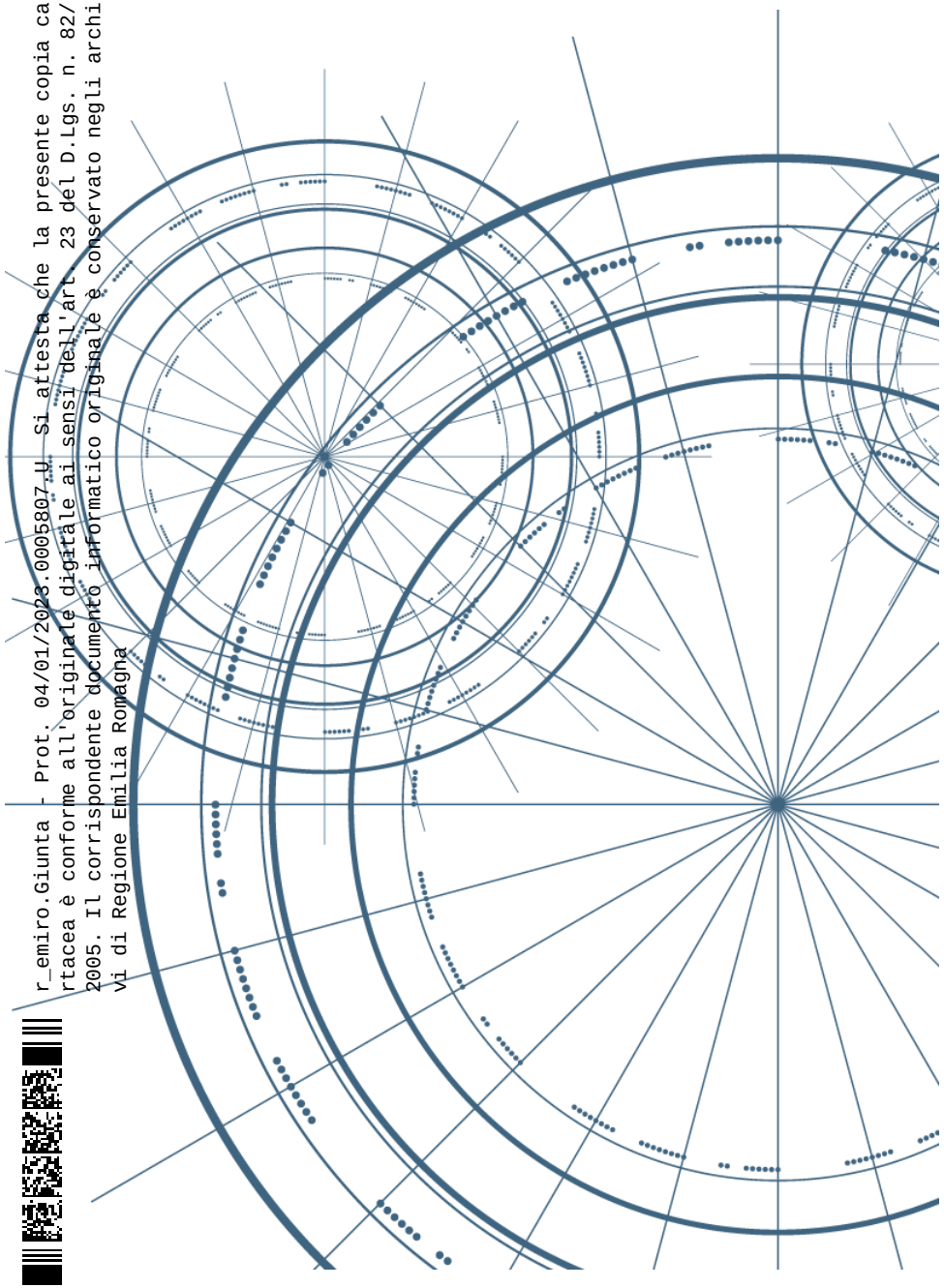

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RegioneEmiliaRomagna

Professions and skills for the Big Data Valley

Big data at work: professions and skills in the field of big data

DG Knowledge, Research, Employment, Enterprises – Emilia-Romagna Region
Studies & Research Department - Anpal Servizi

ANPAL Servizi

The project and the work programme

The Emilia-Romagna Big Data and Artificial Intelligence Project

The project develops within the context of two memoranda of understanding signed by the Emilia-Romagna Region with the Ministry of Labour and Social Policies and, subsequently, with Anpal and Anpal Servizi and is implemented according to a work program whose intervention objectives are pursued through 5 operating phases.

The project is coordinated by the Emilia-Romagna Region in collaboration with Anpal Servizi SpA. It makes use of the contribution of a group of companies belonging to the regional production system as well as the support of a vast partnership including ArL-ER, the Regional Employment Agency, Clust-ER Big Data Association, Clust-ER Mech, Clust-ER Innovate, Competence Centre Bi-Rex-Bologna, iFAB, ITS Polytechnic School Association Emilia-Romagna, Emilia-Romagna Universities, Professionally Oriented University Foundation (FUP) and the Regional Education Office for Emilia-Romagna.

The governance consists of a **technical-scientific committee** which operates with consultative and proposing functions with respect to the identification and definition of the partnership model for the development of professions and skills in the field of big data and artificial intelligence, and of a **project table** with functions of technical support during the various phases envisaged by the work programme.

The Emilia-Romagna Big Data and Artificial Intelligence Project

- Memorandum of Understanding between the E-R Region and the Ministry of Labour and Social Policies for the development of skills, employability and employment services in regional areas with highly specialised production (7 June 2021)
- Memorandum of Understanding between the E-R Region, ANPAL and ANPAL Servizi Spa for the design of a territorial partnership model between the demand and education, training and work systems for the development of skills: first experimentation in the big data field (10 September 2021)

Work programme: objectives

- to identify the **professional skills** for big data management
- to perform a **skill gap analysis** to identify the necessary profiles
- to define the paths of **technical-specialist training**
- to design the **public-private partnership model** to respond to needs
- to operate with the **network of regional actors** for the development of big data and AI issues

Activity phases:

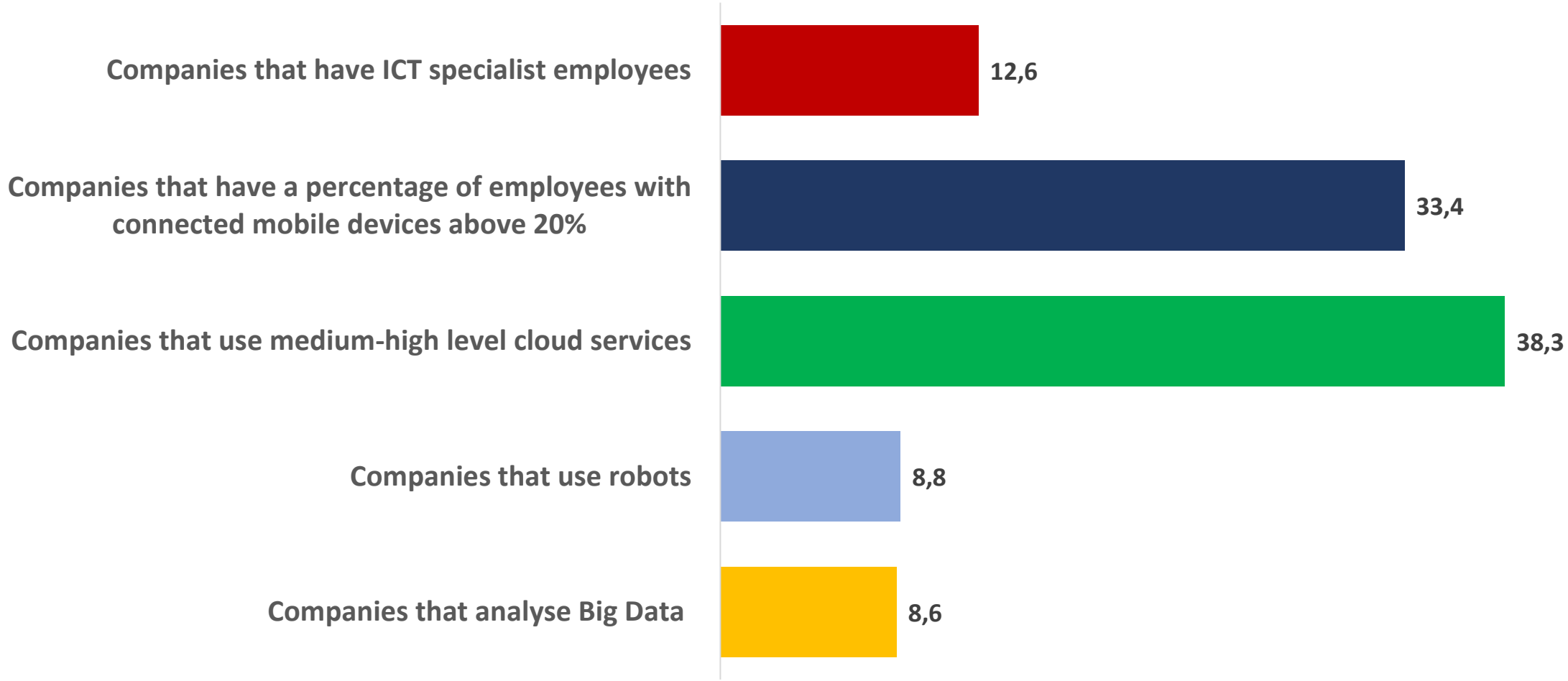
- analysis of the Big Data management **process** and description of the necessary profiles (phase 1)
- analysis of the **demand** for professional profiles and skills for the use of big data (phase 2)
- identification of the **needs** and expectations of the production system for the development of big data (phase 3)
- identification of **training courses** for the acquisition and exercise of skills in the production chains (phase 4)
- development of the **partnership model** for the continuous enhancement of big data skills (phase 5)

