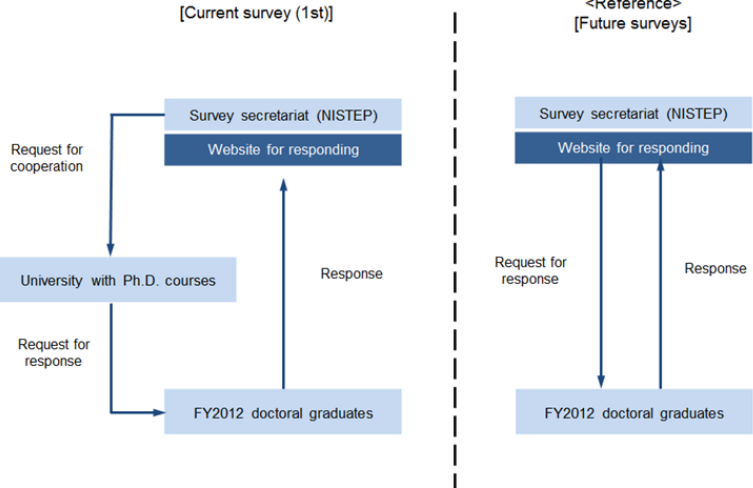
(1) Database of Doctoral Graduates

All Ph.D. candidates are assigned with an ID on their enrollment, and their basic information (e.g., age, nationality, major field of study) are put into the database during their candidature. Upon graduation, basic data for the Japan Doctoral Human Resource Profiling, such as educational and research situations during the candidature, career path, and contact information after graduation, will be put into the database. The Database of Doctoral Graduates is currently in pilot operation with cooperation from 12 universities, and deliberations are held on methods to establish a more efficient survey system.
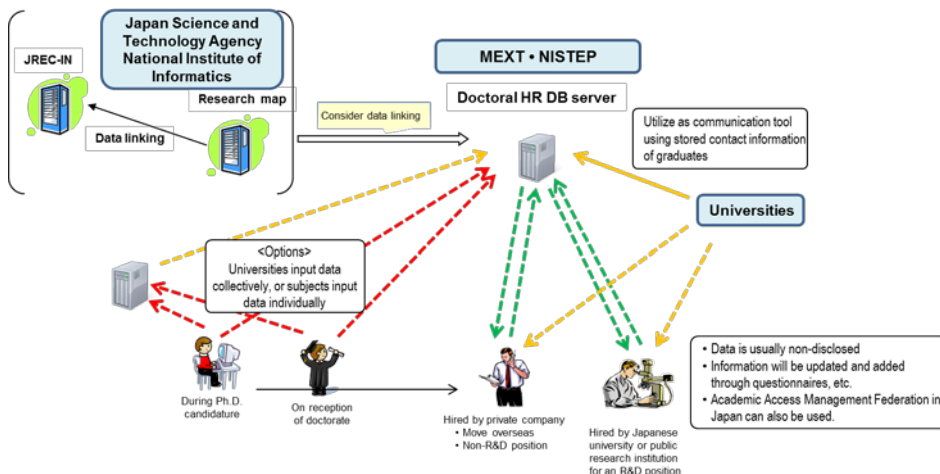
(2) Japan Doctoral Human Resource Profiling (JD-Pro.)

The JD-Pro. tracks doctorate recipient cohorts of specific years. This time was the first survey, targeting people who completed a Ph.D. course in FY2012. Relevant universities send an email to the survey subjects requesting participation in the survey, and the subjects visit a dedicated website to answer questions. The next survey is planned to be conducted in 1-2 years and will be requested directly from NISTEP without going through the graduate universities. NISTEP is considering targeting people who complete a Ph.D. course in FY2015 as new cohorts.

The two activities (1) Database of Doctoral Graduates and (2) Japan Doctoral Human Resource Profiling will be unified in the future, and will become an information base that efficiently and steadily gathers information of doctoral human resources (HRs) in Japan. The schedule of the activities is shown below.

2. Current status of doctoral human resources in Japan

The number of doctorate recipients per 1 million people was 131 in Japan in FY2010, which is relatively small compared to other countries. The largest was Germany, followed by the UK, with both having more than 300 doctoral graduates per 1 million people. The US and South Korea were around 250 doctoral graduates. The number of doctorate recipients in the last 5 years is increasing in all these countries except Japan, with South Korea having the largest increase rate, followed by the UK and the US.

