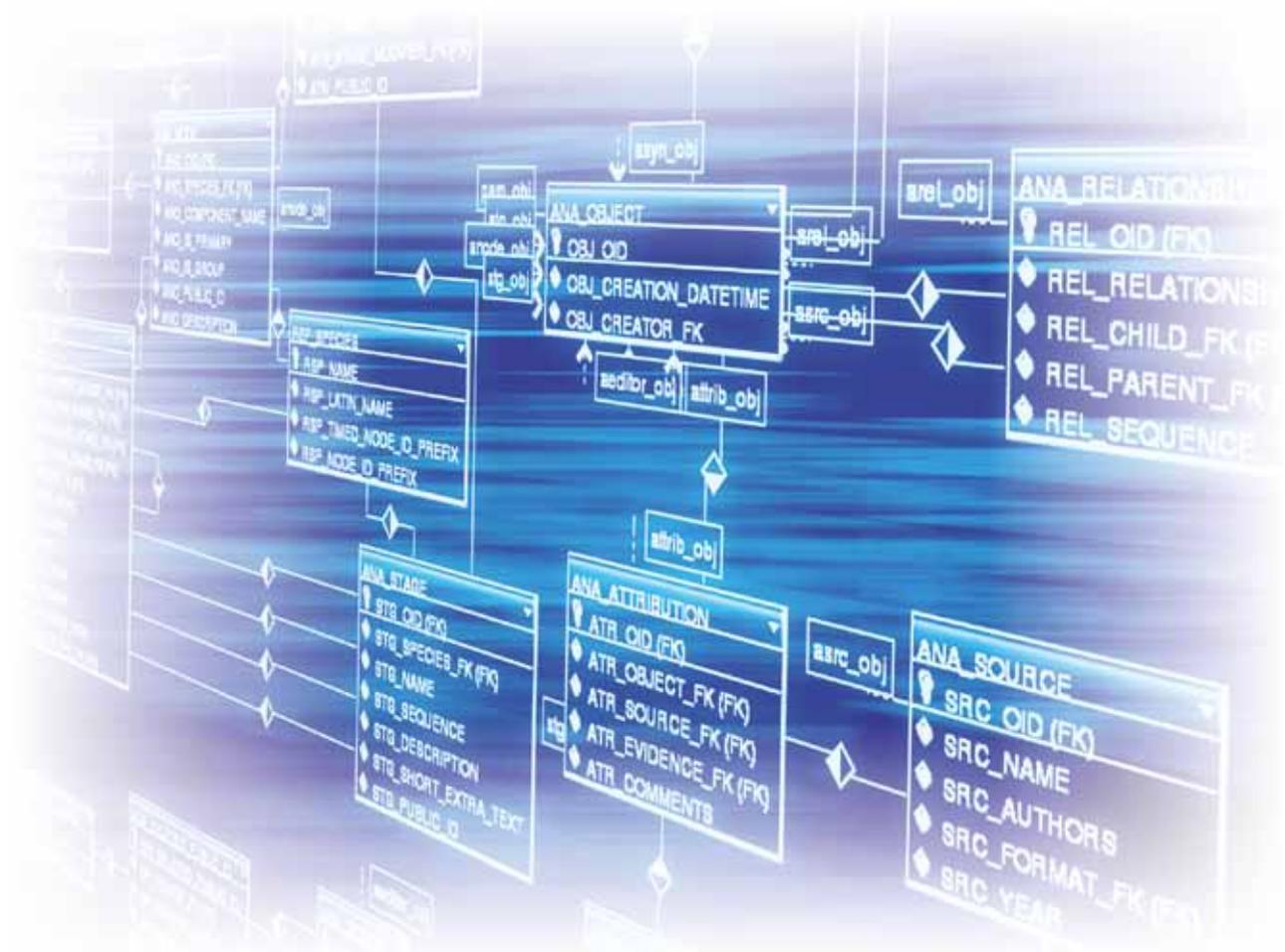


Big Data Analytics

An assessment of demand for labour and skills, 2012-2017



Report for:

About e-skills UK

e-skills UK is the Sector Skills Council for Business and Information Technology working on behalf of employers to develop the **software, internet, computer gaming, IT services** and **business change expertise** necessary to thrive in today's global digital economy. Focused on making the biggest contribution to enterprise, jobs and growth across the economy, e-skills UK's three strategic objectives are to: inspire future talent, support IT professionals, increase digital capability. Delivery on these strategic objectives is underpinned by employer engagement across the sector, authoritative research, a continually developing sector qualifications and learning strategy and effective strategic partnerships.



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IT Jobs Watch provides a concise and accurate map of prevailing trends in demand for IT staff within the UK. This is achieved by collating and analysing related vacancy statistics sourced from leading IT recruitment websites and presenting the associated results in a freely available, fully searchable web application, which is updated on a daily basis to ensure users have access to the very latest information. Our services are employed by a variety of clients including job seekers, careers specialists, recruitment agencies and employers who use either our standard and/or bespoke services to, for example, measure demand for specific skills or specialisms, identify the skills needed by specific IT jobs, and assess remuneration levels for IT positions. For further information, please visit us at: www.itjobswatch.co.uk.



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Foreword

This report has been produced by e-skills UK on behalf of SAS UK. It aims to provide an understanding of the developing demand trends for big data related staff in the UK, focusing in particular on demand arising within the IT function of UK businesses.

Though the findings presented within the report are the views of e-skills UK alone, we would like to offer our thanks to two organisations that have worked very closely with us on this project. Firstly, IT Jobs Watch, who has laboured hard to produce a bespoke set of demand data based on our specified definitions, and, secondly, Experian, who has worked with us to develop the generic/IT specific employment forecasts and big data demand estimates.

We would also like to thank those who have responded to our ad hoc queries for background information about the big data field and related developments in the UK.

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Executive Summary

Background to the study

- Despite the existence of many reports setting out the state of big data developments, there remains no single, internationally recognised definition of 'big data' and no 'operational' definition that can be employed when seeking to understand/compare market/related developments.
- Information on the state of big data development in the UK is limited and commonly based upon findings from global studies, which, in turn, tend to be biased towards the experiences of extremely large (often US-based) employers.
- What is clear from these studies, however, is that the volume, variety and velocity of data is increasing rapidly and with it the recognition that competitive advantage and new business opportunities may be achieved through the successful development of capability in the field of big data analytics.
- When initiating any new business venture or activity, there will be an intrinsic need to attract/develop an associated skills base, and respondents to many studies have voiced concern over the availability of big data skills within the existing labour pool both at a global and UK level.
- This report seeks to aid those undertaking/supporting big data projects in the UK by providing a detailed analysis of current/projected demand for big data skills based on a) an analysis of recruitment advertising data and b) bespoke forecasts of IT&T employment and big data demand for the coming five years.

Current demand for big data skills in the UK

- It is estimated that there were approximately 3,790 advertised positions for big data staff in the UK in the third quarter of 2012, 75% of which were for permanent posts.
- The most commonly advertised roles for big data staff were: Developers (42% of advertised positions), Architects (10%), Analysts (8%) and Administrators (6%).
- Data Scientists, whilst recognised as being an important role for big data developments, was found to constitute less than 1% of all big data positions advertised.
- The technical skills most commonly required for big data positions as a whole were: NoSQL, Oracle, Java and SQL, whilst the technical process/methodological requirements most often cited by recruiters were in relation to: Agile Software Development, Test Driven Development (TDD), Extract, Transform and Load (ETL) and Cascading Style Sheets (CSS).

- An analysis of skills requirements for different big data roles showed the specific/related technical knowledge and skills currently most in demand in each case were as follows:
 - o For big data Developers: NoSQL, Java, JavaScript, MySQL and Linux together with TDD, CSS and Agile development knowledge.
 - o For big data Architects: Oracle, Java, SQL, Hadoop, and SQL Server and Data Modelling, ETL, Enterprise Architecture, Open Source and Analytics.
 - o For big data Analysts: Oracle, SQL and Java together with Data Modelling, ETL, Analytics and Data Analysis.
 - o For big data Administrators: Linux, MySQL, Puppet, Hadoop and Oracle along with Configuration Management, Disaster recovery, Clustering and ETL.
 - o For big data Project Managers: Oracle, Netezza, Business Objects and Hyperion together with ETL, and Agile Software Development – PRINCE2 and Stakeholder Management skills are also a common specified requirement in this case.
 - o For big data Designers: Oracle, SQL, Netezza, SQL Server, Informatica, MySQL and Unix plus ETL, Data Modelling, Analytics, CSS, Unit Testing, Data Integration and Data Mining.
 - o For Data Scientists: Hadoop, Java, NoSQL and C++ along with Artificial Intelligence, Data Mining and Analytics. A high proportion of adverts were noted also to make reference to a need for Statistics and Mathematics skills.
- On average the salaries advertised for big data positions were around 20% higher than those for IT staff as a whole and a pay premium was observed for all comparable roles whether for permanent or contract positions.

Trends in demand for big data skills to date

- Despite the currently unfavourable economic climate, demand for big data staff has risen exponentially (912%) over the past five years from less than 400 vacancies in the third quarter of 2007 to almost 4,000 in the third quarter of 2012.
- The overall increase in demand for the specific types of big data staff analysed in this report ranged from 178% for Project Managers to 3363% in the case of big data Developers (1643% for big data Designers, 930% for big data Administrators, 784% for big data Architects, 350% for Data Scientists¹ and 327% for big data Project Managers).

¹ Annual change figure only between Q3.11 and Q3.12.

- Demand for permanent and contract staff has followed similar growth trends over the past five years though demand for contractors lagged that for permanent staff by around two quarters for much of this period.