Scenario data

Scenario data:

Survey on information and communication technologies in companies

Percentage incidence on the total of enterprises with at least 10 employees

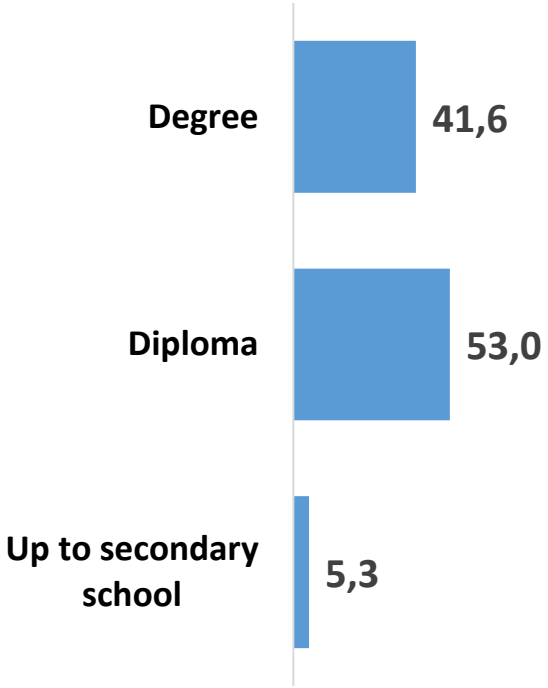


Source: ISTAT, Survey on information and communication technologies in companies. Year 2020

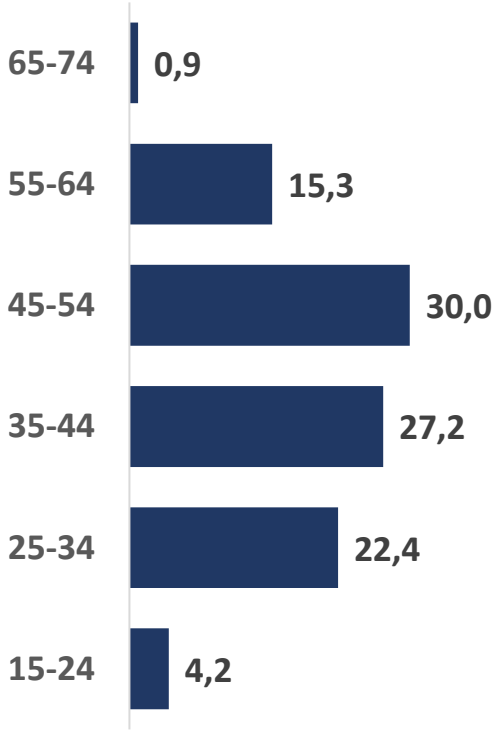
Scenario data: *Labour Force Survey*

780.617 occupati in professioni *ICT specialists in senso stretto* — **3,4% del totale**

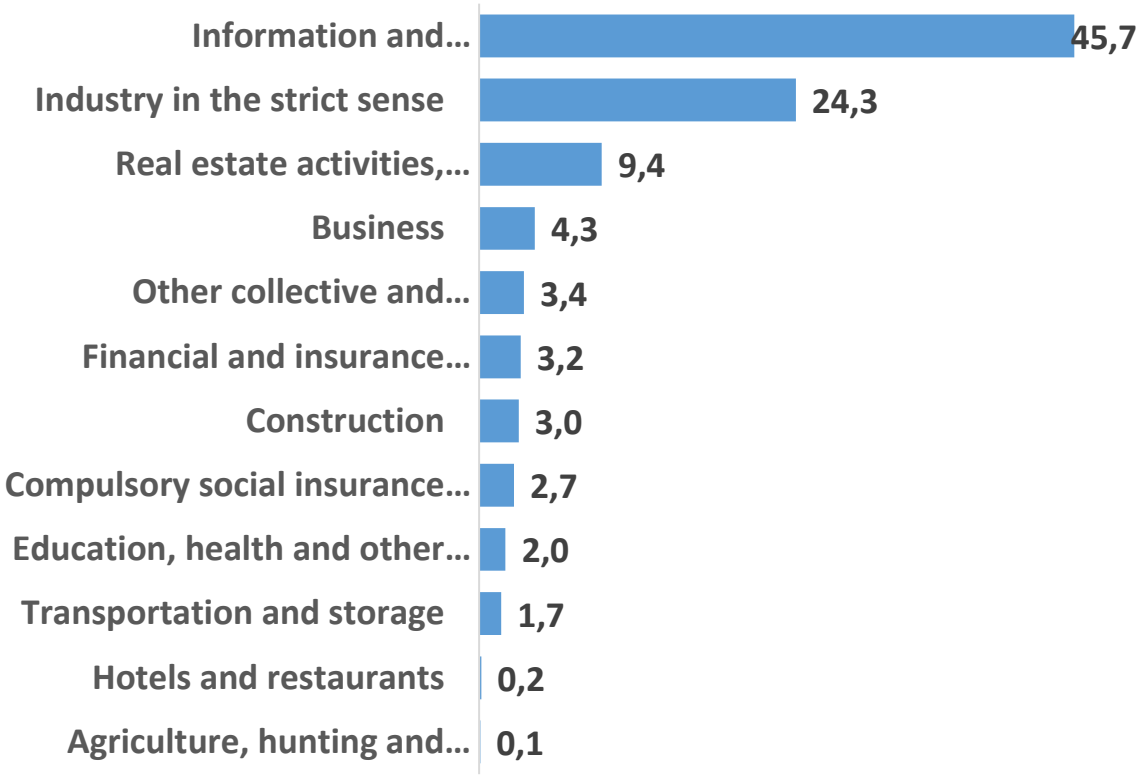
% skills by qualification



% skills by age



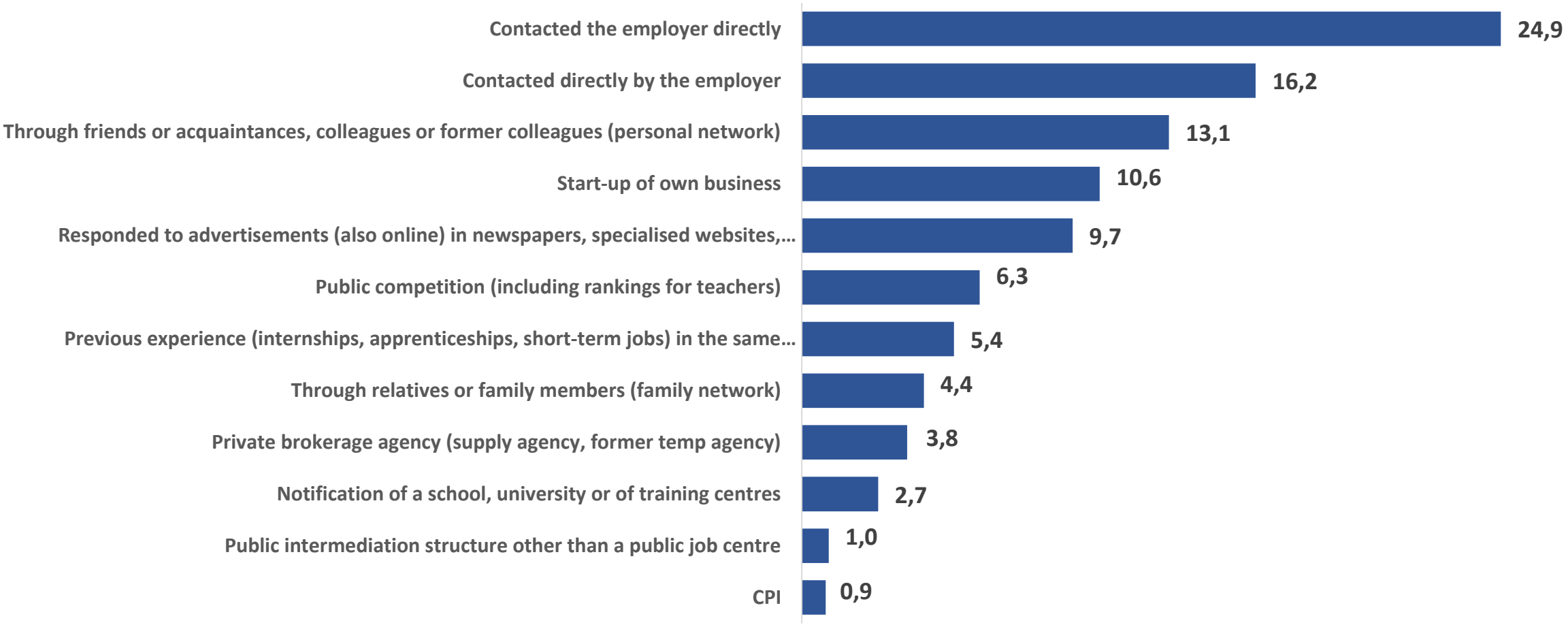
% skills by economic sector



Source: Studies & Research Department - Data Science elaborations on ISTAT-RCFL microdata. Year 2020