The number of Ph.D. course enrollments in Japan peaked in FY2003 at around 18,000, and has been gradually decreasing ever since. In FY2010, the number increased by 3.6% compared to the previous fiscal year, but it again fell in FY2011 and FY2012, resulting in the current number of around 15,000-16,000 enrollments per year. Breaking down the enrollments by field of study, Ph.D. course enrollments are clearly reducing in the fields of engineering, humanities and social sciences.

Chart 1: Number of doctorate recipients per 1 million people in major countries
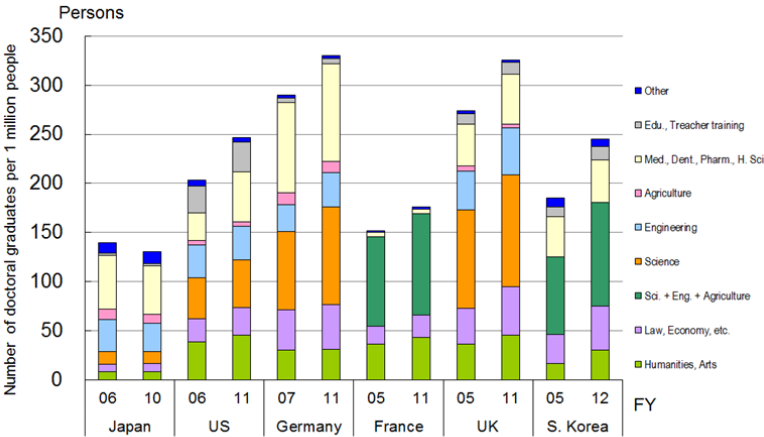
Source: NISTEP "Japanese Science and Technology Indicators 2014"
Research Material 229 [Chart 3-4-1(C)], 2014

Chart 2: Postgraduate (doctorate) course enrollments
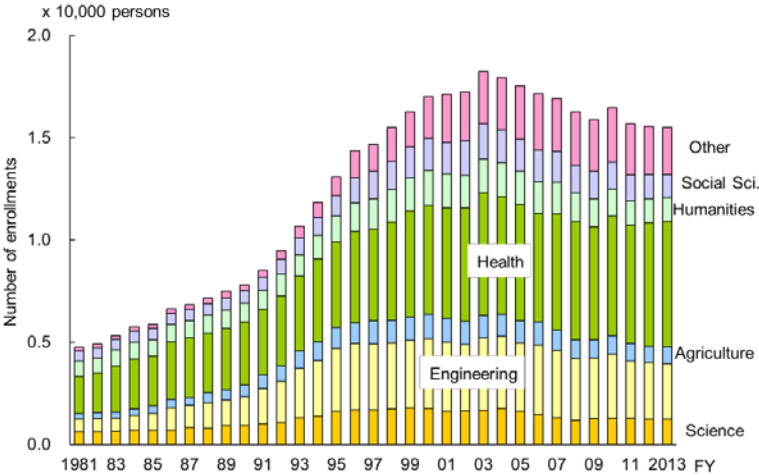
Source: NISTEP "Japanese Science and Technology Indicators 2014"
Research Material 229 [Chart 3-2-4], 2014

With the advent of the aging society with fewer children, the importance of doctoral HRs is increasing in Japan owing to their capabilities in innovating with high added value. However, the career path of young researchers is unclear, and there remain various issues including (1) expansion of career path to private companies, etc., (2) transition from postdoctoral fellows to stable positions, (3) delayed independence for young researchers, (4) lack of supervisory HRs, and (5) lack of female researchers in the fields of science and technology.

