Professions in the data analytics job market – Australia and New Zealand

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Abstract

This article investigates the data analytics job market in Australia and New Zealand with a focus to find the major professions that exist and how they are distinguished one from another in technical competencies. The main purposes are to inform data analytics curriculum design and development to enhance market relevance and graduate employability as well as to provide advice to assist quality assurance for the associated professional course accreditations. Currently, data analytics, either as a course or as a specialised program, is offered by different schools and in different disciplines. The variances and discrepancies among them are large and concerning. This article is the first part and partial literature review of a larger study which later includes text mining and examination (using R) of 540 job advertisements in five industries that demand data analytics skills the most. It is found that business analyst, data analyst and data scientist are three major professions in Australia and New Zealand. The larger study fills a gap in the data analytics literature by focusing on countries other than the U.S. It also offers key specific competencies for universities and the professional accrediting bodies to focus on when developing and evaluating data analytic courses and programs. It will benefit students, practitioners, employers and other parties interested in achieving better outcomes for professional development, employment and economics in capitalising values, capabilities and potentials pertaining to data analytics.

Keywords

Business analyst, data analyst, data scientist, technical competencies, text mining

1. Introduction

Competency-based curriculum is promoted by global IT professional bodies such as ACM, AIS and IEEE and universities that provide IT and IS programs (ACM & AIS 2020; ACM & IEEE,2020; Ding et al., 2021). The curriculum with competency focus may bridge the gap between education and the professional employment market, create market-relevant courses and enhance graduate employability (Topi, 2019). To achieve a curriculum as such,

knowledge of what professions exist in the job market and how they are distinguished or substantiated in technical competencies must be known.

In the case of data analytics, large variances and discrepancies exist in the curriculums of different universities and in different disciplines (Delen & Zolbanin, 2018; Weathers & Aragón, 2019; Sarkar et al., 2021). The situation is concerning as it may confuse educators and developers in the course and program design, undermine the standard of curriculum quality assurance for the related professional course accreditations and disorient students, professional workers, employers and other parties (Clayton & Clopton, 2019; Radovilsky et al., 2020).

Data analytics has long been hosted in the IT discipline, and a dominant share of data analytics jobs is taken by the IT industry (De Mauro et al., 2018; Halwani et al., 2021). The hosting status of IT is being challenged by other disciplines as they are offering data analytics in various courses and programs. The data analytics curriculum has to cover a wide range of topics, content and competencies to accommodate the multi-disciplinary or interdisciplinary needs in the job market. Given that a course or a program has a constrained timeframe, limited resources and facilities, it is practically not possible to cover all that is needed (Clayton & Clopton, 2019). For a course or a program to enhance graduate employability and be market-relevant, it must target a profession. Therefore, a clear understanding of what the major professions are in the job market and how each profession is distinguished from another one is important.

In the literature, there is a large body of studies reflecting professions and competencies. Most of them are conducted in the U.S., while less is known about other countries such as Australia and New Zealand. Studies are required so that data analytics courses and programs can be offered to accommodate the local employment market and economy. It will endeavour to answer three questions:
1. What are the professions that exist in the data analytics job market in Australia and New Zealand?
2. What are the important technical competencies that identify each profession?
3. How are the professions distinguished from one another in technical competencies?

The reason for Australia and New Zealand being studied together is because the two countries share the same employment market. Professional workers move across the countries freely so they can work in either country with no legal restrictions. Many large companies have their headquarters in one country and have branches and subsidiaries in both countries.

2. Literature Review

This section presents an analytical review of the literature towards discovering professions and technical competencies in relation to data analytics.

2.1 Data, data analytics and competency

Data, data analytics and competency are three concepts that are instrumental to this study. They are particularly used to inform data collection, analysis and interpretation. Data is thought as having started from generic forms in statistics, mainly numerical and categorical, and in computer science. As information technology evolves, data grows in all Seven V's (volume, velocity, variety, variability, veracity, visualisation and value) (Aasheim et al., 2015). Data analytics grows from three typical analyses (descriptive, predicative and prescriptive) to a range of mechanisms and capabilities including artificial intelligence, machine learning, data mining, automation and streaming analytics in information and cyber-physical systems (Chang et al., 2018; Wang et al., 2018; Radovilsky et al., 2020; Sun & Huo, 2021).