Forecast changes in IT employment and demand for big data staff

- Over the next five years, employment of IT&T staff is forecast to grow by around 2.5% per annum on average, a rate more than three times higher than that predicted for UK employment as a whole.
- Demand for big data staff, by comparison, is forecast to increase by a rate of between 13% (low growth scenario) and 23% per annum (high growth scenario) on average.
- Taking a mid-point average of these two scenarios would give an expected annual average growth rate of 18% per year (92% in total)². This would be our preferred scenario and would equate to the generation of approximately 28,000 gross job opportunities per annum by 2017.
- Over the whole forecast period, under this scenario there would be around 132,000 gross job opportunities in total created in the big data field within the economy between 2012 and 2017.

² Figures do not total due to rounding.

1 Background

1.1 Overview of recent big data studies

Since the publication of the benchmark report on big data by the McKinsey Global Institute in June 2011ⁱ a plethora of reports have been published over the past year that have sought to define the term 'big data', establish potential use/benefits, and forecast future uptake within the business community. In view of this large volume of readily available supporting research, we have elected not to go into great depth about the benefits/pitfalls of big data adoption, taking it as read that this is a well-identified emerging trend and one that has well-recognised potential for business creation and development. It was thought pertinent, however, to provide a brief overview of some of the generic findings arising from research in this field and to highlight some important caveats that have tended to be overlooked by many of those reporting on big data developments within the media/elsewhere.

Definitions

There is currently no singular, internationally recognised definition of what constitutes 'big data'. Many reports make reference to the three 'V's proposed in 2001 by the META Group,ⁱⁱ i.e. Volume (a reference to data stores of petabytes or above), Velocity (the requirement for real-time collection/analysis of data) and Variety (generation of data in diverse formats from a variety of collection mechanisms), and, in some cases, this definition has been further expanded to incorporate related considerations such as Variability (temporal data peaks) and Complexity (issues relating to linking/cleaning/editing data from different sources)ⁱⁱⁱ for example. In all cases, however, the terminology employed to describe big data is not an operational one and, as such, cannot be used to identify a distinct sector, occupation, process, etc. In fact, even the core terms are highly subjective and liable to change in accordance with social/technological developments.^{iv}

There is no universally recognised operational definition of big data

Uptake

Despite the absence of a specific definition, companies have warmed to the generic term 'big data' and many research organisations have sought to measure associated business adoption rates by way of primary and/or secondary data collection activities. Reported adoption rates vary significantly, and in most cases observed are subject to significant caveats not always readily highlighted within the associated study documents. More specifically, our main concern relates to the manner in which much of the data has been collected and the apparent absence of any weighting to the resulting survey response set, i.e. data collection is typically by way of an open invitation web survey with responses collected on a global basis, primarily from very large organisations, which, as a result will lead to the presentation of potentially inflated rates of adoption.^v

Benefits

Adoption rates aside, the potential benefits of utilising big data/related technologies are significant both in scale and scope and include, for example: better/more targeted marketing activities, improved business decision making, cost reduction and generation of operational efficiencies, enhanced planning and strategic decision making and increased business agility, fraud detection, waste reduction and customer retention to name but a few. Obviously, the ability of firms to realise business benefits will be dependent on company characteristics such as size, data dependency and nature of business activity, though businesses operating in the Financial Services, IT & Telecoms, Healthcare/Pharmaceuticals, Retail and Public sectors are often highlighted as being potentially key beneficiaries.

Most big data studies are un-weighted and focused on large US/multinational businesses

Data sources

Companies employing or looking to employ big data analytics are increasingly drawing in data from a diverse range of sources such as web logs, clickstreams, social media, smart meters, machine sensors, CRM systems and micro blogging sites like Twitter. It is this diverse and expanding range of human/automated mechanisms for data capture that is driving the demand for scalable, often real-time systems able to deal with high volumes of structured and semi/unstructured information.

Technologies/processes

The core technologies capturing the interest of those implementing big data solutions tend to be focused around Hadoop/sub-projects (Cassandra, etc.) and the growing range of NoSQL databases. This said, it would appear that big data solutions based upon SQL and other 'traditional architectures' are currently the most common deployed systems for firms within the UK³.

Though Hadoop and NoSQL are currently in the limelight, firms are currently more likely to use RDBMS to address their big data needs

Human issues

A core concern voiced by many of those participating in big data focused studies is the ability of employers to find and attract the talent needed for both a) the successful implementation of big data solutions and b) the subsequent realisation of associated business benefits⁴.

For e-skills UK, as the Sector Skills Council responsible for promoting IT skills development in the UK, it is the last of these points that causes us particular concern and, as such, we were extremely pleased to partner SAS UK on a programme of research that would seek to a) define the current/future level of demand for big data staff (presented within this report) and b) explore the potential for demand/supply mismatches (by way of a further study report) with the aim of developing a series of recommendations to aid industry, individuals and government to capitalise on the opportunities that big data presents.

³ See, for example: 'Computing research: how and why big data has hit the mainstream', 10 May 2012.

⁴ *ibid.*

2 Study Parameters

2.1 Methodological overview

As noted in the previous section there is, at present, no consistent, globally recognised, operational definition of what constitutes big data, big data employment or big data related activity in general. As such, a key task in the early stages of the project was to produce an agreed, workable definition, which would allow us to sensibly define the parameters of our labour market analysis whilst remaining cognisant of the limitations of related secondary data sources upon which we would be reliant when undertaking our analysis/developing forecasts for the future.

To aid readers' interpretation of the findings presented in this paper, we have summarised our thinking in this area and set out the related caveats employed when conducting our analysis:

- i) The focus of this report is to provide an understanding of the demand for big data practitioners⁵ as opposed to big data users⁶. The reasons for this are threefold: firstly, the realisation that the IT function (i.e. in which practitioners are generally employed) appears, at this time, to be the most common driver of big data related adoption/developments; secondly, attempts to define/quantify the overall employment effects of big data adoption in the UK have already been carried out by other research organisations⁷; and thirdly, it is our opinion that more detailed analysis of demand for user skills would not be feasible considering the limited availability of required (secondary) data for other occupations/professions.
- ii) More specifically, the report is based upon an analysis of demand exhibited by recruiters operating within the IT & Telecoms (IT&T) space, i.e. those advertising for big data practitioners via some/all of the main associated recruitment sites and/or portals – this is once again due in part to the recognition of IT&T as a main driver for big data developments and in part to the availability of detailed demand data for this recruitment sector. It is also our belief that the majority of positions for both practitioners and 'power users' are, in any case, advertised either solely or jointly within this recruitment space.
- iii) At an operational level we have defined big data related demand as instances in which a job advert makes reference to either a) the specific term 'big data', b) a job title deemed to be big data specific or c) a skill deemed to be big data related. The definition has been developed according to the following logic:

This report looks at the demand for big data labour and skills from employers of IT&T staff in the UK

5 Those involved in the design, development, maintenance, administration and support of big data systems/services.

6 Individuals using big data/big data tools as a means of undertaking tasks associated with a different occupation, i.e. marketers using big data analytics to perform customer segmentation.

7 Such as Cebr or the EIU for example in their respective reports: Data Equity: Unlocking the Value of Big Data, April 2012, and Big Data: Lessons from the Leaders, 2012.

- a. Adverts citing big data as the field of work are included as this is the common language of recruiters. It is recognised that in some cases there may be a propensity for recruiters to include terms that are 'in vogue'. However, following a preliminary analysis of related adverts, it was determined that this would not have a major effect upon the resulting analysis as such instances appeared minimal in number.
- b. To determine which job titles could be considered to be big data related, an analysis of the top 500 commonly occurring titles within the IT recruitment space was undertaken and a value judgement made as to the likelihood that the positions on offer were a suitable fit. In reality, owing to the overlap with generic Analytic/Business Intelligence related roles, this resulted in our selecting just one title – Data Scientists – for inclusion within our definition.
- c. To determine which skills were considered to be commensurate with big data employment, an extensive background research exercise was first undertaken to identify the common technical/related skills called for. This listing was then considered by industry experts and cross-referenced with job titles commonly used by IT recruiters as an additional check. The resulting list of just under 40 technical skills was then used as the primary identifier of big data vacancies for our analysis (i.e. together with cases citing big data and/or a requirement for Data Scientists).
- iv) In developing our forecasts of future demand for big data staff, we elected to base our model upon a dedicated series of IT&T employment forecasts provided by Experian using a definition of IT&T occupations derived from 11 specific occupational codes set out by the Office for National Statistics' (ONS') Standard Occupational Classification system (SOC2010)⁸.

Further details of the methodology and, in particular, that relating to employment forecasts is contained within the related sections/appendix of the report.

⁸ See appendix A.

3 Big Data Demand Trends

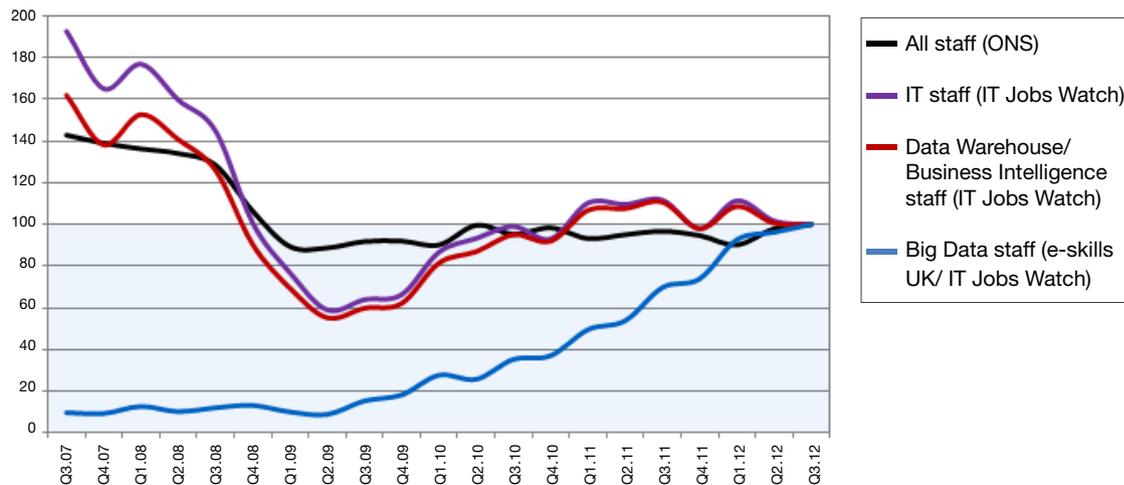
3.1 Demand overview

Although big data has been something of a media ‘darling’ over the past year or so, many would point out that, fundamentally, big data has in fact been around for a much longer period of time albeit most likely under the banner of analytics and/or business intelligence. It is the growth in data volumes, together with associated technological developments and declining relative cost of storage retrieval and analysis, that has really pushed big data into the mainstream.