Chart 3: Postdoctoral career path
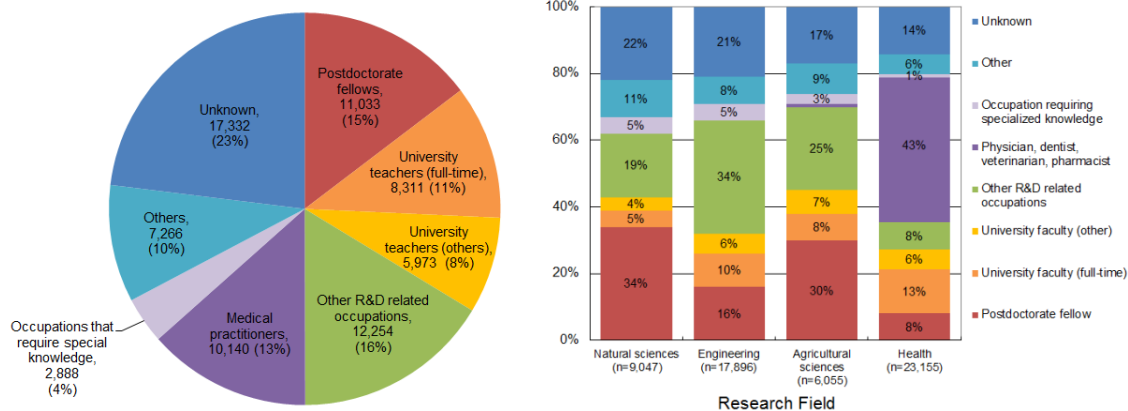
Source: NISTEP "Career Trends Survey of Recent Doctoral Graduates", NISTEP REPORT No. 126, 2009

Chart 4: Employment resources of postdoctoral fellows

[November 2012: 14,175 persons]
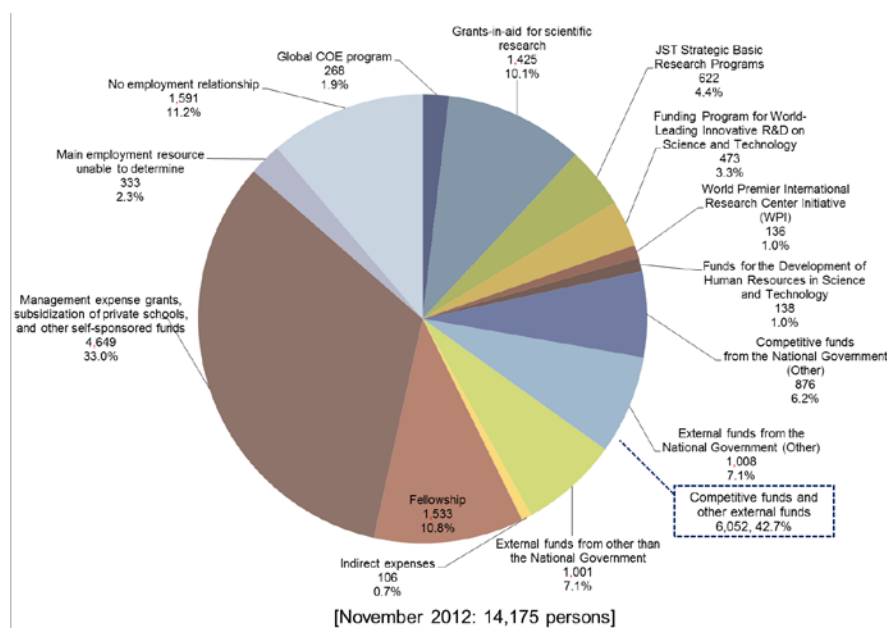
Source: NISTEP "Survey on Postdoctoral Fellows Regarding Employment and Moving-out Situations -Complete Survey for Universities and Research Institutions in Japan (FY2012 Data)-", NISTEP REPORT, 2014

* The main results of research studies on doctoral HRs are summarized in NISTEP Booklet-2 "Current Status of Human Resource development and Innovation Issues on Career Dynamics of Highly Skilled Personnel in the Science and Technology Field -Mobility, Globalization, and Diversification-"
http://data.nistep.go.jp/dspace/handle/11035/2457