The definition of competency also varies. Among various conceptual frameworks, the common ones are KSD (Knowledge, skills and dispositions), KSA (Knowledge, skills and abilities) and CFS (Cognitive, functional and social) in the fields of IT and data analytics research (ACM & AIS, 2017; Dong & Triche, 2020). Competency is captured in two categories: technical skills and soft skills (Radovilsky et al., 2020). Soft skills, such as communication, teamwork and collaboration, are required for all professions today and are unlikely to distinguish a profession from another (Radovilsky et al., 2020; Verma et al., 2019). For entry-level job positions that apply to most university graduates, technical skills (what a graduate can do) are more important for employers (Kurtzke & Setkute, 2021).

2.2 Home of data analytics

Data analytics is demanded by many professions and its courses and programs are offered in many disciplines. This raises a question as to which discipline it belongs or whether it should be hosted by IT. If hosted, IT should educate the basics of data analytics and cover the various analytics needs. A review of the historical literature reveals that data analytics has been a major domain in the IT curricula since 1990's (Kang et al., 2018. The view that IT is the host discipline of data analytics is also due to IT placing a higher emphasis in the professional curriculum or accreditation guidelines. For example, in IT 2107 (ACM & AIS, 2017), data analytics is a primary competency whilst in the 2021 Accounting Professional Accreditation Guidelines (CPA & CAANZ, 2021), it is treated as an item for enrichment.

The scope of data analytics is expanding and becoming more multi-interdisciplinary or interdisciplinary. This is caused by the growing demands from various industries but mainly, in the broad business category (Mamonov et al., 2015). The demands are so huge that they cannot be satisfied only by the IT expansion. Many disciplines start offering their own data analytics courses in various forms, such as marketing analytics, financial informatics and business analytics, and this trend is continuing (Radovilsky et al., 2020). In the data analytics job market, professions are not in a binary division (IT versus non-IT) anymore, but have now possibly adopted a transformed structure. In the literature that studies professions in association with data analytics, professions are varied a lot and are identified in different ways. For example, De Mauro et al. (2018) identifies the professions as business analyst, data scientist, developer and engineer, while Verma et al. (2019) identifies them as business analyst, business intelligence analyst, data analyst and data scientist. These variations confuse educators, developers and evaluators when they are trying to design and develop a

data analytics curriculum that targets the professional market. Therefore, finding the major professions in the job market and identifying the important competencies that distinguish each profession are crucial.

Business analyst, data analyst and data scientist appear to be three professions that are commonly found in the previous studies (Wilder & Ozgur, 2015; Mamonov et al., 2015; Halwani et al., 2021). These studies share a view that business analyst professionals graduate from the traditional business schools, possessing competencies such as consumer behaviour analysis, sales forecasting and financial fraud detection; data analyst professionals grow from the traditional IT schools (more specifically, in the IS specialisation), featuring skills such as database management, programming and application of infrastructures (distributed, cloud, etc.), and lastly, data scientist professionals expand from the traditional applied mathematics or statistics schools, demonstrating capabilities such as data description, statistical analysis, algorithmic and intelligence modelling. The professionals' names are sometimes used interchangeably. For example, data scientist is used interchangeably with data analyst by De Mauro et al. (2018), but it is identified as an umbrella term, including data analyst in Dong and Triche (2020). In Aasheim et al.'s opinion (2015), both data analyst and data scientist are developed from IT schools. The composite set of competencies, skills and capabilities that are contributed from all the three professions largely remains the same across the various studies (De Mauro et al., 2018; Halwani et al., 2021).

2.3 Professions in further examination

There is a number of studies that reveal how professions are formed and divided in the data analytics job market. Table 1 shows the professions and how they are substantiated in competency focuses and emphasised skills that are reported in this brief literature review.