In fact, as illustrated in the chart below, demand for big data staff has been a readily identifiable aspect of the IT recruitment market for at least five years albeit at levels well below those observed in the current period.^{vi}

Demand for big data staff overall is thought to have increased by approximately 912% in total between the third quarter of 2007 and the third quarter of 2012, with the number of advertised positions in this field rising from around 380 in Q3.07 to 3,790 in Q3.12 – an equivalent annual average increase of 182%.

Figure 1: Demand for labour and skills in the UK 2007–2012 (indexed)^{vii}



Source: e-skills UK analysis of data provided by ONS/IT Jobs Watch

Whilst a remarkable growth figure in itself, when reflecting upon this demand increase it should be remembered that this level of growth has been over a period in which the UK economy has drifted in and out of recession and one in which demand for staff as a whole has declined by around 30% in total, or 6% on average per year. Even within the IT sector, where employment levels have been quite resilient in the face of a troubled economic climate, advertised demand for staff has still declined over the past five years, both as a whole and for Data Warehousing/Business Intelligence specialists more specifically.

Whilst overall demand for staff has declined in the past five years, demand for big data has grown by 182% per annum

Demand for big data staff has outstripped that for IT staff in general and Data Warehouse/Business Intelligence staff more specifically

3.2 Demand by contractual status

The dramatic growth in demand for big data professionals over recent years has been apparent within the markets for both permanent and contract staff, which have grown by 186% and 171% respectively per annum over the Q3.07–Q3.12 period as illustrated in the chart overleaf. This chart also shows how demand for contractors was seen to surge upward over the Q2–Q3.09 period (increasing by 102%) – roughly two quarters prior to a similar jump in demand within the permanent jobs market (where demand rose by 79% between the final quarter of 2009 and the first quarter of 2010). Thereafter, growth trends appear to have continued on a similar path albeit with demand for contractors two quarters in anticipation of that for permanent staff up until the third quarter of 2011 (after which they fell back into alignment following a dip in the contract recruitment market).

Figure 2: UK demand for big data staff by contractual status 2007–2012 (indexed)⁹



Source: e-skills UK analysis of data provided by IT Jobs Watch

Proportionally, however, demand for permanent big data staff has generally been well in excess of that for contractors – much as is the case for demand more generally within the IT labour market (and the labour market as a whole) with typically around 75% of advertised positions for big data jobs thought to be of a permanent nature.

Around 75% of big data positions advertised are for permanent staff

3.3 Demand by sector

Although it is not possible to provide a definitive analysis of the demand for big data (or other IT) jobs by industry sector,^{viii} it would appear that, where sector references are made, these most often relate to finance (referenced in 21% of adverts for big data staff), banking (7%), marketing (5%), games (3%), retail (3%) and telecoms (3%).

⁹ Indexed in this case to the third quarter of 2007, which has a value of 100.

3.4 Demand by salary

Although trend data for big data salaries is not currently available, figures for the latest quarter indicate that big data staff are likely to achieve levels of remuneration significantly higher than those offered to other IT specialists. More specifically the median advertised annual salary for big data staff in the third quarter of 2012 was found to be 21% higher than that for permanent IT staff as a whole (i.e. with comparison figures of £52,500 and £43,500 respectively). Advertised rates for big data contractors were also found to be higher than the norm, though in this case the difference was smaller at just 6% in total (advertised weekly median rates of £410 and £390 respectively).

Not only were advertised rates found to be higher for big data staff as a whole, they were also found to be higher for each of the main roles analysed in the course of this study – and both with respect to permanent and contract positions being recruited. In particular, this pay differential between big data and other IT staff was found to be most pronounced for permanent IT Administrator posts and contract positions for Designers as illustrated within the table below:

Table 1: Comparison of advertised rates for big data/other IT positions Q3.12

	Permanent positions (median annual salary)			Contract Positions (median daily rate)		
	Big Data	All IT	Delta	Big Data	All IT	Delta
Developers	£47,500	£40,000	19%	£400	£380	7%
Architects	£72,500	£67,500	7%	£500	£480	5%
Analysts	£43,250	£40,000	8%	£450	£380	20%
Administrators	£47,500	£38,750	23%	£390	£320	21%
Designers	£46,000	£38,000	21%	£480	£350	35%
Data Scientists	£52,500	-	-	£500	-	-
Project Managers	£55,000	£53,000	4%	£500	£430	18%
All Vacancies	£52,500	£43,500	21%	£410	£390	6%

Source: e-skills UK analysis of data provided by IT Jobs Watch

Advertised rates for big data staff 21% higher than for other IT workers

Advertised rates for big data staff are higher for both permanent and contract positions

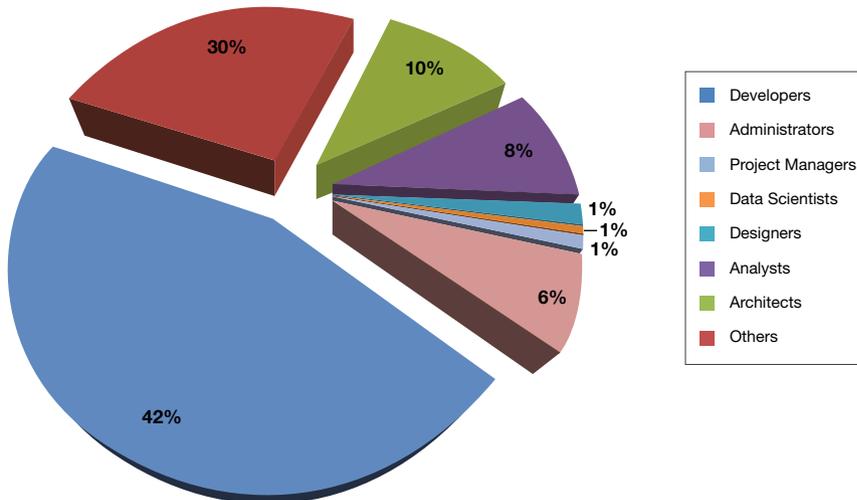
4 Demand Trends by Role

4.1 Overview of big data demand trends by role

Although 'Data Scientist' may currently be the 'sexiest job' in big data,^{ix} the recruitment of Data Scientists (in volume terms at least) appears relatively low down the wish list of recruiters at this time. Instead, the openings most commonly arising in the big data field (as is the case for IT recruitment as a whole) are Development positions, which accounted for approximately 42% of all big data related job adverts during the third quarter of 2012. In contrast, postings for Data Scientists, by comparison were thought to account for just 1% of big data jobs at this time and 0.02% of total demand for IT staff.

Four in ten big data jobs advertised are for 'developers'

Figure 3: Demand for big staff by role Q3.12



Source: e-skills UK analysis of data provided by IT Jobs Watch

4.2 Demand by role and contractual status

The focus on Development staff is equally apparent in both the permanent and contract markets, where 40% and 44% of advertised positions respectively in Q3.12 were for development positions. Variations in demand patterns do exist between these two markets, however, and whilst 7% of permanent big data jobs were for Analysts in Q3.12, the figure for contract positions was almost double this level at 13%. Similarly, the proportion of permanent big data Administrator jobs at 7% was more than twice that for contractors at that time.

Big data recruiters of permanent and contract staff are seeking the same specialisms

Table 2: UK demand for big data staff by job title and contractual status Q3.12

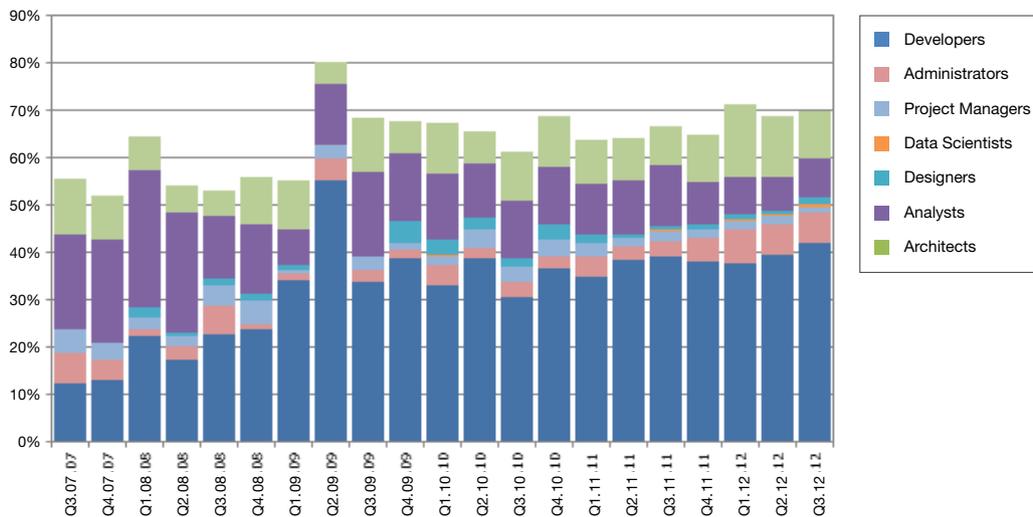
	Vacancy Numbers			Vacancy Proportions		
	Total	Permanent	Contract	Total	Permanent	Contract
Developers	1,590	1,150	420	42%	40%	44%
Architects	380	300	80	10%	11%	8%
Analysts	310	190	130	8%	7%	13%
Administrators	240	210	30	6%	7%	3%
Designers	50	30	20	1%	1%	2%
Data Scientists	30	10	10	1%	0%	1%
Project Managers	50	30	20	1%	1%	2%
Others	1,140	910	250	30%	32%	26%
All Vacancies	3,790	2,840	950	100%	100%	100%

Source: e-skills UK analysis of data provided by IT Jobs Watch

The focus on Development positions has not always existed, however, and five years earlier big data recruiters were more likely to have been seeking to fill Analyst positions than Development posts, with the relative proportion of job vacancies standing at 20% and 13% respectively during the third quarter of 2007 (i.e. compared with 8% and 42% during the latest quarter). The proportion of big data jobs that were for Project Managers was also notably larger at that time than at present (5% and 1% respectively) as illustrated within the chart below.

