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Measuring the digitalisation of Australia's economy 2012–13 to 2016–17

Mapping the economic contribution of IoT, ICT and digital activity in Australia

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Statistical working paper—experimental estimates

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Glossary

This glossary provides a general guide to terms used in this paper. Unless otherwise stated, the majority of the glossary is defined by the Australian Bureau of Statistics.

Current prices—Measure the value of goods and services based on their prices at the period in which the transaction occurred.

Digital activity—The BCAR adopts the structure used by the US Bureau of Economic Analysis (BEA), which is split into three categories: digital-enabling infrastructure, e-commerce and digital media.

Domestic output—Represents total Australian production. This is the sum of final goods and services produced (also known as GVA) and total intermediate use.

Gross value added (GVA)—The value of output less the value of intermediate use and is a measure of the contribution to GDP made by an individual producer, industry or sector.

Implicit price deflator (IPD)—Captures the change in price between current prices and volume measures.

Input-Output tables—A means of presenting a detailed analysis of the process of production and the use of goods and services (products) and the income generated in the production process. These tables can be either in the form of (a) supply and use tables or (b) symmetric input and output tables.

ICT activity—The BCAR defines ICT activity as a broader measure of communications technology and services. ICT includes goods that capture, store, transmit and display data and information electronically (such as computers and television receivers) and services that facilitate the use of these goods (such as computer system design).

IoT activity—The BCAR defines IoT activity as the final goods or services produced that enable an internet connection between physical objects, such as semi-conductors and sensors.

National accounts—The complete and consistent accounting approach for measuring the economic activity of a nation.

Satellite account—A framework linked to the national accounts, which enables focused attention on a particular aspect of economic or social life by combining national accounts estimates with the findings of other surveys and statistics.

Volume measures—Captures economic activity for a given period without accounting for changes in price.

Executive summary

Advances in communications technologies are transforming Australia's economy. Digitalisation—the use of digital technologies to transform business activities—is giving businesses greater connectivity and efficiency through new communication channels, data management systems and an increased online presence. These activities are found across all sectors of the economy.

While digitalised activities are already captured in Australia's national accounts, they are incorporated in industry aggregates which do not explicitly identify digital drivers. This creates a gap in information that affects understanding of the size and importance of these technologies to the economy.

To help fill this gap, this paper presents estimates of the direct economic contribution of three measures of digitalised activities—the Internet of Things (IoT) activity, Information and Communications Technology (ICT) activity, and digital activity.

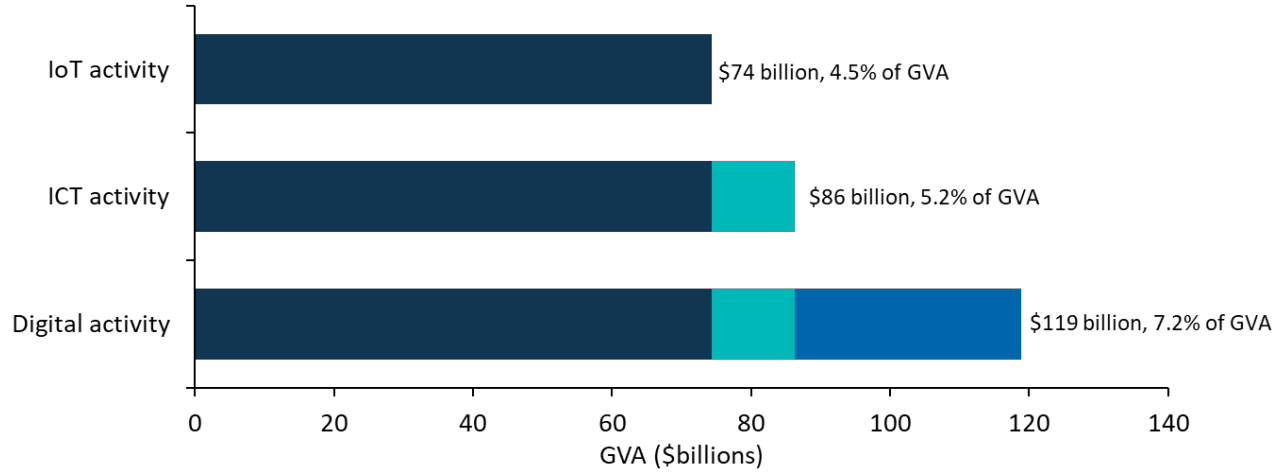
- IoT activity is defined in this analysis as the final goods and services produced that enable an internet connection. IoT activity consists of hardware, software, telecommunications, internet service providers, support services and big data. IoT activity is a subset of both ICT activity and digital activity.
- ICT activity is defined as goods that capture, store, transmit and display data and information electronically and services that facilitate the use of these goods. ICT activity is a subset of digital activity, and includes digital enabling infrastructure (but excludes construction in telecommunications infrastructure) and digital media.
- Digital activity consists of three broad categories: digital enabling infrastructure, e-commerce and digital media.