Author (year)	Data	Study context	Division of professions	Competency focus	Emphasised skills
Wilder & Ozgur, 2015	University course descriptions	U.S.	Data scientist	Quantitative expertise	Development of models and communication of results
			Data specialist	Data management expertise	Accessing and displaying data
Aasheim et al., 2015	University course descriptions	U.S.	Data analyst	Apply data warehousing and programming in business	Application of data mining
De Mauo et al., 2017	Job advertisements	U.S.	Data scientist	Apply data analytics and methods to insights	Data methods, understanding of data warehouse queries
			Developer	Design, develop and modify data-reliant application software	Coding, cloud computing and distributed technology
			Engineer	Build and maintain full technology infrastructure	Data architecture and enterprise eco-systems
			Business analyst	Transform insights to business impact	Manage projects and create business impact
Radovilsky et al., 2020	Job advertisements	U.S.	Data science	Apply algorithms and programming language	Machine learning, programming, and big data technology
			Business analytics	Database design and big data technology application	SQL, python, statistics in design, processing and analysis
Verma et al., 2019	Job advertisements	U.S.	Data scientist	Apply computer science to analyse big data sets	Statistical and programming skills
			Data analyst	Apply statistical analysis and business acumen to big data	Communication and statistical skills
			Business intelligence analyst	Use computer-based tools to solve business problems	Applying structured data management skills and statistical knowledge
			Business analyst	Disciplinary analysis in business domain	Using domain knowledge and data management skills
Dong & Triche, 2020	Job advertisements	U.S.	Data scientist	Find values in data and create data products	Data hacking, analysis, communication and advice
			Data analyst	Clean, transform and model data for decision-making	Recognition of data problems and solving them
			Business intelligence analyst	A range of applications, technologies, and architectures to store, access and analyse data	Using fact-based support systems
Halwani et al., 2021	Job advertisements	U.S.	Data scientist	Mine and analyse data for business, and design architecture for relational databases	Discovering, extracting and analysing data for decision-making and prediction
			Data analyst	Initialise to develop tools, data collection processes and data management systems	Using analytical and technical skills (esp. relational database and data modelling)
			Big data analytics professional	Apply semantic correlation, ontology and text analytics techniques	Developing datasets, automation and data validation processes

Table 1. Professions, competency focus, and emphasised skills identified in previous studies

There are obvious discrepancies in the competency focuses and emphasised skills for each profession. Data analyst, for instance, as identified by Verma et al. (2019), has expertise in both statistics and business. But, according to Dong and Triche (2020), it specialises in data cleaning, transformation, and modelling. In the key skills that are identified for business analyst, De Mauro et al. (2018) emphasises on managing projects and making business impacts, whilst Halwani et al. (2021) highlights creating data-driven strategies and performing cross-functional (visualised) communications.

2.4 Competencies in deeper examination

Data analytics-related competencies include coding, database management, project management, distributed computing, analytics, and business impact; and after adding visualisation as informed by Chang et al. (2018) and Sun and Huo (2020), a comprehensive set of dimensions is achieved as in Table 2.

Author (year)	Coding	Database management	Project management	Distributed Computing	Statistics and algorithms	Business impact	Visualisation
Aasheim et al., 2015	DS	DS			DS		DS
Wilder & Ozgur, 2015					DS		DS
De Mauro et al., 2018		DS	DS		DS	DS	
Radovilsky et atl, 2020	DS		DS	DS	DS		
Halwani et al., 2021					DS	DS	

Table 2. Data analytics competencies in the data scientist profession

We examine data scientist (DS) as an example. Coding is claimed for data scientist professionals by Aasheim et al. (2015), Radovilsky et al. (2020) and Verma et al. (2019), while it is not recognised by Wilder and Ozgur (2015). Some skills such as Microsoft Access, SAP and Congos (for database development and systems management) have declined whilst Python, R and Tableau (for data analytics and visualisation) are on the rise (Dong and Triche, 2020).

3. Findings and Discussion

Business analyst, data analyst and data scientist are the major professions in the data analytics job market. As shown in Figure 1, the business analyst profession shows the range of technical competencies developed in traditional business schools; the data analyst profession, competencies from IT schools; and the data scientist profession, skills from applied mathematics. In the technical dimension, the business analyst profession takes the lower range, and the data scientist profession takes the higher range. The data analyst profession takes a wider range, from both the business analyst and data scientist areas.