The initial recruitment focus for big data was for analyst positions

Figure 4: UK demand for big data staff by job title status 2007–2012



Source: e-skills UK analysis of data provided by IT Jobs Watch

The following sections look at demand for these top level big data roles in more detail, exploring in depth how demand has changed over the past five years both within the permanent and contract markets.

4.3 Big data Developers

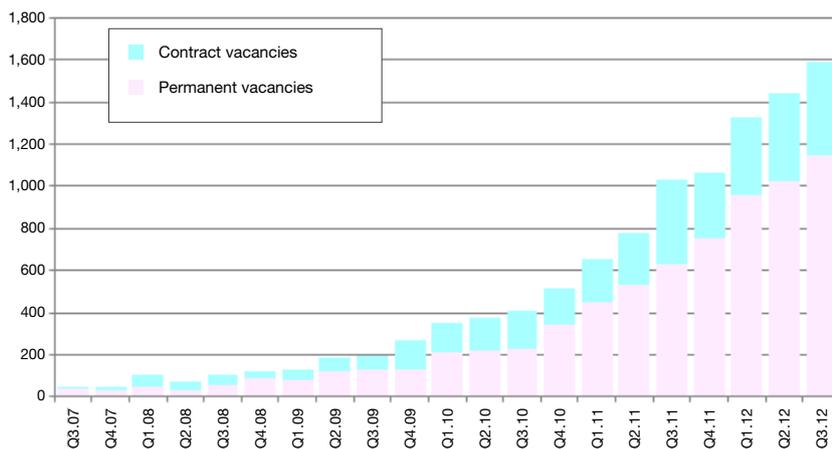
i) Demand trends

Demand for big data Developers has risen by an estimated 3363% in total over the past five years (Q3.07–12) – the equivalent of an average annual growth rate of 673% pa. As with demand for big data staff as a whole, this exponential growth has been observed within both the permanent and contract job markets, which are characterised by related (average) annual increases of 584% and 1093% respectively over the five-year period.

By comparison, the demand for developers as a whole within the UK economy is thought to have declined by around 41% in total or 8% per annum between 2007 and 2012, with a similar level of decline observed within both the permanent and contract markets (down 8% and 9% per annum respectively).

Demand for big data developers has risen by an estimated 673% per annum over the past five years

Figure 5: Demand for Developers from big data recruiters 2007–2012



Average number of vacancies per quarter	
2007	60
2008	100
2009	200
2010	410
2011	880
2012*	1,460

* Average for Q1-Q3 only

Source: e-skills UK analysis of data provided by IT Jobs Watch

ii) Common specialisms and key skills requirements

In a relatively small number of cases, big data recruiters will specify a particular type of Development activity when advertising related positions and in the third quarter of 2012 the most common of these were: Business Intelligence Developer, Web Developer, Software Developer, Business Developer, Analyst Developer, Applications Developer, Database Developer and Front-End Developer (all featuring in less than 10% of adverts for Developer jobs).

The top three skills required of big data developers are NoSQL, Java and SQL

In the main, however, the generic title of developer is normally employed together with a detailed description of the specific technical/related skills required for the post and it is this description that defines the specific type

of development activity undertaken. In the third quarter of 2012, the technical skills most often cited by recruiters in adverts for big data Developers (in order) were: NoSQL (MongoDB in particular), Java, SQL, JavaScript, MySQL, Linux, Oracle, Hadoop (especially Cassandra), HTML and Spring – all of which featured in 20% or more of adverts for big data Developers.

In addition, the generic areas of technical knowledge/competence often requested at this time included (in order) TDD, CSS and Agile Software Development, all of which again featured in 20% or more of adverts for big data Developers¹⁰.

4.4 Big data Architects

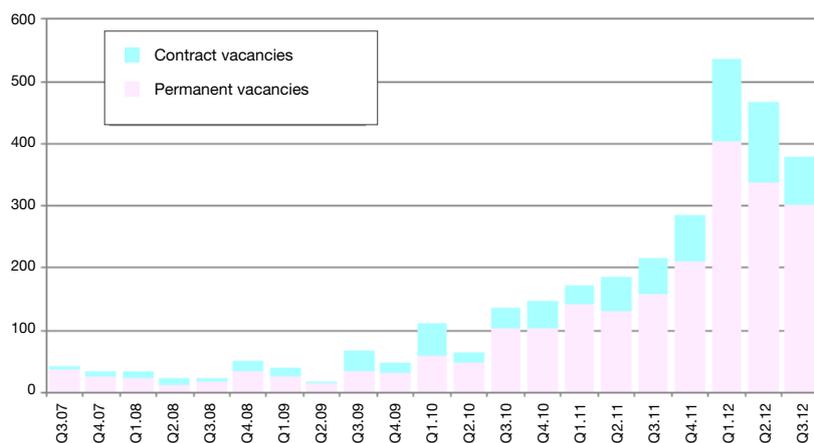
i) Demand trends

On average, demand for big data Architects has increased by 157% per annum over the past five years (784% in total) with comparative increases of 143% and 240% per annum respectively reported in the number of vacancies for permanent and contract staff. By comparison, demand for IT Architects as a whole was seen to fall by 4% per annum on average over the period despite a small increase in demand for contract staff to work in such positions (up by 3% per annum or 13% in total compared with figures of -6% and -31% within the permanent market).

Demand for big data architects has risen by 157% per annum over the past five years

As illustrated in the chart below, the increase in demand for contractors working as big data Architects tends to have outstripped that for permanent staff (overall increases of 1200% and 716% respectively over the past five years) though the share of adverts for big data Architects has remained relatively unchanged at around one in ten adverts in total.

Figure 6: Demand for Architects from big data recruiters 2007–2012



Average number of vacancies per quarter	
2007	40
2008	30
2009	40
2010	120
2011	220
2012*	460

* Average for Q1-Q3 only

Source: e-skills UK analysis of data provided by IT Jobs Watch

¹⁰ See glossary for common acronyms.

ii) Common specialisms and key skills requirements

During the third quarter of 2012, the most common specialism for Architects sought by big data recruiters were: Solutions Architects, Data Architects and Business Intelligence Architects (specified within 26%, 17% and 12% of adverts for big data Architects respectively).

More specifically, however, applicants for these positions were required to hold skills in a range of technical disciplines including (in order): Oracle (BI EE in particular), Java, SQL, Hadoop and SQL Server (all featuring in 20% or more of adverts for big data Architect positions), whilst the main generic areas of technical knowledge/competence required were: Data Modelling, ETL, Enterprise Architecture, Open Source and Analytics (all featuring in 10% or more of related job adverts).

The top three skills required of big data architects are Oracle, Java and SQL

4.5 Big data Analysts

i) Demand trends

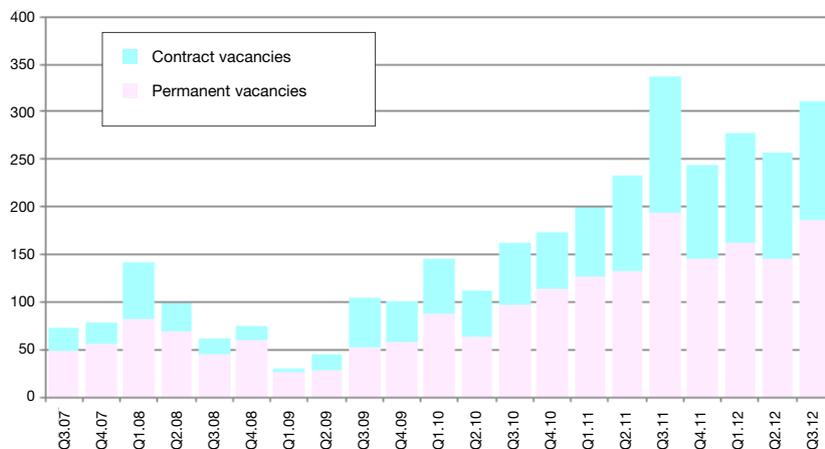
Demand for IT Analysts to work with big data was seen to rise by 327% over the past five years (i.e. an annual average of 65%) with demand for permanent staff increasing by 290% and that for contractors by 400% over the same period. Demand growth, though high, was less than that associated with the other key big data occupations, however, and as a result the proportion of overall big data demand accounted for by Analyst jobs has fallen from around one in five to one in ten vacancies over the past five years.

Demand for big data analysts has risen by 65% per annum over the past five years

Within the wider IT recruitment market by comparison there has been a decline in demand for IT Analysts of around 10% per annum over the past five years with a similar change occurring within both the permanent and contract sectors (i.e. 11% and 8% per annum respectively).

Though demand growth for contract big data Analyst jobs has been stronger than that for permanent staff in recent years, the proportion of contract jobs has remained largely unchanged at around 60% of the total – a distribution broadly in line with that of analyst positions as a whole (i.e. 41% of all adverts for IT Analysts in Q3.12 were contract posts).

Figure 7: Demand for Analysts from big data recruiters 2007–2012



Average number of vacancies per quarter	
2007	80
2008	90
2009	70
2010	150
2011	250
2012*	280

* Average for Q1-Q3 only

Source: e-skills UK analysis of data provided by IT Jobs Watch

ii) Common specialisms and key skills requirements

When considering demand for big data Analysts in more detail, it was found that the major proportion of related vacancies in the third quarter of 2012 were for: Business Analysts, Data Analysts, Business Intelligence Analysts and Support Analysts (30%, 20%, 19% and 11% of all big data Analyst positions respectively), whilst the associated technical skills most in demand at this time were: Oracle (particularly BI EE and Reports), SQL and Java (featuring in 20% or more of related adverts).