Scenario data: *Labour Force Survey*

Employed *ICT specialists in the strict sense*. % skills by work placement channel



Source: Studies & Research Department - Data Science elaborations on ISTAT-RCFL microdata. Year 2020

Scenario data: Mandatory Communications

85.575 assunzioni con contratti di lavoro dipendente e parasubordinato — 0,9% del totale

8.659 missioni attivate in somministrazione — 0,8% del totale

Employment relationships activated (Unilav and Unisomm-Missioni) by type of contract (current val. and %). Professions *ICT specialists in the strict sense*

TYPE OF CONTRACT	2019	2020	*% Skills (Year 2020)*
Employee and parasubordinate work	103,672	85,575	*90.8*
Permanent	52,672	41,745	*44.3*
Fixed-term	26,804	23,953	*25.4*
Apprenticeship	18,432	14,693	*15.6*
Collaboration contract	4,992	4,527	*4.8*
Other	772	657	*0.7*
Missions activated in administration	12,087	8,659	*9.2*
Total	115,759	94,234	*100.0*

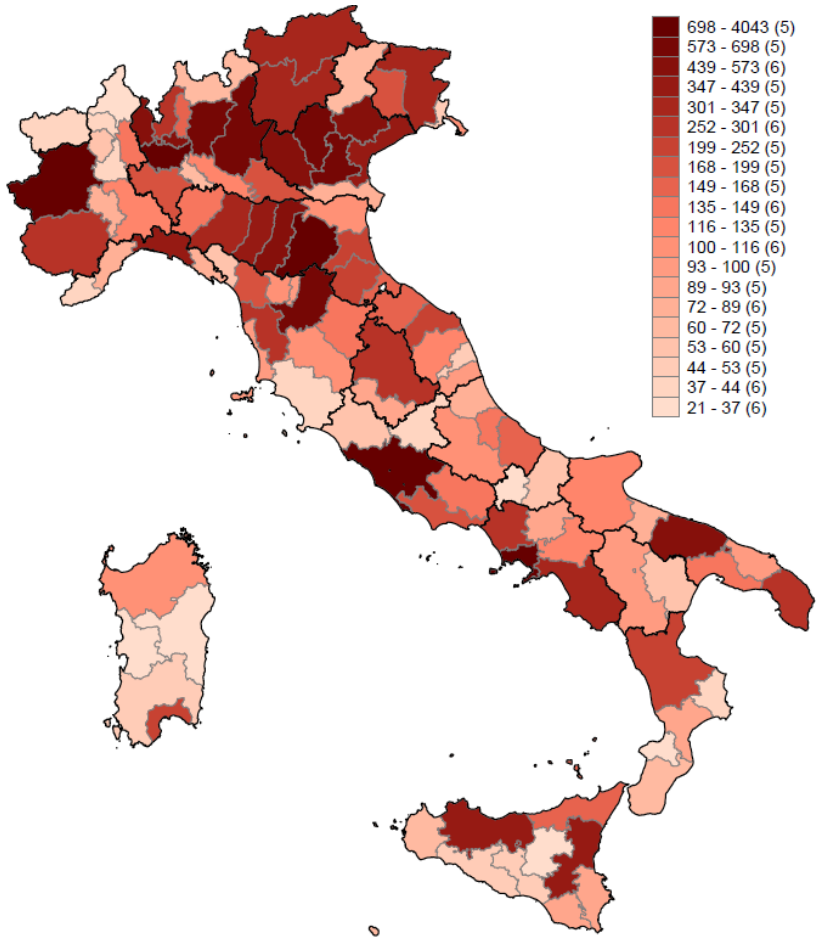
Employment relationships activated (Unilav and Unisomm-Missioni) by economic sector (current val. and %). Professions *ICT specialists in the strict sense*

SECTOR OF ECONOMIC ACTIVITY	Employee and parasubordinate work.	Missions activated in administration.	Total
Information and communication services	38,806	1,914	40,720
Manufacturing activities	15,222	4,015	19,237
Constructions	6,632	634	7,266
Professional, scientific and technical activities	6,724	494	7,218
Wholesale and retail trade; vehicle repair etc.	5,625	362	5,987
Instruction	3,144	29	3,173
Other service activities	2,473	192	2,665
Rental, travel agencies, company support services	2,322	162	2,484
Health and social care	686	352	1,038
Transportation and storage	921	48	969
Pub. admin. & defence; Oblig. social assist.	637	131	768
Financial and insurance activities	633	117	750
Artistic, sporting, entertainment and fun activities	590	34	624
Accommodation and catering services activities	371	20	391
Supply of electricity, gas, steam and air conditioning	268	43	311
Water supply; sewage networks, waste management activities etc.	134	98	232
Real estate activities	211	5	216
Other sectors	176	9	185
Total	85,575	8,659	94,234

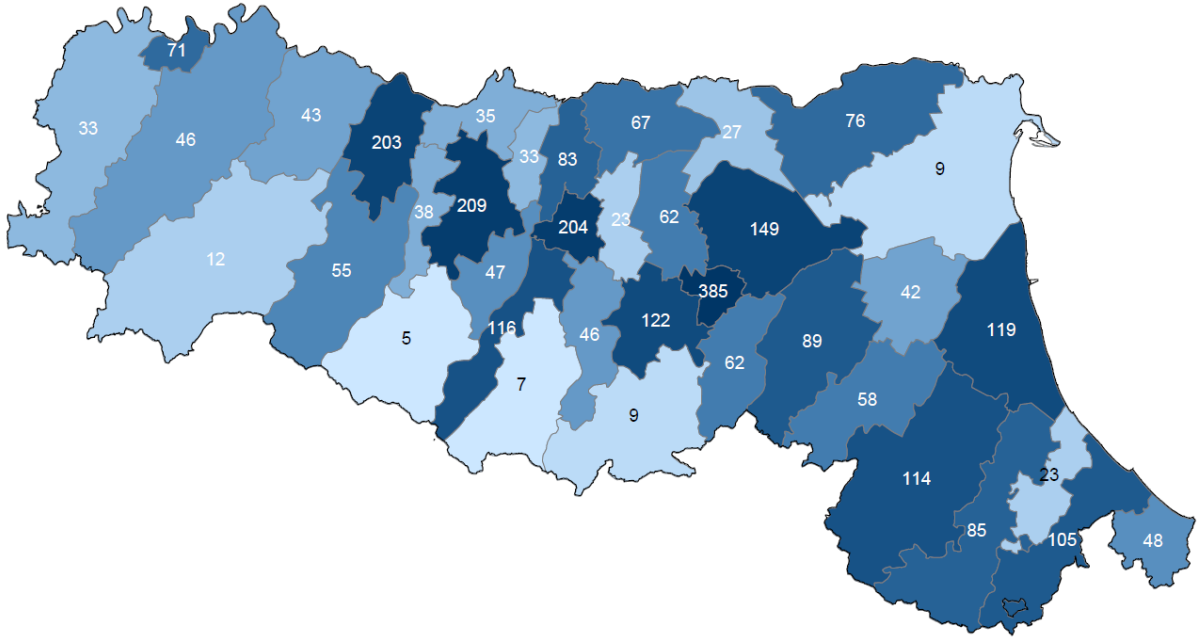
Source: Studies & Research Department - Data Science elaborations on SISCO (Statistical Information System of Compulsory Communications) microdata. Year 2020

Scenario data: *Mandatory Communications*

Number of companies that have hired at least one professional *ICT specialists in the strict sense* by workplace province (UNILAV archive).



Number of companies that have hired at least one professional *ICT specialists in the strict sense* by catchment area of the Job Centre (CpI) (UNILAV archive).



Source: Studies & Research Department - Data Science elaborations on SISCO (Statistical Information System of Compulsory Communications) microdata. Year 2020

The phases of the Emilia-Romagna Big Data and Artificial Intelligence project

Phases and flow of activities

✓ Completed;
❑ On going

The experimental project develops over a period of 12-18 months starting from the preparation of the memoranda of understanding with the Ministry of Labour and with Anpal and Anpal Servizi. The activity steps have been, and will be, carried out in close collaboration with Anpal Servizi and together with the different partners involved from time to time according to the purposes of the individual work phases.