Figure 1. Competencies for the three professions in the data analytics job market

Data scientist professionals extend their applied mathematical and statistical skills through competencies in programming, algorithmic and intelligence modelling, and machine learning. Apart from roles in database management, software development and infrastructure development, data analysts share some competencies from the business analyst and data scientist areas. They are involved with visualisation, application of systems and tools, programming, and using machine learning algorithms. However, an IT school curriculum should also take in modules from the business and science domains.

In Australia and New Zealand, the data analytics job market is largely distributed in IT and business industries in the order of marketing, accounting, banking and government administration from large to small, as shown in Figure 2 below:

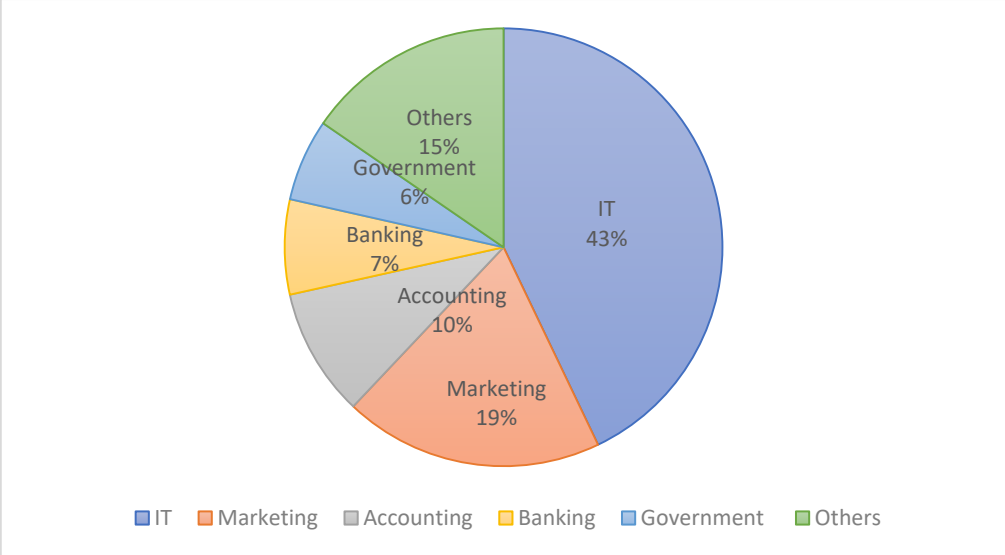

Figure 2. Five industries that demand data analytics, in percentage of the total job number

Surprisingly, those industries such as healthcare, logistics and mining that are often targeted by many IT and business schools are not in the mainstream job market.

4. Implications for Schools and Professional Accreditation Bodies

There are several implications that are derived from this study:

• When developing a program or a course in data analytics, a school should follow its disciplinary tradition. For example, if it is an IT school, then grow the curriculum from its existing IT skillset. In other words, do not forgo the existent repertoire but extend or enrich it.

• Certain competencies, as shown in Figure 1, will still need to be retained to maintain the discipline's core, the curriculum coherence, and to target the job market niche that is well established.

• No matter what a discipline is, the list of competencies as shown in Figure 1 must be covered (more or less). This is potentially important for a professional accreditation body when accrediting a program or a course aiming to have a data analytics focus or as a major learning outcome. The range of the competencies that each profession takes should also be referred to by the corresponding professional accreditation bodies.

5. Limitations and Directions for Future Studies

There are certain limitations associated with this study. The most salient ones are:

• Data collected for this study was from a certain period. It may need updating to recognise that competencies for data analytics (as a young professional domain) are still shaping and reshaping in the job market.

• Methods in this study are based on the literature and the job descriptions which are probably not fully and correctly reflecting the data analytics job reality.

It is suggested the following approaches should be attempted for the studies in the future:
• Apply data mining of a larger set of data (data analytics job descriptions) in the job market to refine the distinctive competencies for the different professions.
• Interview employers, educators and practitioners in data analytics. This may obtain more insights about the professions and associated technical competencies.

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