Particular process/methodological skills required from applicants for Analyst positions were primarily in respect of: Data Modelling, ETL, Analytics and Data Analysis (all appearing in 10% or more of related adverts).

The top three skills required of big data analysts are Oracle, SQL and Java

4.6 Big data Administrators

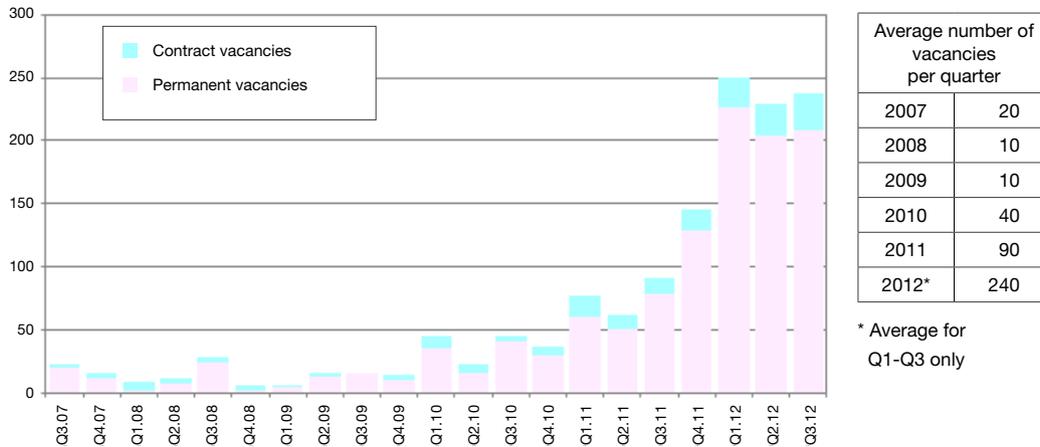
i) Demand trends

Demand for IT Administrators by recruiters seeking to fill big data posts has increased by an average of 186% per annum over the past five years (Q3.07–Q3.12) compared with a figure of -10% for IT administrators as a whole. Despite having one of the highest average annual growth rates, however, the proportion of all big data vacancies arising in this field has remained fairly static over the past five years at around one in eighteen of all big data positions on offer (6%).

Unlike many of the other big data roles investigated, demand growth for permanent staff in this area has tended to exceed that for contractors (averaging at 188% and 173% per annum respectively between Q3.07 and Q3.12) and, as a result, the proportion of adverts for big data Administrators that are for permanent staff has increased significantly to around nine in ten (88%) jobs advertised (compared with around just seven in ten for IT Administrators as a whole).

Demand for big data administrators has risen by 186% per annum over the past five years

Figure 8: Demand for Administrators from big data recruiters 2007–2012



Source: e-skills UK analysis of data provided by IT Jobs Watch

ii) Common specialisms and key skills requirements

Approximately 58% of Administrator positions advertised in the third quarter of 2012 were for Systems Administrators (most often specialising in Linux or Unix) and 42% were for Database Administrators (most commonly working on Oracle, SQL, Teradata and/or MySQL databases).

In general the technical skills most often requested by employers from big data Administrators at that time were: Linux (79% of big data Administrator positions), MySQL (46%) and Puppet (39%), Hadoop (35%) and Oracle (31%), whilst the process/methodological competences most often requested were in the areas of: Configuration Management, Disaster Recovery, Clustering and ETL (appearing in between 10% and 21% of adverts).

The top three skills required of big data administrators are Linux, MySQL and Puppet

4.7 Big data Project Managers

i) Demand trends

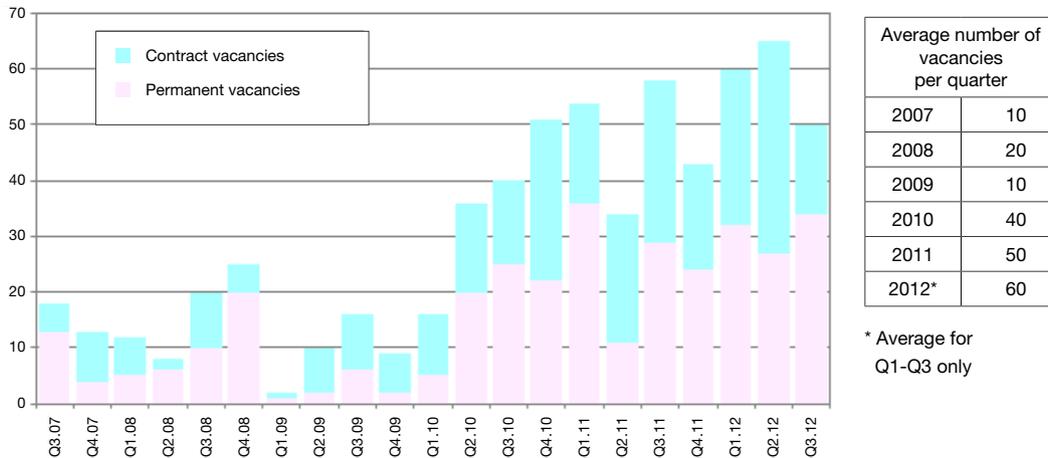
It is estimated that 1% of all big data vacancies in the third quarter of 2012 were for Project Managers, a figure well below that for the IT recruitment market as a whole (6%) at this time.

As with other big data roles, demand for Project Managers to work in this field has grown significantly over the past five years (36% per annum on average and 178% as a whole) whilst demand for project managers more generally has been in decline in the period (down by 51% in total or 10% per annum on average).

Demand for big data project managers has grown by 178% over the past five years

Overall growth in demand for permanent and contract staff in this field has been similar at 32% and 44% per annum respectively and, by the third quarter of the year, permanent vacancies accounted for 68% of the total demand for big data Project Managers (compared with 53% within the IT recruitment market more generally).

Figure 9: Demand for Project Managers from big data recruiters 2007-2012



Source: e-skills UK analysis of data provided by IT Jobs Watch

ii) Common specialisms and key skills requirements

The specific types of Project Manager most often required by big data recruiters in 2012 to date¹¹ have been: Oracle Project Managers, Technical Project Managers and Business Intelligence Project Managers, which were cited within 25%, 14% and 12% of related big data vacancies (i.e. for Project Managers) over the Q1-Q3.12 period.

Aside from Oracle (and in particular BI EE, EBS and EBS R12), which was specified in over two-thirds of all adverts for big data related Project Management posts, other technical skills often needed by applicants for this type of position were: Netezza, Business Objects and Hyperion (featuring in 9% or more of related adverts). Process/methodological skills commonly required included: ETL and Agile Software Development (cited in 30% and 10% of related adverts respectively) together with a range of more ‘business focused’ skills, i.e. PRINCE2 (22%) and Stakeholder Management (15%).

The top three skills required for work in big data project management are Oracle, PRINCE2 and Netezza

4.8 Big data Designers

i) Demand trends

As with Project Management positions, the number of big data vacancies for Designers is relatively small at just 1% of the total, although, in this case, the proportion was found to be equal to that within the IT recruitment market as a whole at the time of data collection (i.e. Q3.12).

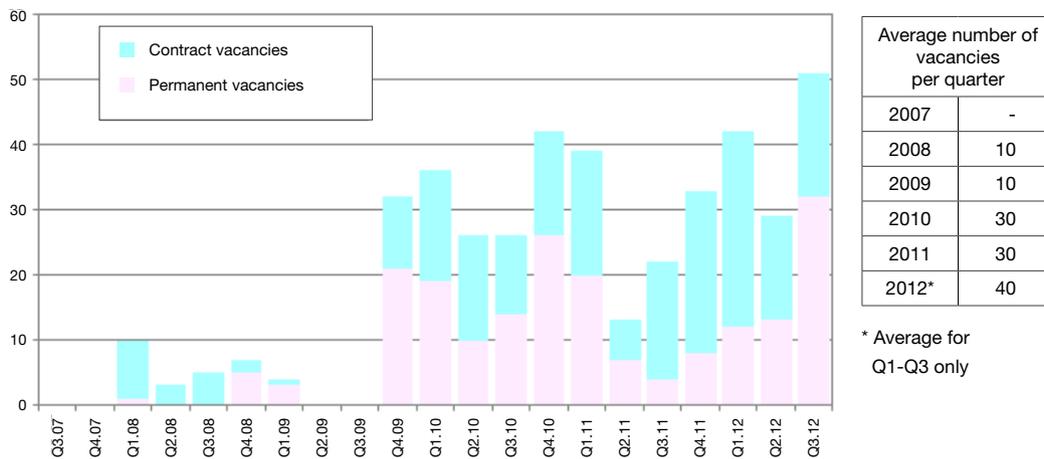
Demand for big data designers has grown by 329% on average in each of the past five years

11 A yearly total (Q1-Q3.12) was employed owing to the small sample available for this role.

An analysis of demand trends for related big data positions over the past five years¹² shows an associated annual average growth figure of 329% and overall growth of 1643% for the period (compared with an overall fall of 49% and an annual average fall of 10% when considering positions for IT Design roles as a whole).

During this period, demand for permanent Design vacancies has exceeded that for contract staff by around 60% per annum on average (with associated growth rates of (360% and 305% per annum respectively) and the proportion of all big data Design vacancies that are permanent now stands at around six in ten advertised positions (as is the case for design positions more generally in the IT recruitment market).

Figure 10: Demand for Designers from big data recruiters 2007–2012



Source: e-skills UK analysis of data provided by IT Jobs Watch

ii) Common specialisms and key skills requirements

As with Project Management positions and those for Data Scientists, due to the limited number of vacancies advertised for big data Designers, the analysis of related skills has been undertaken using combined figures for the first three quarters of the year. This analysis shows the most commonly requested technical skills associated with such posts to have been: Oracle (particularly BIEE) and SQL (which both featured in over one quarter of related adverts) followed by Netezza, SQL Server, Informatica, MySQL and UNIX (apparent in 15% or more of adverts).