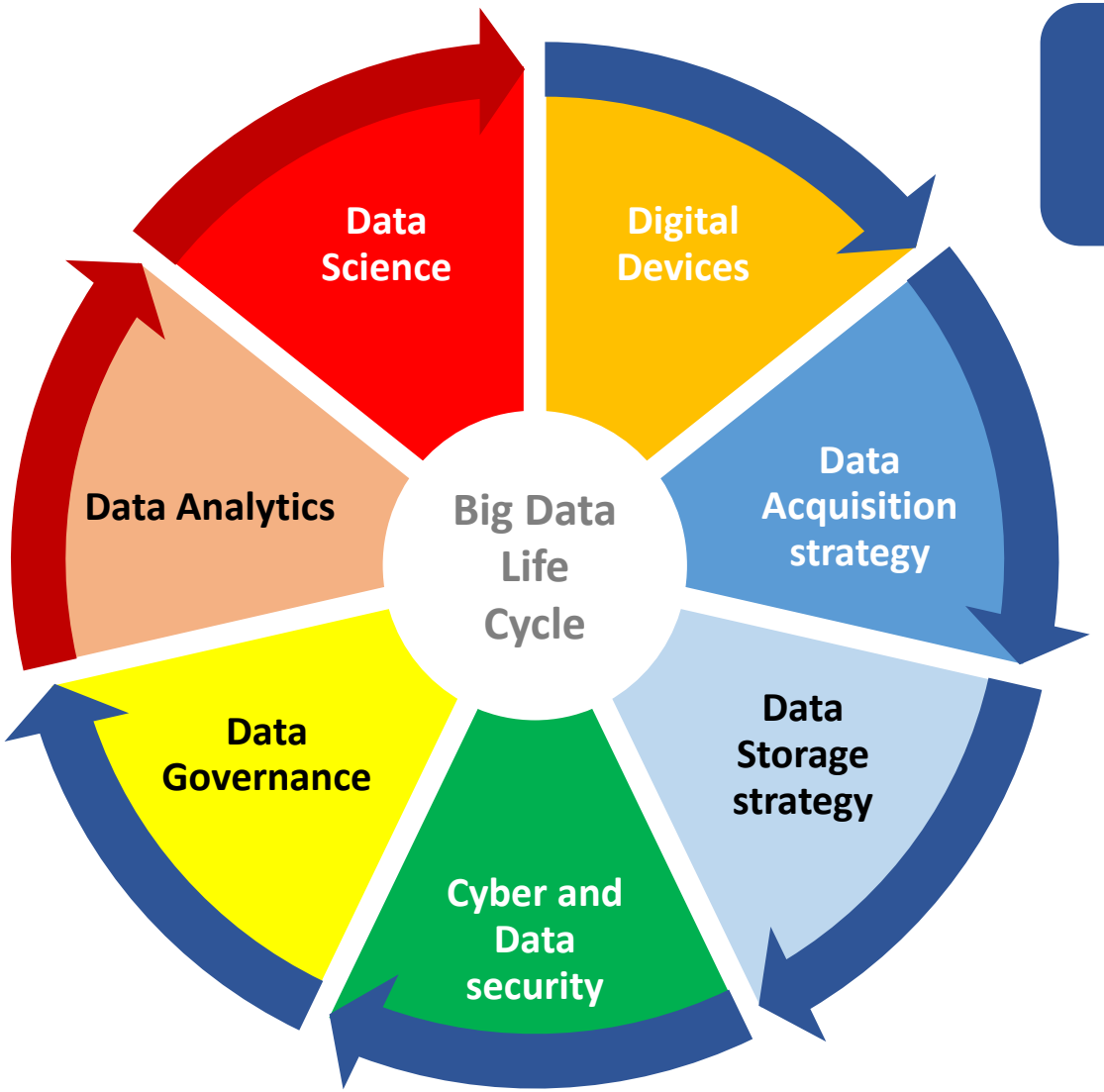
- ✓ **Analysis of the** national and regional **labour market** regarding the existence, diffusion and demand for professional profiles connected to the use of big data (phase 1);
- ✓ **Quantitative analysis of professional profiles** in the context of national and European classification systems (phase 2);
- ✓ **Analysis of knowledge and skills mapped by the European ESCO classification system** by analysing recurrences in the identified profiles (phase 2);
- ✓ **Creation of focus groups with companies and training agencies** aimed at detecting the needs expressed by the various stakeholders within the regional context, on the subject matter of the research, in relation to the objective of implementing and integrating the training offer into existing training courses (phase 3);
- ✓ **Preparation and implementation of an online survey using semi-structured questionnaires** aimed at university professors and companies, intended to reveal the needs of new profiles and skills necessary for the development of big data and artificial intelligence (phase 3);
- ✓ **Identification of «Profiles and of key Skills»** in relation to the needs of the regional production system and on which to focus to define the activities of literacy, training and requalification of skills, the inter-professional mobility of professional figures (phase 3);
- ❑ **Definition of training courses** and of **partnership model architecture** for the development of skills in the field of big data and artificial intelligence (phases 4 and 5);

Phases 1 and 2: *the Big Data Life Cycle and associated professions*

Big Data Life Cycle

Big Data Analytics

- *Data modelling and predictive analytics*
- *Data science (artificial intelligence, machine learning, high performance computing)*



Big Data Management

- *Digital devices*
- *Data acquisition strategy*
- *Data storage strategy*
- *Cyber and data security*
- *Data governance*

The professions

48 PROFESSIONS

Big Data Life Cycle

Occupations	Digital devices	Data acquisition strategy	Data storage strategy	Cyber and data security	Data governance	Data Analytycs	Data science
ACCOUNT MANAGER					x		
ARTIFICIAL INTELLIGENCE SPECIALIST							x
AUTONOMOUS DRIVING SPECIALIST							x
BLOCKCHAIN ARCHITECT				x	x		
BLOCKCHAIN SPECIALIST				x			
BUSINESS ANALYST					x		
BUSINESS INFORMATION MANAGER					x		
CLOUD COMPUTING SPECIALIST			x				
CLOUD ENGINEER			x				
COMPUTER VISION ENGINEER						x	x
DATA PROTECTION OFFICER				x			
DATA SCIENTIST						x	x
DATA SPECIALIST		x				x	
DATABASE ADMINISTRATOR			x				
DEPENDABILITY ENGINEER		x	x	x	x	x	x
DEVELOPER	x		x				x
DEVOPS EXPERT		x	x	x	x	x	x
DIGITAL CONSULTANT					x		
DIGITAL MARKETING MANAGER					x	x	
DIGITAL MEDIA SPECIALIST		x			x		
EMBEDDED SYSTEMS SECURITY ENGINEER				x			
ENTERPRISE ARCHITECT		x	x		x		
ICT CHANGE AND CONFIGURATION MANAGER					x		
INFORMATION SECURITY MANAGER				x			

The professions

48 PROFESSIONS

Big Data Life Cycle

Occupations	Digital devices	Data acquisition strategy	Data storage strategy	Cyber and data security	Data governance	Data Analytycs	Data science
INFORMATION SECURITY SPECIALIST				x			
IOT SPECIALIST		x					
MICROELECTRONICS DESIGNER	x						
MICROELECTRONICS MAINTENANCE TECHNICIAN	x						
MICROELECTRONICS SMART MANUFACTURING ENGINEER	x						
MOBILE DEVICES TECHNICIAN	x						
MOBILE SPECIALIST		x					
NETWORK SPECIALIST		x					
PREDICTIVE MAINTENANCE EXPERT		x					
PRODUCT OWNER		x			x	x	
QUALITY ASSURANCE MANAGER		x			x		
ROBOTICS ENGINEERING TECHNICIAN							x
ROBOTICS SPECIALIST						x	x
SCRUM MASTER		x			x		
SERVICE MANAGER		x			x	x	
SERVICE SUPPORT	x	x					
SMART HOME ENGINEER	x						
SMART HOME INSTALLER	x						
SOLUTION DESIGNER					x		
SYSTEMS ADMINISTRATOR					x		
SYSTEMS ANALYST					x		
SYSTEMS ARCHITECT					x		
TECHNICAL SPECIALIST	x						
TEST SPECIALIST	x						

The professions

Of the 48 professions identified, *14 are new* that is to say inferred from *job vacancies* and only partially present in the official classifications

- ARTIFICIAL INTELLIGENCE SPECIALIST
- BLOCKCHAIN ARCHITECT
- BLOCKCHAIN SPECIALIST
- CLOUD COMPUTING SPECIALIST
- CLOUD ENGINEER
- COMPUTER VISION ENGINEER
- IOT SPECIALIST
- MOBILE DEVICES TECHNICIAN
- DEPENDABILITY ENGINEER
- MOBILE SPECIALIST
- ROBOTICS ENGINEERING TECHNICIAN
- ROBOTICS SPECIALIST
- SMART HOME ENGINEER
- SMART HOME INSTALLER

The professions mapped in ESCO

Of the 33 professions mapped in ESCO we have:

- **Description of the profession**
- ***Knowledge* that is both essential and optional**
- ***Skills/Competencies* that are essential and optional**

Connections

- ***Connection to the ISTAT CPI***
- ***Hirings* for ISTAT CPI (source*: CO*)**
- **Geolocation of the hiring *companies* (source: *CO*)**

Phase 3: *focus groups and company panels*

The results of the field survey: the Focus Groups/1

Focus Group with enterprises: ***Request for Summary Identification of*** **a number of professional profiles.**

1- **The Profiles** - The profiles of the *Analytics Phase* are in great demand even if it is often the case that professions such as the **Data Analyst** and the **Artificial Intelligence Specialist** are covered by a single figure. Other profiles indicated: **Devops Expert** (a profile that over-arches many of the *Big Data Life Cycle Phases*, which involves very high training costs); **Solution designer**; **Systems Architect, Enterprise Architect**.

2- **The key concept of Nursery -** Small and medium-sized *ICT* companies often carry out the function of *recruitment* and *on-the-job training* of young people who subsequently, having acquired the experience, are absorbed by large companies. All companies, in fact, indicate that the interest is in professional figures who have not only technical knowledge but also "experience", thus attributing utmost importance to "know-how" also with regard to cross-cutting skills (keeping up to date, communicating, etc.)

3- **The synthesis** – Significant demand has emerged for the unification of the professions presented in multifunctional profiles as, especially in small and medium-sized enterprises, it is often the case that one single person covers several professional profiles.