3. International framework regarding doctoral human resources surveys

In 2004, OECD, along with the UNESCO Institute for Statistics and Eurostat, started an international comparison survey of doctorate recipients, the Careers of Doctorate Holders (CDH) project. Data of doctorate holders aged no greater than 70 years are collected from cooperating countries, and international comparative analysis is carr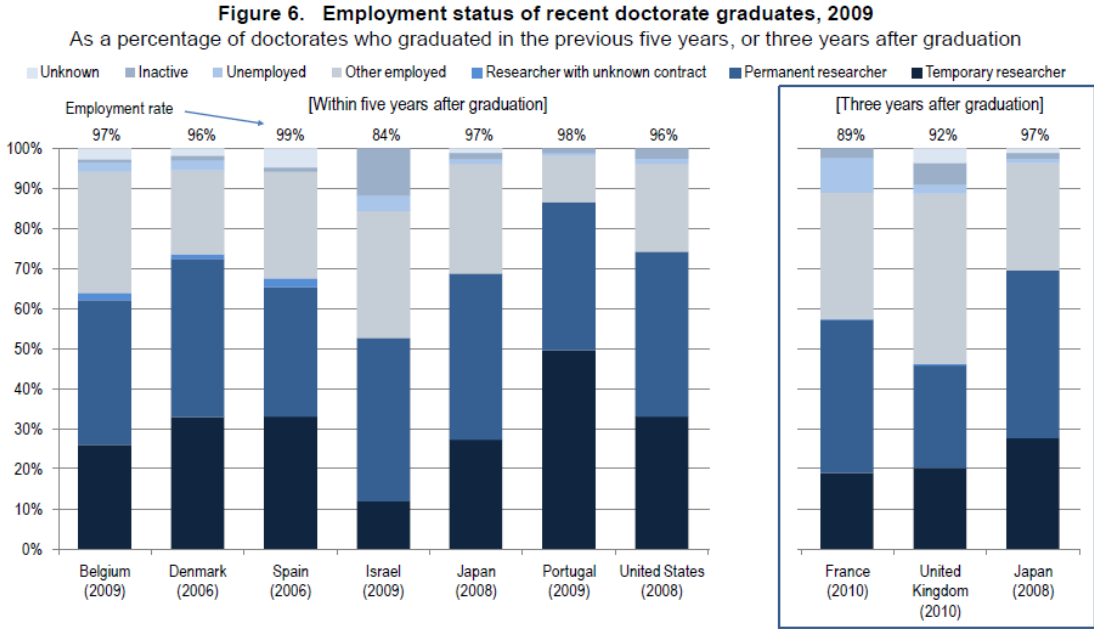ied out on their age, nationality, major field of study, employment status, international movement, major field during doctoral candidature, etc., while considering the international integrity. For the 2010 survey, 25 countries including the US participated in the CDH project.

Additionally, in the KnowINNO-CDH product conducted from 2011 to 2012, with cooperation by countries that are not participating in the CDH project, individual data of doctorate holders in their early career stage were collected, and detailed analysis was carried out on the employment status, etc., of doctorate holders.

In Japan, the national census and employment statistics often do not differentiate postgraduates from undergraduates, and even if there was any differentiation there is no distinction between master degrees and Ph.D. degrees. Therefore, the employment status of doctorate recipients cannot be clarified in these data and hence, Japan is not participating in the CDH project. However, Japan participated in the detailed international comparisons by the KnowINNO-CDH project, using the individual data of career trend surveys on doctoral graduates conducted by NISTEP from FY2002 to FY2006.

Japan will continuously and steadily gather career information on doctoral HRs, aiming at establishing a database that allows for international comparison.

Figure 6. Employment status of recent doctorate graduates, 2009
As a percentage of doctorates who graduated in the previous five years, or three years after graduation

http://www.oecd.org/sti/inno/CDH%20FINAL%20REPORT-.pdf

4. Survey on doctoral human resources in major countries – Outline and utilization

Large-scale surveys on the career trends, living conditions, etc., of doctoral HRs were commenced in the 1970s in the US, in the 1980s in France, and in the 2000s in the UK. These surveys are conducted in various forms in collaboration with governmental agencies and universities. Tracking surveys are conducted if the national census, etc., cannot identify data for doctoral HRs, where continuous accumulation of data enables clear understanding of educational characteristics, employment characteristics, demographic characteristics, etc., of doctoral HRs. Additionally, such data are utilized as an information base for obtaining knowledge that is important in deciding science and technology measures as well as higher education policies.