Common process/methodological skills needed over the first three quarters of the year were: ETL, Data Modelling, Analytics, CSS, Unit Testing, Data Integration and Data Mining, whilst more general knowledge requirements related to the need for experience/understanding of: Business Intelligence, Data Warehouse, Big Data, Migration and Middleware (cited in 10% or more adverts in each case).

The top three technical skills for big data designers are Oracle, SQL and Netezza

¹² Data for the entire five-year period are not available.

4.9 Data Scientists

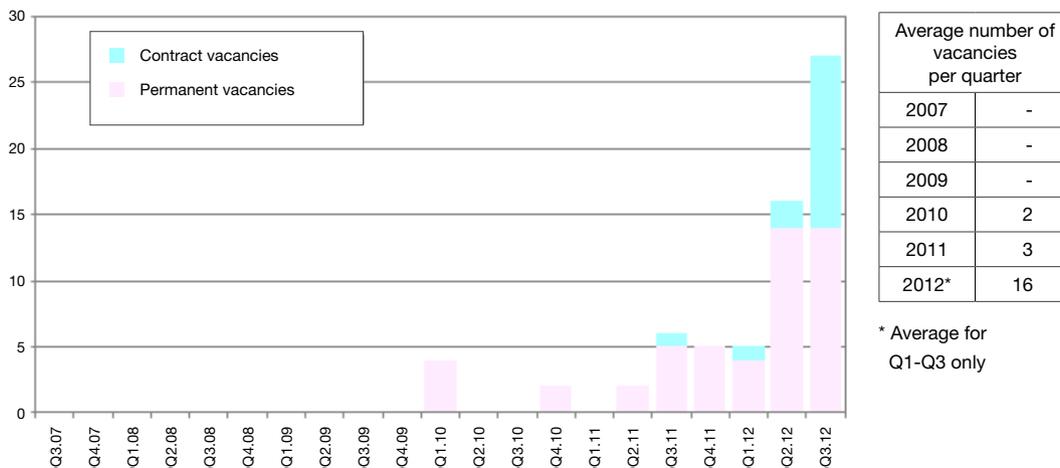
i) Demand trends

Demand for Data Scientists (as a definitive job title) was near non-existent prior to 2011 and, despite the extremely high level of associated demand growth recorded over the past year (i.e. 350% between the third quarter of 2011 and that of 2012), the number of vacancies observed for this niche occupation remain extremely small (i.e. less than 20 per quarter on average during 2012).^x

A comparison of permanent/demand data (again for the first three quarters of 2012) shows that around two thirds of Data Scientist positions advertised will be of a permanent nature and this figure relates both to big data/the wider IT sector being that all Data Scientists were thought to be working on big data projects.

Demand for data scientists has grown by 350% over the past year

Figure 11: Demand for Data Scientists from big data recruiters 2007–2012



Source: e-skills UK analysis of data provided by IT Jobs Watch

ii) Common specialisms and key skills requirements

The core technical skills needed to secure a position as a Data Scientist (based on an analysis of all vacancies for the first three quarters of 2012) were found to be: Hadoop (Pig in particular), Java, NoSQL and C++ (all of which featured in 30% or more of advertised vacancies).

The top three technical skills for data scientists are Hadoop, Java and NoSQL

As was the case for other big data positions, adverts for Data Scientists often made reference to a need for various process/methodological skills and competences. Interestingly however, in this case, such references were found to be much more commonplace and (perhaps as would be expected) most often focused upon data and/or statistical themes, i.e. Statistics, Analytics and Mathematics were all cited within 30% or more of adverts during the first three quarters of the year whilst Data Analysis, Artificial Intelligence and Data Mining were present within 20% or more related adverts during this period.

5 Demand Trends by Skill

5.1 Overview of demand for related skills needs

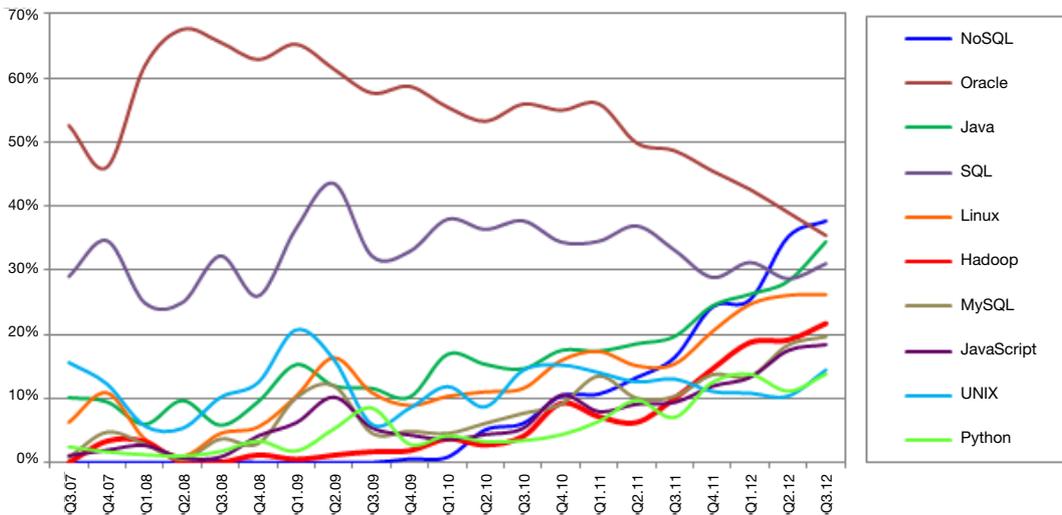
As illustrated within the previous section, employers seeking to recruit staff to big data jobs will typically specify a need for a number of specific technical skills along with a wide range of process/methodological skills.

Although the skill sets required will typically vary according to the occupation/job title in question, it was thought useful to provide an overview of how demand for specific skills and competences has changed within the big data labour market in recent years and, in particular, highlight changes in demand for two of the newest yet perhaps most important emerging skill sets in this field, i.e. NoSQL and Hadoop.

The most commonly cited technical skills appearing in adverts for big data staff during the third quarter of 2012 were NoSQL, Oracle, Java and SQL, each of which featured within at least 30% of associated recruitment adverts at that time.

Overall, NoSQL is now the technical skill most often demanded by big data recruiters

Figure 12: Demand for specific technical skills from big data recruiters 2007–2012¹³



Source: e-skills UK analysis of data provided by IT Jobs Watch

As illustrated in the chart above, Oracle had been the most commonly required skill for big data staff up until the second quarter of 2012, at which point demand for related skills was exceeded by that of NoSQL. The chart also shows how SQL, though appearing in a similar proportion of big data adverts throughout the past five years, is, like Oracle, now being surpassed by the demand for NoSQL and other core skills associated with big data developments (i.e. Java on which Hadoop, for example, is based).

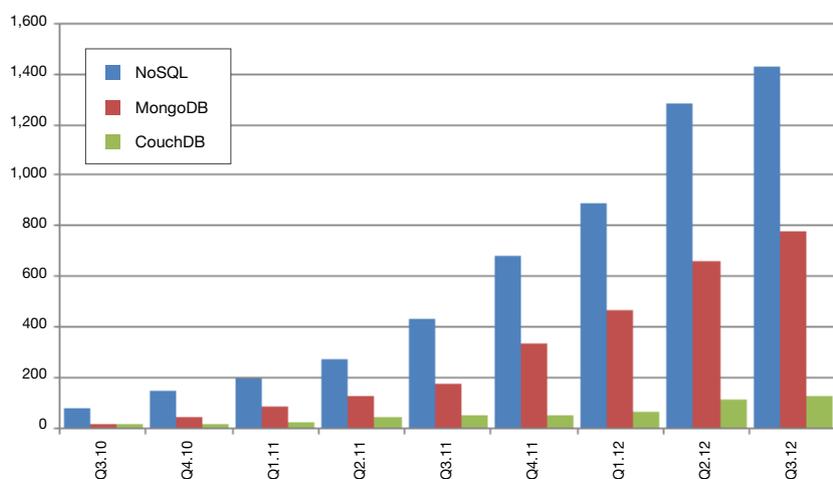
¹³ Note that percentages will not total 100% as vacancies may reference more than one skill.

5.2 NoSQL

NoSQL (Not Only SQL) databases are ‘next generation databases, often “non-relational”, distributed and open-source as well as being horizontally scalable^{xi}. The NoSQL database has emerged as a core requirement for employers seeking to develop their capacity for big data and amongst the 150 or more variants of NoSQL¹⁴, the two most commonly featured within adverts for big data staff in the UK during the third quarter of the year were MongoDB and, to a lesser extent, CouchDB.

Demand for NoSQL skills from big data recruiters has risen by 1600% in the past two years

Figure 13: Demand for NoSQL skills from big data recruiters 2010–2012



Average number of vacancies per quarter	
2007	-
2008	-
2009	-
2010	110
2011	400
2012*	1,200

* Average for Q1-Q3 only

Source: e-skills UK analysis of data provided by IT Jobs Watch

Over the past two years the increase in demand from big data recruiters for NoSQL skills has been phenomenal. Even in the case of CouchDB, which exhibited the lowest rate of growth over the 2010-12 period, a 650% increase in demand was recorded whilst for NoSQL as a whole an increase of 1600% was observed. Even this figure was dwarfed, however, by the increase in demand for MongoDB, which rose by 4200% between Q3.10 and Q3.12.