The results of the field survey: the Focus Groups/2

Focus group with Training Agencies (Universities and ITS):

1- **"Streamlining"** – Rationalisation of the 48 profiles identified is needed in order to identify those most relevant to the *big data cycle*. It is also necessary to rearrange the knowledge/skills proposed by the ESCO system thus better identifying and focusing on key knowledge and skills and then segmenting them with respect to possible training paths.

2- **The ITS -** In ITS, correspondence with the presented professions is only partially present. For example, there is a correspondence with the *IOT Technician,* with the *autonomous driving specialist* or with the *Predictive Maintenance expert.* In training contents, the theme of Big Data is present but should be further strengthened also as an *over-arching content*.

3- **Universities -** The university system, instead, manages to respond well to the **verticality** of the training of most of the profiles presented, training cutting-edge figures both in *Management* and in the *Analytics Phase*. However, it struggles to manage the cross-cutting nature of knowledge on *Big Data*, for example, still leaking into "*other degree courses*" (i.e. non-specialist ones) to a very small extent. Another critical issue concerns training *in productive contexts* (trinship, third level apprenticeship placements, etc.), a problem that often also affects research doctorates.

4- **Few young people.** Both the ITS and the Universities report the important need to promote the disciplines and higher technical training related to the development of Big data among young people. Currently the number of students remains low

The results of the field survey: the Focus Groups/3

Through the preparation of **dedicated survey forms**, a number of professors indicated by the Universities present in the Focus Group (and who made themselves available) were asked to select, from the list of **33 profiles Mapped in ESCO**, those most relevant to the development of *Big Data* in the production sector by attributing a «weight» . Furthermore, for each profile identified, it was requested to indicate the essential and optional skills and knowledge deemed relevant. The four professors involved selected 25 profiles (out of the 33 mapped in ESCO) for a total of 258 skills.

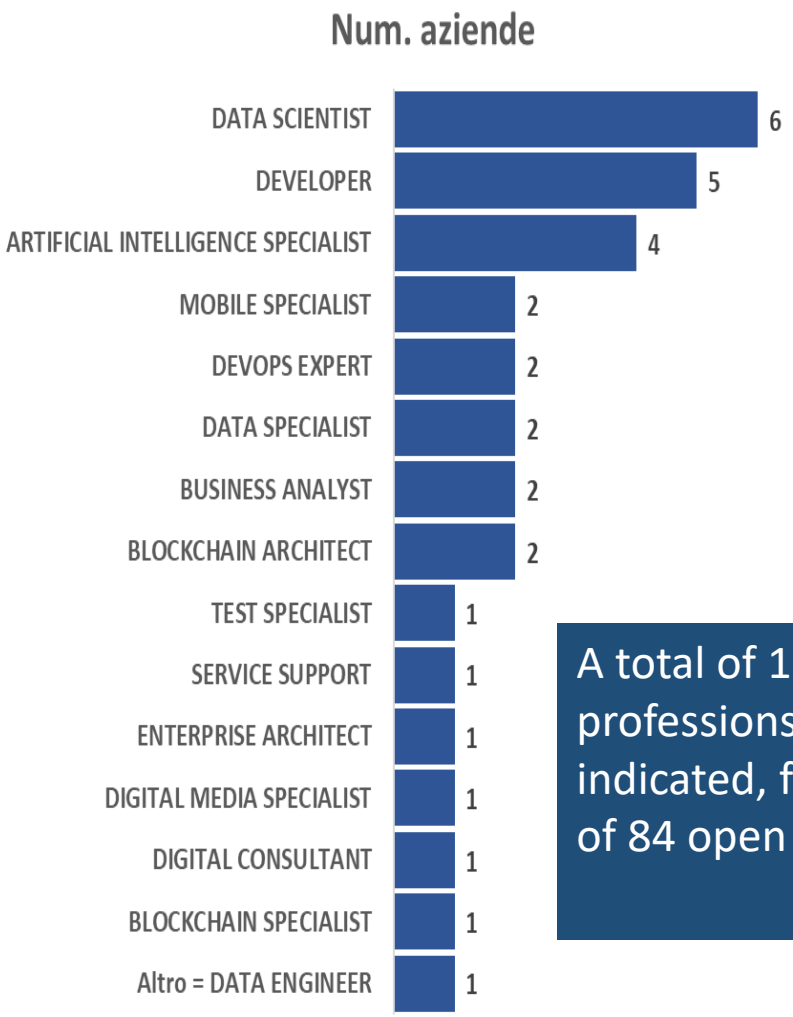
BIG DATA PROFESSIONS	Professors Weight	BIG DATA PROFESSIONS	Professors Weight
DATA SCIENTIST	2.00	NETWORK SPECIALIST	0.75
DATA SPECIALIST	2.00	DIGITAL CONSULTANT	0.50
ARTIFICIAL INTELLIGENCE SPECIALIST	1.75	MOBILE SPECIALIST	0.50
DATABASE ADMINISTRATOR	1.75	BLOCKCHAIN ARCHITECT	0.50
PREDICTIVE MAINTENANCE EXPERT	1.75	SYSTEMS ADMINISTRATOR	0.50
BUSINESS INFORMATION MANAGER	1.25	DIGITAL MEDIA SPECIALIST	0.25
INFORMATION SECURITY MANAGER	1.25	SERVICE SUPPORT	0.25
DEVELOPER	1.00	BLOCKCHAIN SPECIALIST	0.25
BUSINESS ANALYST	1.00	SYSTEMS ANALYST	0.25
SYSTEMS ARCHITECT	1.00	TEST SPECIALIST	0.25
INFORMATION SECURITY SPECIALIST	1.00	PRODUCT OWNER	0.25
DEVOPS EXPERT	0.75	QUALITY ASSURANCE MANAGER	0.25
ENTERPRISE ARCHITECT	0.75		

Table 2.2. The 25 Big Data Life Cycle professions indicated by the Professors
Source: Studies & Research Department - Data Science processing of Teachers Panel Survey data

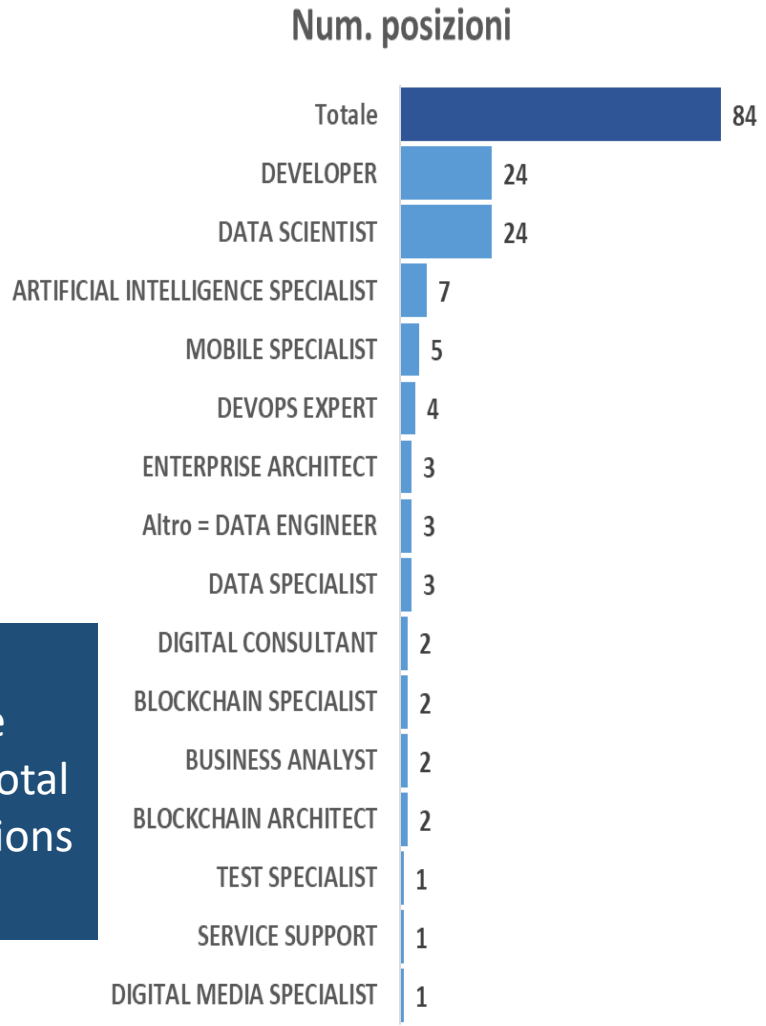
The results of the field survey: Company Panel

The 25 *Big Data* professions identified through the professors *panel*, together with the 258 *skills*, are evident from the survey aimed at companies identified by the Emilia-Romagna Region.

Out of 26 companies participating in the *field survey*, 20 completed the *Questionnaire* and of these 20, 15 declared that they were interested in hiring *Big Data* professionals.