Outline of surveys on doctoral human resources in major countries

Country	Current situation	Conducting entity, future direction
US	The large-scale data set on science and technology HRs (SESTAT) consists of the following three surveys: (1) Recipients of a bachelor's or master's degree (NSCG) (2) Recent recipients of a bachelor's or master's degree (NSRCG) (3) Recipients of a doctorate degree (SDR)	• Conducted by the NORC of the University of Chicago, funded by federal organizations (e.g., NSF, NIH) • Degree-granting institutions are required to submit the result of SED to NSF, etc. • SDR supplements SED, which is conducted immediately after receiving Ph.D.
UK	All graduates of higher education institutions are the subjects. (1) Survey 6 months after graduation (DLHE) (2) Following tracking surveys (L-DLHE) 3.5 years later, then 7 years later	• Conducted by the Higher Education Statistics Agency (HESA) • DLHE: Survey is a legal obligation of higher education institutions. • L-DLHE: Storage and provision of contact information are legal obligations of higher education institutions.
France	All educational stages are the targets. "Survey on transition from education to society" (Generation) Tracks select cohorts 3, 7 and 10 years later	• Conducted by the French qualification research center (Cereq) in collaboration with the Ministry of Higher Education and Research and various educational institutions.
Germany	Survey on Ph.D. candidates and graduates (ProFile) is conducted by multiple cooperating universities and research institutions. A 3-stage tracking survey is conducted.	• Conducted by the Institute for Research Information and Quality Assurance (iFQ). • New survey corresponding to CDH is under deliberation.
Netherlands	By conducting a dedicated survey, an information management system on doctorate recipients, etc., corresponding to CDH is established.	• The Statistics Netherlands collates the doctorate holder information with the resident register.
Japan	Survey on career trends and financial status of doctoral graduates (irregular) (1) On graduation and the current status for FY2002-2006 (2) On graduation for FY2009 and FY2012 *** Continuous individual tracking is required.**	• "Japan Doctoral Human Resource Profiling" was started in Nov 2014 (NISTEP) • Giving ID to Ph.D. candidates by the Doctoral HR DB and linking with other information infrastructure (e.g., R&R) are under deliberation *** It is important to compare with master's and bachelor's data in the future.**

(1) US

In the US, the Survey of Earned Doctorates (SED) conducted during Ph.D. candidature and immediately after graduation is recognized as part of doctorate conferment, and the recovery rate of the SED exceeds 90%. In the SED, basic information of doctoral HRs is surveyed, including the person's personal affinity, demographic (family) information, the research field during the doctorate candidature, duration of candidature and cost.

Additionally, the Science and Engineers Statistical Data System (SESTAT) is established in the US mainly by the National Science Foundation (NSF). SESTAT consists of three surveys as shown in the figure below, which clarify the situation of scientists and engineers who actively work in US society. Combining the Survey of Doctorate Recipients (SDR) with the National Survey of College Graduation (NSCG) and National Survey of Resent College Graduation (NSRCG) enables the situation of science and technology HRs in the US to be understood, while clarifying the characteristics of doctorate recipients.

SESTAT (Scientists and Engineers Statistical Data System)
With the National Science Foundation (NSF) and National Institutes of Health (NIH) being the main entities, the survey is conducted by the NORC of the University of Chicago. A data set on scientists and engineers. Conducted once every 2-3 years, and more than 100,000 samples are surveyed each time. The SDR asks in detail about the research field, occupation, annual income, etc., becoming important data for evaluation, deliberation, and planning of science and technology human resource policies.

NSCG (National Survey of College Graduates)
Recipients of a bachelor's or master's degree

NSRCG (National Survey of Recent College Graduates)
Recent recipients of a bachelor's or master's degree

SED
(Survey of Earned Doctorate)
On reception of a doctorate

SDR (Survey of Doctorate Recipients)
Recipients of a doctorate degree

[Example of Data utilization]

Doctorates awarded by U.S. colleges and universities: 1958–2012
Doctorate recipients (thousands)
SOURCE: Doctorate Recipients from U.S. Universities 2012. Related detailed data: table 1.

http://www.nsf.gov/statistics/sed/digest/2012/nsf14305.pdf

Science & Engineering Indicators.