5.3 Hadoop

Another integral aspect of many big data developments is the adoption/integration of Apache Hadoop¹⁵ and related sub-components/projects, i.e. Avro, Cassandra, Chukwa, HBase, Hive, Mahout, Pig, ZooKeeper, etc. Apache Hadoop is ‘an open-source software framework that supports data-intensive distributed applications running on large clusters of commodity hardware’^{xii} and, as such, it provides organisations with a cost-effective means of implementing a scalable distributed computing solution to help address their big

Demand for Hadoop skills from big data recruiters has risen by 700% in the past two years

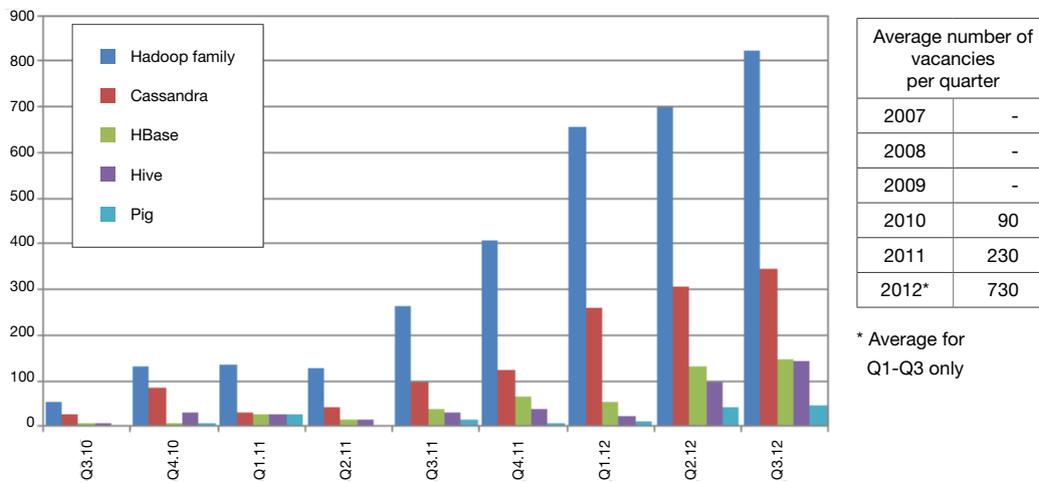
14 <http://nosql-database.org/>

15 The Apache™ Hadoop® project is open-source software (<http://hadoop.apache.org/>) allowing for the distributed processing of large data sets across clusters of computers using simple programming models. It is designed to scale up from single servers to thousands of machines, each offering local computation and storage.

data development needs. For this reason alone Hadoop has quickly become a core requirement for individuals pursuing a career in the field of big data.

Like NoSQL, demand for Hadoop has increased dramatically in recent years and, whilst there were only around 55 big data vacancies citing a requirement for Hadoop in the third quarter of 2010, the number has increased by 700% by the third quarter of 2012 to 820 positions in total. This said, demand for Hbase (the associated NoSQL database component of Hadoop) has increased by an even greater rate, rising by 2370% over the past two years.

Figure 14: Demand for Hadoop skills from big data recruiters 2010–2012



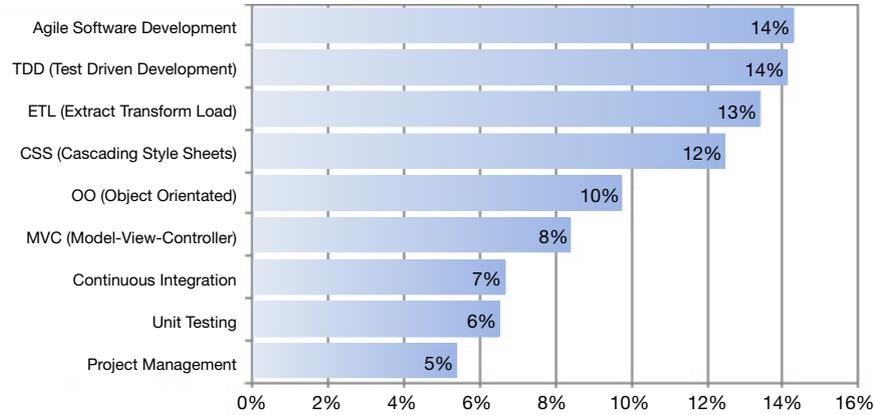
Source: e-skills UK analysis of data provided by IT Jobs Watch

5.4 Overview of process/methodological skills demanded

As mentioned throughout the last section, aside from specific technical skills requirements, big data employers will often make reference to the need for technically related process/methodological skills/knowledge/experience which, in the main, reflect the fact that a sizeable proportion of big data positions advertised are for Development posts. Hence, it is unsurprising to find that the most common skills of this nature in the third quarter of the year related to Agile Software Development and Test Driven Development (TDD).

Agile Software Development skills cited in around 14% of all adverts for big data staff

Figure 15: Common process/methodological skills demanded by big data recruiters Q3.12

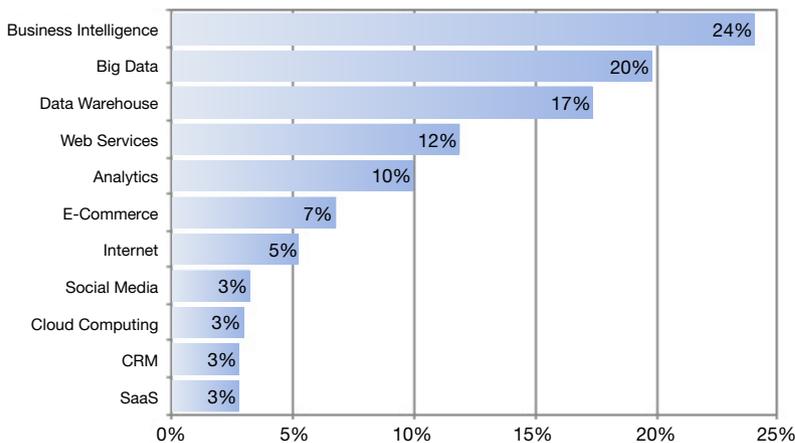


Source: e-skills UK analysis of data provided by IT Jobs Watch

5.5 Overview of generic/functional knowledge requirements

At a still higher level, applicants to big data positions will need an understanding of broad principles involved with various business functions/activities, and an analysis of related vacancy data would suggest that this would be most likely to arise with respect to Business Intelligence and big data in general.

Figure 16: Common functional knowledge/skills demanded by big data recruiters Q3.12



Source: e-skills UK analysis of data provided by IT Jobs Watch

6 Future Demand

6.1 Forecasting overview

Having developed an operational definition of big data within an employment context and then using this as a basis for a detailed analysis of demand trends to date, we then sought to develop a series of forecasts setting out the likely future demand in the UK for big data related labour and skills over the coming five years.

This component of the research exercise was carried out in association with Experian's Economics Group, who has integrated our big data demand data with a series of bespoke forecasts of IT & Telecoms (IT&T) staff¹⁶ commissioned specifically for this project and, as a result, has been able to work with us to generate a set of dedicated demand forecasts for big data occupations.

6.2 Methodological details

The initial element of the forecasting activity focused on the generation of related employment forecasts (i.e. IT&T employment) for the 2012–2017 period based on an occupational definition derived from relevant components of the ONS Standard Occupational Classification system (SOC2010).

To produce these forecasts, Experian's Regional Planning Service (RPS) first creates output and employment forecasts for the 38 industry divisions defined by the ONS Standard Industrial Classification coding system (SIC2003), i.e. at 2 digit SIC level. Using Index of Production (IOP) data from the ONS, estimates of consumer demand and intermediate demand and related trend data, a shift share methodology is then employed to extrapolate results at a more detailed level (i.e. SIC industry class/4 digit level).

The 4-digit forecasts are anchored to the higher level industry estimates to increase robustness/ensure consistency and are then disaggregated by regions using official employment data. The resulting regional estimates are then also anchored at the broader industry level to increase robustness. The end result is a set of 4-digit forecasts for each region that are fully consistent with Experian's broader industry forecasts, which are then subject to a SIC converter (from ONS) to produce equivalent forecasts using the latest version of the industry classification system, i.e. SIC2007.

To translate these industry forecasts to occupation forecasts (SOC2010), Experian has developed a dynamic matrix system, which maps industry employment to occupations for the current/previous years. This matrix can be extrapolated forward to 2017 using past trends and has been adjusted to account for shifts in occupational distributions observed between 2002 and

**Bespoke forecasts of IT
employment have been
produced to guide the
generation of future demand
estimates**

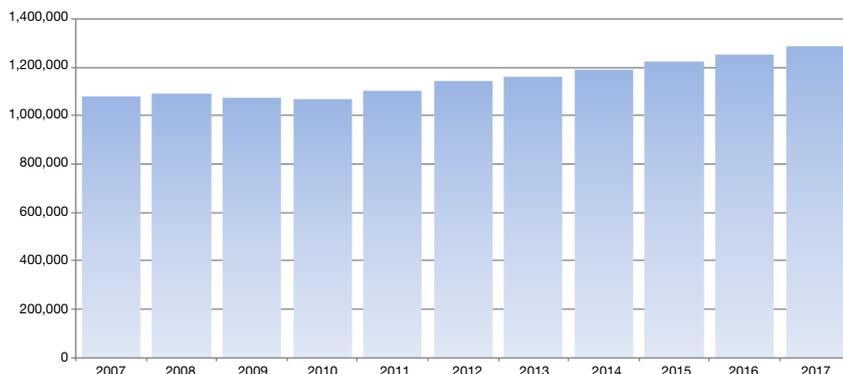
¹⁶ It was necessary to forecast IT & Telecoms employment as a whole, as available data from ONS (upon which forecasts are based) does not easily differentiate the two distinct groups of technical specialists. It was considered that this would not have a major effect upon related outputs, in part due to the relative shares of employment but also due to the continued blurring of boundaries between associated roles.

2010 under previous ONS classification systems, i.e. SOC2000 (which encompasses a longer time series). Hence, by applying this matrix to the regional industry forecasts previously generated, a series of estimates for future employment by IT/other occupation can be derived covering the subsequent five-year period.