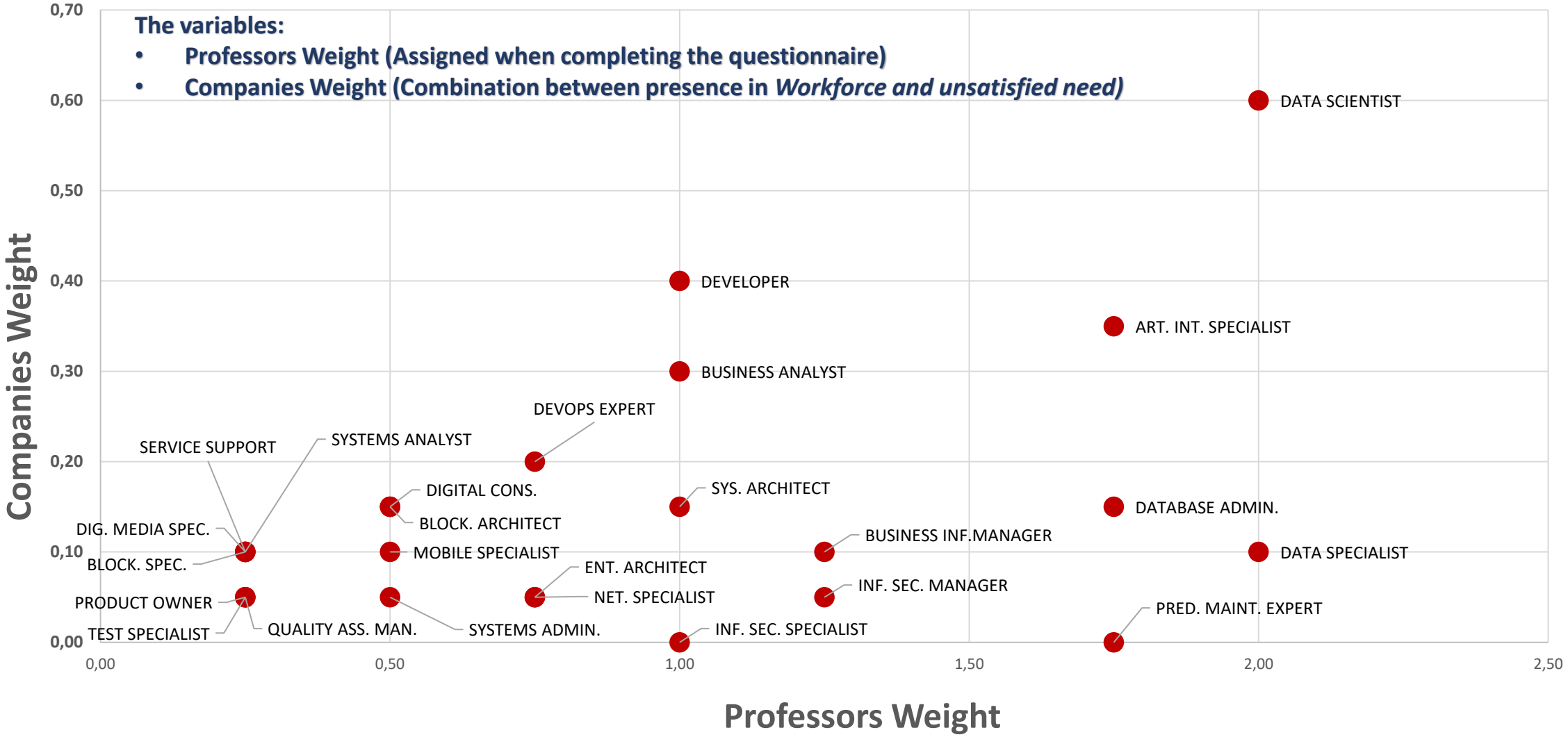


A total of 15 professions were indicated, for a total of 84 open positions



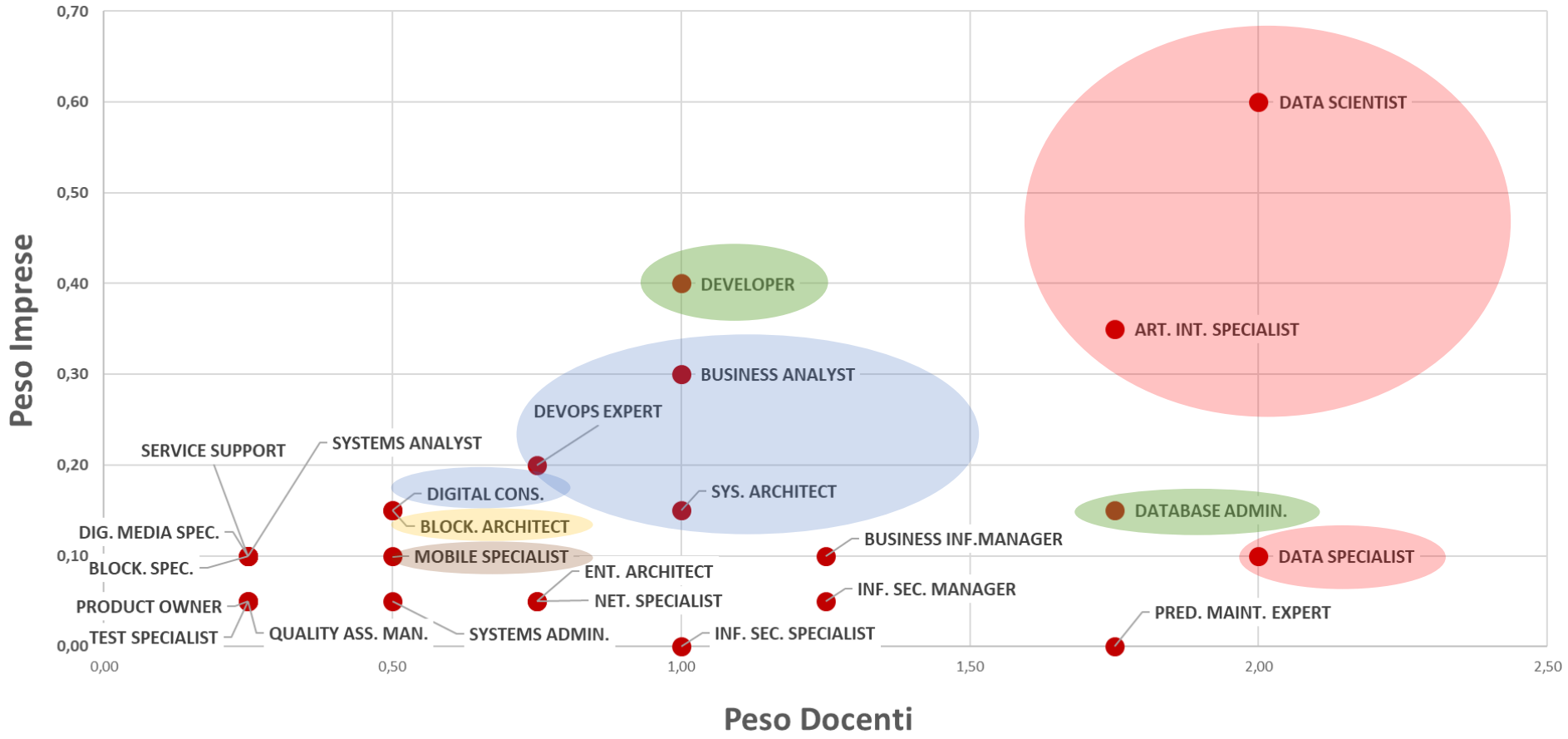
Phase 3: *profiles and key skills*

The professions indicated by companies and professors



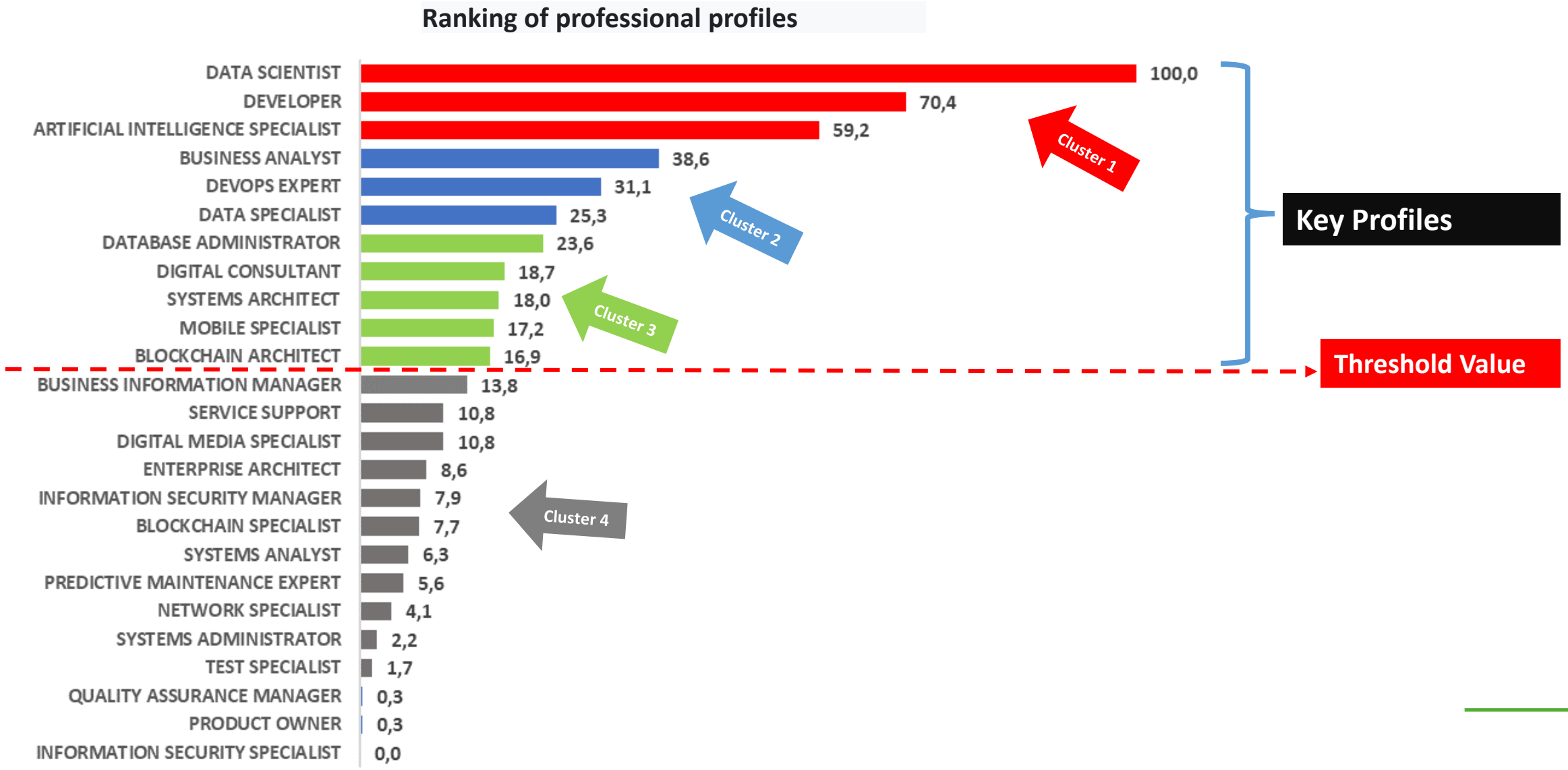
Professional profiles compared to the weight attributed by professors and companies (needs and staff)