Women, Minorities, and Persons with Disabilities in Science and Engineering

(2) France

France has a major survey called "Génération" that tracks people who left education at all the stages (e.g., universities, technical colleges, special schools, Grandes écoles) and moved into society. It consists of a single small-scale survey conducted 3 years after graduation and a large-scale continuous survey conducted 3 years, 5 years, 7 years and 10 years after graduation. Educational institutions and other related institutions are requested to provide information, and a list of all graduates, totaling about 1,200,000 is created. About 1/3 of the graduates are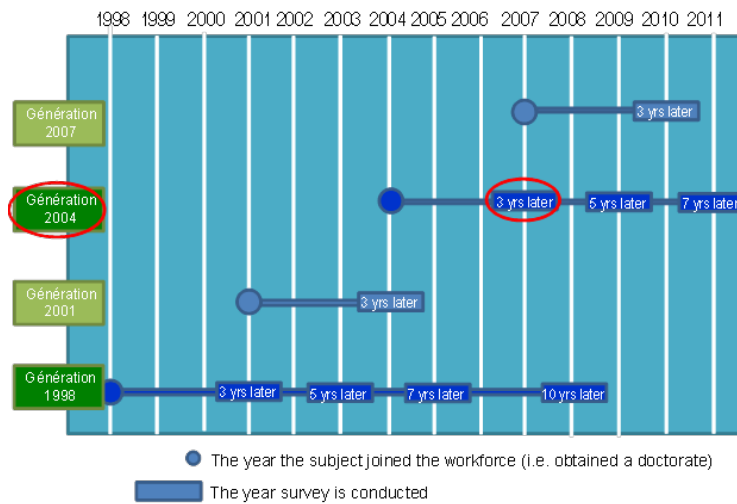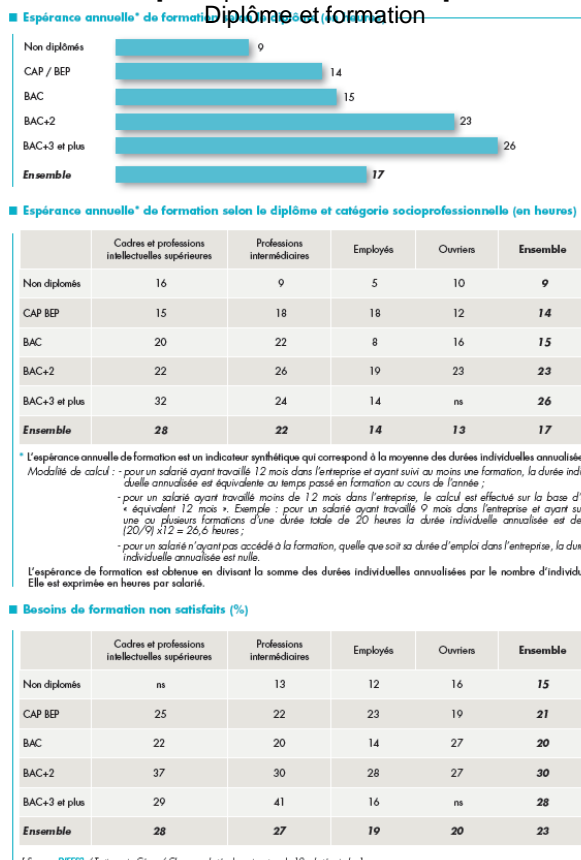 selected and their contact information is identified by using the data of France Télécom, and a phone survey is conducted. The survey is conducted by Cereq (qualification research center) located in Marseille.

● The year the subject joined the workforce (i.e. obtained a doctorate)
▬ The year survey is conducted

[Example of data utilization]

Diplôme et formation

■ Espérance annuelle* de formation selon le diplôme (en heures)

Non diplômés		9
CAP / BEP		14
BAC		15
BAC+2		23
BAC+3 et plus		26
Ensemble		17

■ Espérance annuelle* de formation selon le diplôme et catégorie socioprofessionnelle (en heures)

	Cadres et professions intellectuelles supérieures	Professions intermédiaires	Employés	Ouvriers	Ensemble
Non diplômés	16	9	5	10	9
CAP BEP	15	18	18	12	14
BAC	20	22	8	16	15
BAC+2	22	26	19	23	23
BAC+3 et plus	32	24	14	ns	26
Ensemble	28	22	14	13	17