6.3 Forecast employment of IT&T staff 2012–2017

ONS estimates from the Labour Force Survey (LFS) suggest that in 2011 there were approximately 1.1 million people working in IT&T roles in the UK and that, in total, IT&T staff accounted for approximately 3.8% of all employment in the UK. The number of people working in IT&T positions is thought to have increased by approximately 53,000 people over the past five years (2006–2011 using annual comparisons) and the annual average growth rate (1.0%) is in stark contrast to the decline exhibited for the UK as a whole (-0.2%).

Figure 17: Employment of IT&T staff¹⁷ in the UK 2007–2017



Source: e-skills UK/Experian

Over the 2012-2017 period, growth in IT&T employment is forecast, on average, to increase at a more rapid pace (2.5% per annum) and by 2017 it is anticipated that there will be approximately 1.3 million people employed in IT&T roles in the UK (by comparison, growth in employment overall is forecast to be around 0.8% per annum for the UK labour market as a whole).

IT&T employment is forecast to grow by 2.5% pa on average over the next five years

Near term employment growth for IT&T specialists is anticipated to be higher for more senior roles, i.e. senior level managers and professionals, whilst the number of people employed in lower skilled IT&T positions will continue to contract or, at best, remain static over the period.

¹⁷ By staff we mean both permanent and contract workers.

6.4 Forecasting demand for big data positions 2012–2017

The second forecasting component of this project was the generation of demand forecasts for big data positions based upon an analysis of historical recruitment (advertising) combined with the results of the dedicated IT&T employment forecasting exercise.

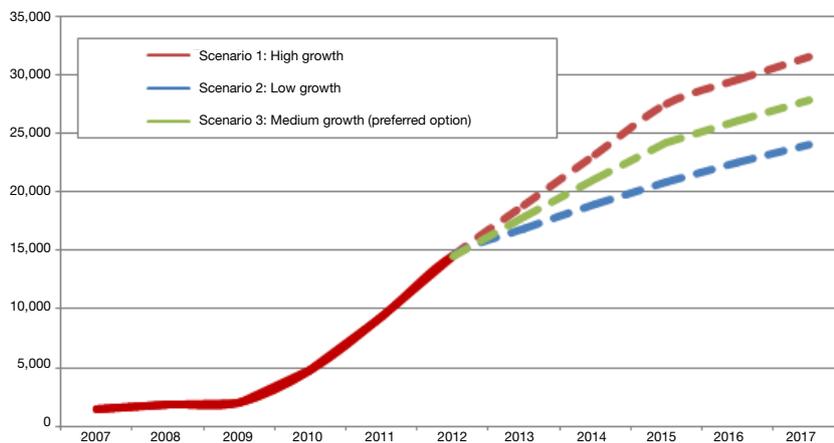
When developing these forecasts, we have assumed that, given the skills requirements for big data, related jobs should be captured within the IT&T employment estimates/forecasts discussed and that advert vacancy statistics can reasonably be employed to quantify the gross number of big data job opportunities arising in the future.

We use the term gross job opportunity in the understanding that an advertised position may arise as a result of a) a new post being created (growth) or b) someone leaving a job (replacement), e.g. to take up another post or to exit the labour market entirely. When considering the two effects together (i.e. growth + replacement), the result equals total gross job opportunities (job vacancies).

When developing our forecasts, we were also cognisant of the fact that gross job opportunities created by replacement tend to be much more numerous than those created by expansion (our research shows a ratio averaging at around 6:1 for IT&T positions) and that the net change in employment can be either positive or negative. Lastly, and perhaps most significantly, it is worth bearing in mind that the future growth in the number of big data job opportunities may not continue at the growth rates we have seen before – historical demand series and adoption rates tend to relate to very limited time periods and/or specific circumstances (e.g. actions of major employers) and, hence, it is by no means certain at what point of the adoption curve companies, as a whole, are likely to have reached. With this in mind we have decided to produce three growth scenarios:

- 1) A high growth scenario, which assumes the big data industry is still at the early majority stage where adoption of the new technology will continue to rise for a further two years before reaching the late majority stage where growth in adoption rate is expected to slow.
- 2) A low growth scenario, which assumes that the industry has moved further along the adoption curve and, as such, adoption rates and employment demand will slow considerably in comparison with the recent past.
- 3) A medium growth scenario, which follows a path of growth midway between the two cited above.

Figure 18: Actual/forecast demand (vacancies per annum) for big data staff 2007–2017



Source: e-skills UK/Experian

Under the high growth scenario, big data demand (vacancies) is expected to grow by 117% over the coming five years – the equivalent of an annual average growth rate of 23% per year. Accordingly, the gross job opportunities for big data related jobs would be approximately 32,000 per annum by 2017 and over the whole forecast period there will have been around 146,000 big data gross job opportunities created in the economy.

Demand for big data staff is expected to grow by 92% over the next five years.

Under the low growth scenario, job vacancies would be expected to grow at a rate of 13% per year on average (65% in total) with gross job opportunities at a rate of 24,000 per annum by 2017. Over the whole forecast period, under this scenario there would be around 118,000 gross job opportunities in total created within the economy between 2012 and 2017.

Under the medium growth scenario (the favoured of the three scenarios presented), job vacancies would be expected to grow at a rate of 18% per year on average (92% in total) with gross job opportunities at a rate of 28,000 per annum by 2017. Over the whole forecast period, under this scenario there would be around 132,000 gross big data job opportunities in total created in the economy between 2012 and 2017.

Appendix A: SOC

The Standard Occupational Classification (SOC) system has been developed by ONS to provide a common methodology for the classification of occupations in the UK based upon associated skill levels and skill content.

SOC is based on a hierarchical system, starting with 9 high level, single-digit codes (SOC major groups) which are then sub-divided into 25 more detailed two-digit classifications (SOC sub-major groups), 90 three-digit codes (SOC minor groups) and finally 369 four-digit (SOC Unit) codes.

When developing our forecasts of employment for IT&T occupations, we defined this group at the most detailed level possible using the following four-digit unit codes:

- 1136 Information technology and telecommunications directors
- 2133 IT specialist managers
- 2134 IT project and programme managers
- 2135 IT business analysts, architects and systems designers
- 2136 Programmers and software development professionals
- 2137 Web design and development professionals
- 2139 Information technology and telecommunications professionals n.e.c.
- 3131 IT operations technicians
- 3132 IT user support technicians
- 5242 Telecommunications engineers
- 5245 IT engineers

Glossary and Terminology

1. The analysis of vacancies presented within this report is based upon data provided by IT Jobs Watch (www.itjobswatch.co.uk) who tracks the demand patterns for IT staff through the application of semantic analysis to data obtained from major IT recruitment sites. Where we have referenced specific groupings of skills in this report, e.g. process/methodological skills of functional knowledge/skills, these groupings have been drawn together by e-skills UK only, and are not groupings developed or employed by IT Jobs Watch (with the exception of 'Data Warehouse/Business Intelligence' cited on page 10 of the report).
2. Where figures are provided showing the number of advertised vacancies, they have typically been rounded to the nearest 10 (i.e. unless specified otherwise, and unless shown within related charts). As a result of this rounding process, apparent discrepancies may appear in row/column total (i.e. integers/percentages).
3. Various references have been made to specific technologies/processes within this report, the more commonly used of which are set out below:

CSS	Cascading Style Sheets
ETL	Extract, Transform, and Load
Oracle BI EE	Oracle Business Intelligence Enterprise Edition
Oracle EBS R12	Oracle E-Business Suite (Release 12)
TDD	Test Driven Development

4. In order to aid the reader, a number of abbreviations/shortcuts have been employed when writing this report, the more commonly used of which are set out below:

Staff	Term used when referring to individuals working in stipulated positions irrespective of contractual status (i.e. permanent or contract workers).
Current	Term used when referring to the third quarter of 2012 (unless otherwise stated), which was the latest quarter for which a full set of related data was available.

End Notes

- i Big Data: The next frontier for innovation, competition, and productivity
- ii 3D Data Management: Controlling Data Volume, Velocity and Variety, META Group (now Gartner), February 2001
- iii SAS® High-Performance Analytics: Transforming Big Data into Corporate Gold, SAS, September 2012
- iv It should be borne in mind that a megabyte was considered to be big data in the not-so-distant past and that, today, whilst some would view a petabyte as defining the 'bigness', i.e. volume element of big data, others may instead favour a measure relating to terabytes (or multiples thereof) for example.
- v An adoption figure of 34%, for example, is provided by TDWI in their Best Practices Report Q4.11, which is based on information from 325 respondents, 56% of which were based in the US and 74% of which were from firms with a turnover of \$100 million or more. Aside from the geographical bias, putting these turnover figures in perspective using data from the UK from the Office for National Statistics, it can be seen that, in 2011, just 9% of UK enterprises had a turnover of £1 million or more.
- vi The 'current period' for the purposes of this report is considered to be the third quarter of 2012 in that this was the last full quarter for which relevant data is available.
- vii Indexed figures are used to show the proportional change over time for data series of different magnitudes. In this series the latest quarter (Q3.12) takes the value 100 and all other figures are presented as a related proportion (and the shaded area at 100 represents no change). For clarity again, other charts may be indexed to the third quarter of 2007. This variation is for presentation purposes only and in no way affects the results reported on within this document.
- viii Although adverts may sometimes reference an industry sector, it is not common practice and, even where industry associations are made, they are often relatively vague. As such, this section is to be used as a broad guide only.
- ix 'Data Scientist: The Sexiest Job of the 21st Century', Harvard Business Review, October 2012.
- x To alleviate our concerns that the analysis of vacancy counts for the IT recruitment sector may fail to capture a significant proportion of demand for Data Scientists, we monitored demand for such roles reported in two well-known recruitment portals (Simply Hired and Indeed) throughout the months of October/November 2012. The results of this activity showed that, after the data had been de-duplicated, the difference between the associated vacancy counts was not substantial and, as such, would not significantly alter the findings presented within this report.
- xi <http://nosql-database.org/>
- xii http://en.wikipedia.org/wiki/Apache_Hadoop

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