Professions Big Data Life Cycle: representation of professional profiles with respect to the weight attributed by Teachers and Companies (requirement and workforce)



Fonte: elaborazioni *Direzione Studi & Ricerche – Data Science* su dati *Indagine Panel Imprese e Docenti*

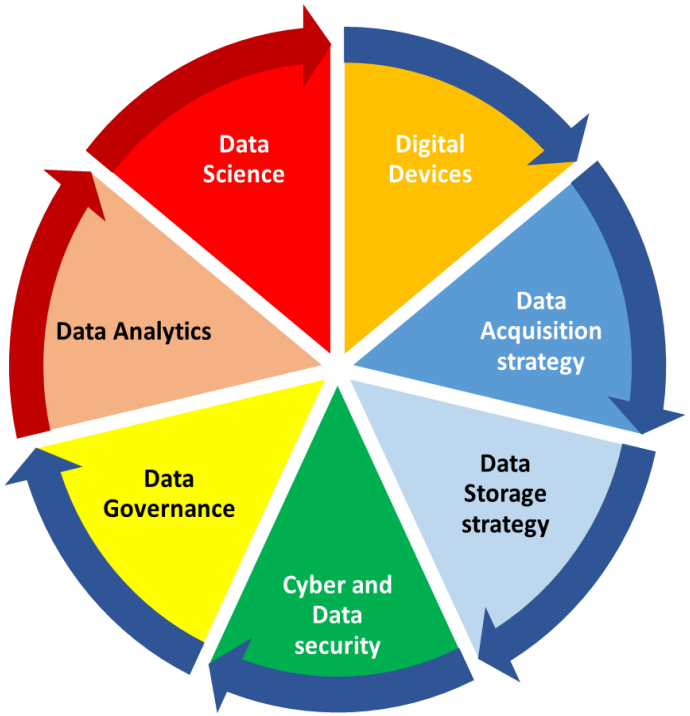
Clusters of professions by weight attributed by professors and companies



Key Profiles and Phases of the BDL Cycle

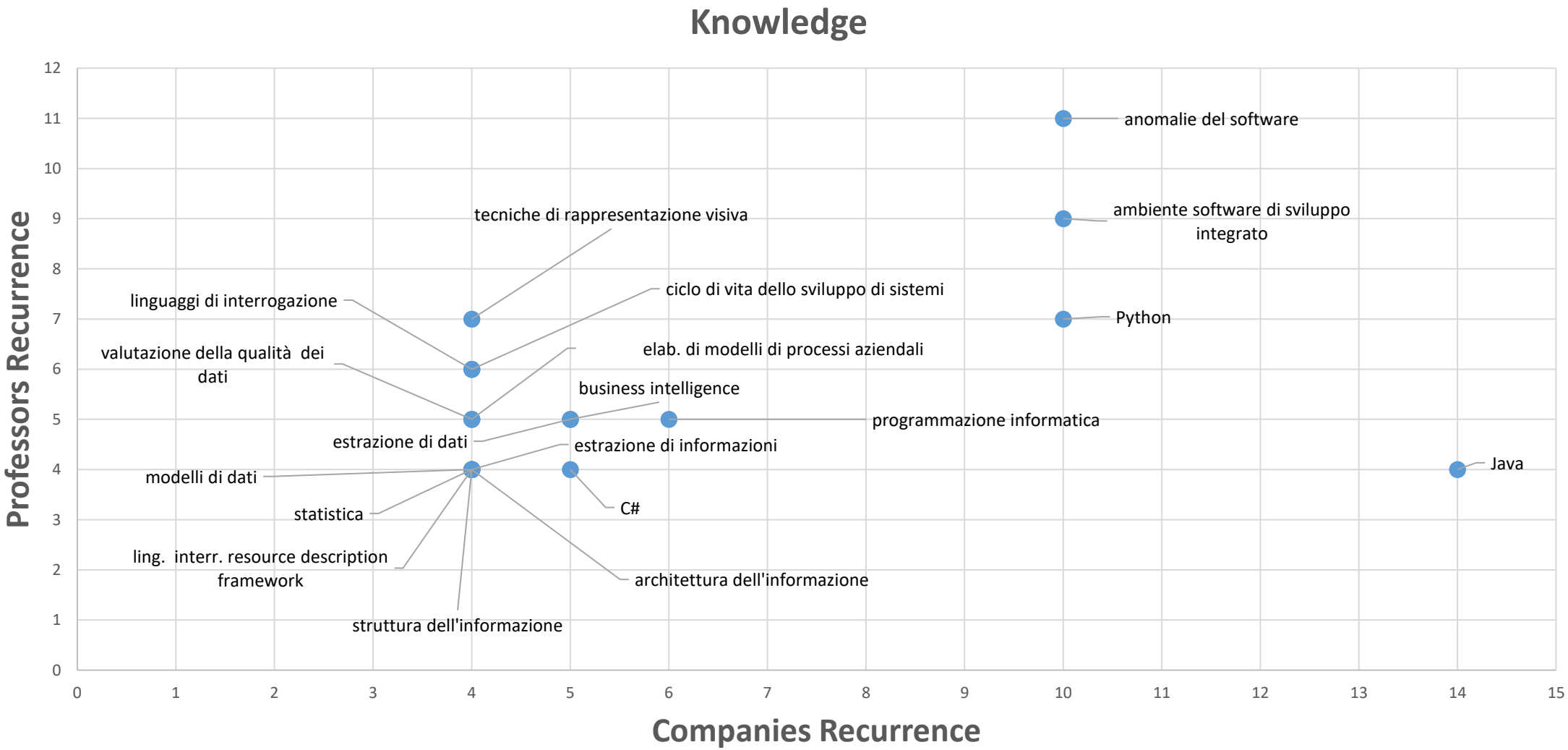
Tavola 3.1. I Profili chiave per rilevanza e *Fase* del *Big Data Life Cycle*

Profili Chiave	*Rilevanza*	Ruolo nelle fasi
• **DATA SCIENTIST**	***100,00***	**Data Analytics** Integra le competenze di tre profili simili DATA SCIENTIST, ARTIFICIAL INTELLIGENCE SPECIALIST (rilevanza 59) DATA SPECIALIST (rilevanza 25)
• **DEVOPS EXPERT**	***31,06***	**Data Governance** I quattro profili svolgono una funzione chiave nelle fasi di governance del processo sebbene, come illustrato con funzioni tra loro complementari
• **BUSINESS ANALYST**	***38,57***	
• **SYSTEM ARCHITECT**	***18,00***	
• **DIGITAL CONSULTANT**	***18,70***	
• **DEVELOPER**	***70,39***	**Data Storage** Lo stoccaggio dei dati riveste una particolare rilevanza accompagnando sia la fase di *Acquisition* (in ingresso) che di messa a disposizione nelle fasi di *Analytics*
• **DATABASE ADMINISTRATOR**	***23,59***	
• **MOBILE SPECIALIST**	***17,22***	**Data Acquisiton** La fase di acquisizione spesso implica la rilevazione di dati provenienti da mobile device. Il MOBILE SPECIALIST deve possedere competenze sulle diverse forme di acquisizione delle informazioni dal mobile all'IOT.
• **BLOCKCHAIN ARCHITECT**	***16,86***	**Data Security** In tutte le aziende in cui vengono sviluppati applicativi, prodotti, servizi. Il BLOCKCHAIN ARCHITECT è verosimilmente il nuovo profilo emergente nel campo della sicurezza.