* L'espérance annuelle de formation est un indicateur synthétique qui correspond à la moyenne des durées individuelles annualisées.
Modalité de calcul : - pour un salarié ayant travaillé 12 mois dans l'entreprise et ayant suivi au moins une formation, la durée individuelle annualisée est équivalente au temps passé en formation au cours de l'année ;
- pour un salarié ayant travaillé moins de 12 mois dans l'entreprise, le calcul est effectué sur la base d'un « équivalent 12 mois ». Exemple : pour un salarié ayant travaillé 9 mois dans l'entreprise et ayant suivi une ou plusieurs formations d'une durée totale de 20 heures la durée individuelle annualisée est de : (20/9) x12 = 26,6 heures ;
- pour un salarié n'ayant pas accédé à la formation, quelle que soit sa durée d'emploi dans l'entreprise, la durée individuelle annualisée est nulle.
L'espérance de formation est obtenue en divisant la somme des durées individuelles annualisées par le nombre d'individus. Elle est exprimée en heures par salarié.

■ Besoins de formation non satisfaits (%)

	Cadres et professions intellectuelles supérieures	Professions intermédiaires	Employés	Ouvriers	Ensemble
Non diplômés	ns	13	12	16	15
CAP BEP	25	22	23	19	21
BAC	22	20	14	27	20
BAC+2	37	30	28	27	30
BAC+3 et plus	29	41	16	ns	28
Ensemble	28	27	19	20	23

[Source : DIFES2 / Traitement : Céreq / Champ : salariés des entreprises de 10 salariés et plus]
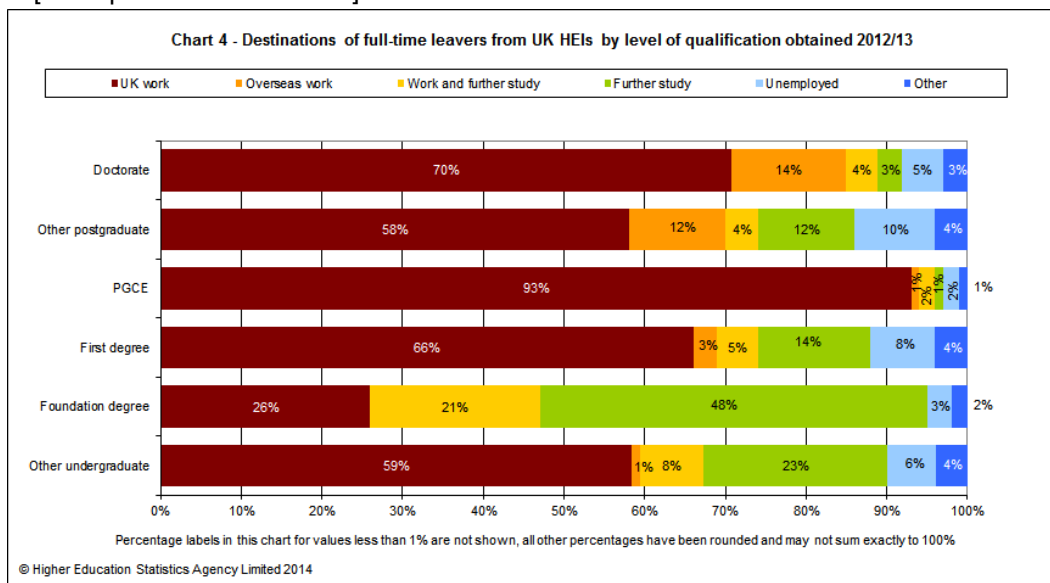
(3) UK

Supported by governmental agencies such as the Higher Education Funding Council for England (HEFCE) and RCUK, the Higher Education Statistics Agency (HESA) gathers information every year on universities and higher education and provides the necessary information to the UK government and higher education supporting organizations as official statistical data.

In addition to the early survey for Destinations of Leavers from Higher Education (DLHE), which is a survey 6 months after graduation from higher education, the Longitudinal Survey is also conducted 3 and a half years after graduation. Currently, a continuous survey is conducted for the graduate cohorts of the years 2002-3, 2004-5, 2006-7, 2008-9, and 2010-11.

[Roles of HESA]

[Example of data utilization]

Chart 4 - Destinations of full-time leavers from UK HEIs by level of qualification obtained 2012/13

https://www.hesa.ac.uk/streams/dlhelong

https://www.hesa.ac.uk/dlhelong0809_intro