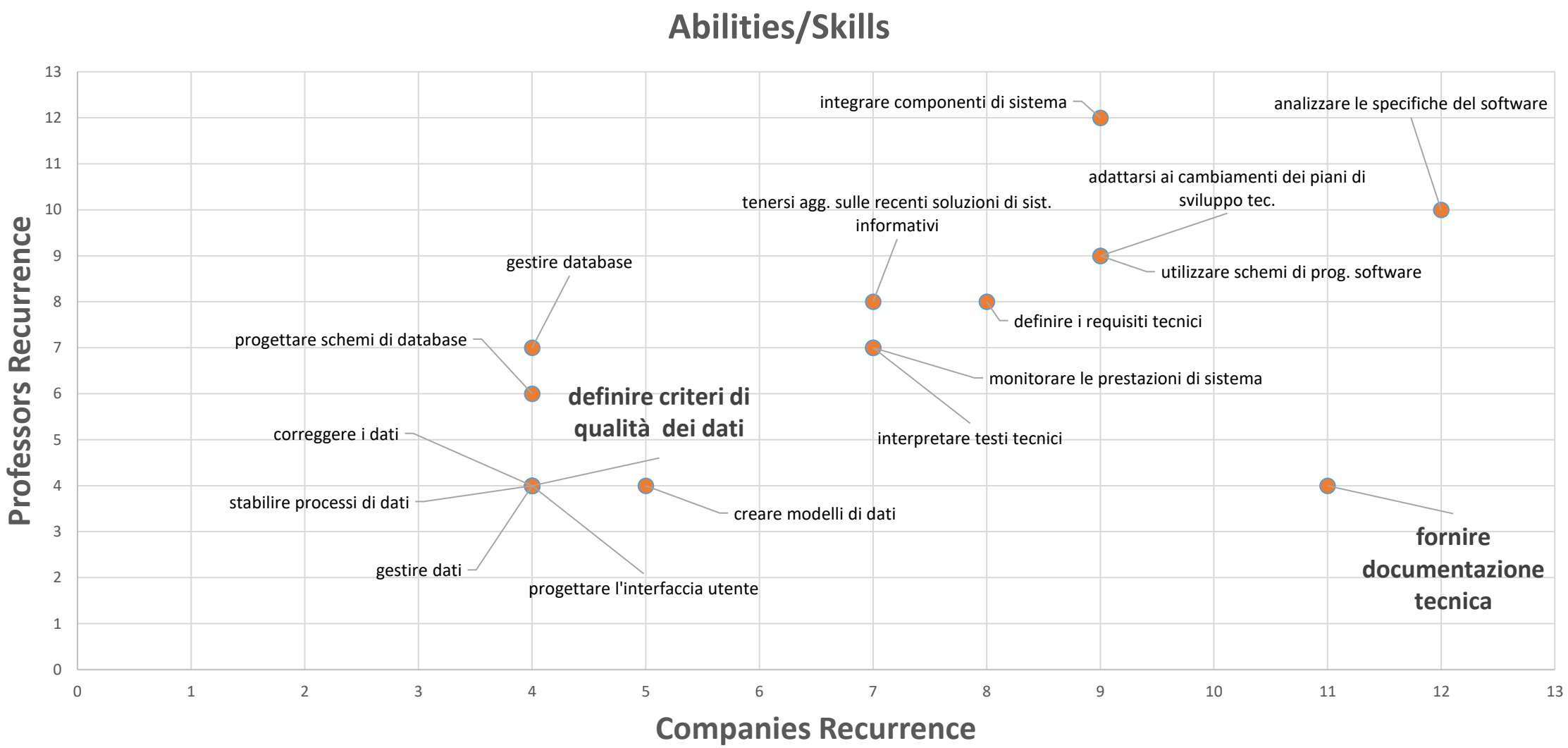


Fonte: elaborazioni *Direzione Studi & Ricerche – Data Science* su dati *Indagine Panel Imprese e Docenti*

Key Skills: the *19 types of Knowledge*



Key Skills: the*17 Abilities/Skills*



Key profiles and educational levels indicated by companies

DATA SCIENTIST (Integra in uno tre profili: DATA SCIENTIST, ARTIFICIAL INTELLIGENCE SPECIALIST DATA SPECIALIST)	• Laurea magistrale Informatica, scienze dell'informazione • Laurea magistrale Economia Aziendale • Laurea magistrale Fisica, astronomia • Laurea magistrale Ingegneria • Laurea magistrale Matematica • Laurea magistrale Statistica
	• Dottorato di ricerca Economia/scienze economiche • Dottorato di ricerca Fisica, astronomia • Dottorato di ricerca Matematica • Dottorato di ricerca Statistica
DEVOPS EXPERT	• Laurea magistrale Informatica, scienze dell'informazione (informatica) • Laurea magistrale Ingegneria (meccanica chimica, metallurgica, elettrica, elettronica, dell'energia, dei trasporti, gestionale, clinica, biomedica, ecc.).
DEVELOPER	• Laurea triennale/magistrale Informatica, scienze dell'informazione (informatica) • *Diploma di Istituto Tecnico Superiore (ITS) / Tecnico Superiore per la progettazione di infrastrutture e la gestione di architetture IT*
BUSINESS ANALYST	• Laurea primo livello Ingegneria • Laurea magistrale Statistica
DATABASE ANDMINISTRATOR	• *Diploma di Istituto Tecnico Superiore (ITS) / Tecnico Superiore per la progettazione di infrastrutture e la gestione di architetture IT* • Laurea triennale/magistrale Informatica, scienze dell'informazione (informatica)
DIGITAL CONSULTANT	• Laurea magistrale Ingegneria (meccanica chimica, metallurgica, elettrica, elettronica, dell'energia, dei trasporti, gestionale, clinica, biomedica, ecc.). Tecnologia di protezione ambientale
SYSTEM ARCHITECT	• Laurea magistrale Informatica, scienze dell'informazione (informatica) • Laurea magistrale Ingegneria (meccanica chimica, metallurgica, elettrica, elettronica, dell'energia, dei trasporti, gestionale, clinica, biomedica, ecc.). Tecnologia di protezione ambientale
	• Dottorato di ricerca Informatica • Dottorato di ricerca Ingegneria/Tecnologia di protezione ambientale
MOBILE SPECIALIST	• Laurea magistrale Informatica, scienze dell'informazione (informatica)
BLOCKCHAIN ARCHITECT	• Laurea magistrale Ingegneria (meccanica chimica, metallurgica, elettrica, elettronica, dell'energia, dei trasporti, gestionale, clinica, biomedica, ecc.). Tecnologia di protezione ambientale

Table 3.2 indicates the **qualifications associated with key professions**: for some, both the qualifications of the professions present in companies and those indicated for professional needs have been considered.

In most cases, a master's degree in scientific disciplines is required and in the case of the DATA SCIENTIST (which, as mentioned, also includes the Artificial Intelligence Specialist) there are numerous reports for *post graduate* levels (including the PhD).

Only for two profiles do companies report ITS courses or professional qualifications of at least EQF level 5 and they are the *Developer and the Database Administrator*.

This indication reflects the complexity of the needs of companies in the field of BIG DATA which focus on essentially *high skilled* profiles.

Initial reflections and proposals for the implementation of the project (phases 4 and 5)

Working hypothesis

The results of the first three phases of the program suggest the need to focus on four areas of intervention:

- **The development of a series of literacy paths in the *Big Data* cycle**, differentiated by education and training level (i.e. divided, for example, by ITS upper secondary education institutes, degree courses, etc.).
- **The review of a number of professional profiles** already existing in the context of *regional professional training* that could cover the needs of companies for certain key profiles involved in the development of *Big Data*.
- **The identification of a set of knowledge/key skills** functional to integrate the curricula of certain ITS courses *already present in the regional context*, progressively directing them towards the key professional profiles in the *Big Data* life cycle.
- **The creation of *regional laboratories on Big Data*,** closely linked to companies, with the participation of the main training agencies (FP, ITS and Universities), created through a *public-private partnership* **capable of proposing educational paths that are highly oriented towards "know-how"**, certifying not only the "skills" acquired but also the "experience" gained in operational contexts.

Big Data Labs

The idea is to create actual **"laboratories"** where it will be possible:

- on the one hand to allow young people leaving vocational and university training courses and workers to acquire the **"know-how"** (Skills) essential to be rapidly employed in production processes;
- on the other, to certify this process of acquiring know-how with formulas similar to **Open Badges(*)** carried out by the companies themselves at the end of the courses thus allowing rapid professional integration.

(*) An Open Badge is a digital photograph of your skills. Just as a photo contains - in addition to the photo itself - information on the date and place it was taken, in the same way the Badge also contains additional information - metadata - which can be read by all applications that read Open Badges. The metadata make it possible to verify that the Badge is assigned to you and to access all the descriptive contents of the Badge, hosted on the platform that issued it.

Laboratories as areas of experimentation

The **creation of laboratories on Big Data** :

- better coordination and better targeting of the training offer to the needs of companies operating in the *Big Data Valley*;
- a continuous process of updating existing qualifications and a greater enhancement of the existing tertiary training offer precisely through the close relationship with companies;
- greater functional integration between the regional training offer, that of the ITS and that of the University;
- the **enhancement of laboratories** also for the development of new **start-ups** that are able to develop talents;
- the development of on-the-job training opportunities both with the creation of laboratories and by enhancing the various forms of internship and tertiary level apprenticeship thanks to the close collaboration between training agencies and sponsoring companies.

The contribution to the promotion of a big data culture

In addition to the training activities, the laboratories could contribute:

- to the development of *literacy modules*;
- to the creation of *Open Badges* or in any case to the certification of "know-how"
- to promotion and specialist orientation activities;
- to *skills intelligence* activities.