These estimates are presented over a 5-year period in order to track the pace at which activity is growing over time.

Key findings

Digitalised goods and services play an important role in the Australian economy (Figure 1). The gross value added (GVA) from these activities represents a growing share of the economy.

Figure 1. IoT, ICT and digital activity estimates, gross value added in 2016–17



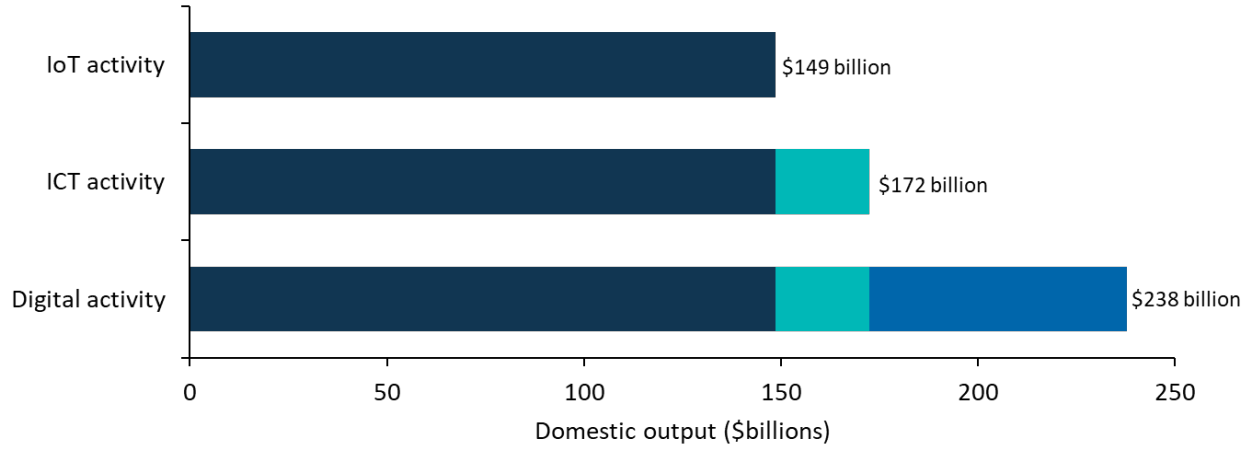
Source: ABS cat. 5215, 5217; BCAR estimates.

Growth in IoT activity, ICT activity and digital activity outpaced growth in the economy overall between 2014–15 and 2016–17. This is consistent with technological advances which have seen a transition towards goods and services that are primarily digitally-enabling, such as computer system design and telecommunications services.

Growth rates are even stronger once price effects are removed, as prices for these three activities have fallen due to advances in telecommunications technology and network infrastructure as well as domestic price competition in telecommunications services.

Domestic output, which is a broader measure of economic activity that also includes goods and services used up in the process of production, was more than double the size of the equivalent GVA measures (Figure 2).

Figure 2. IoT, ICT and digital activity estimates, domestic output in 2016–17

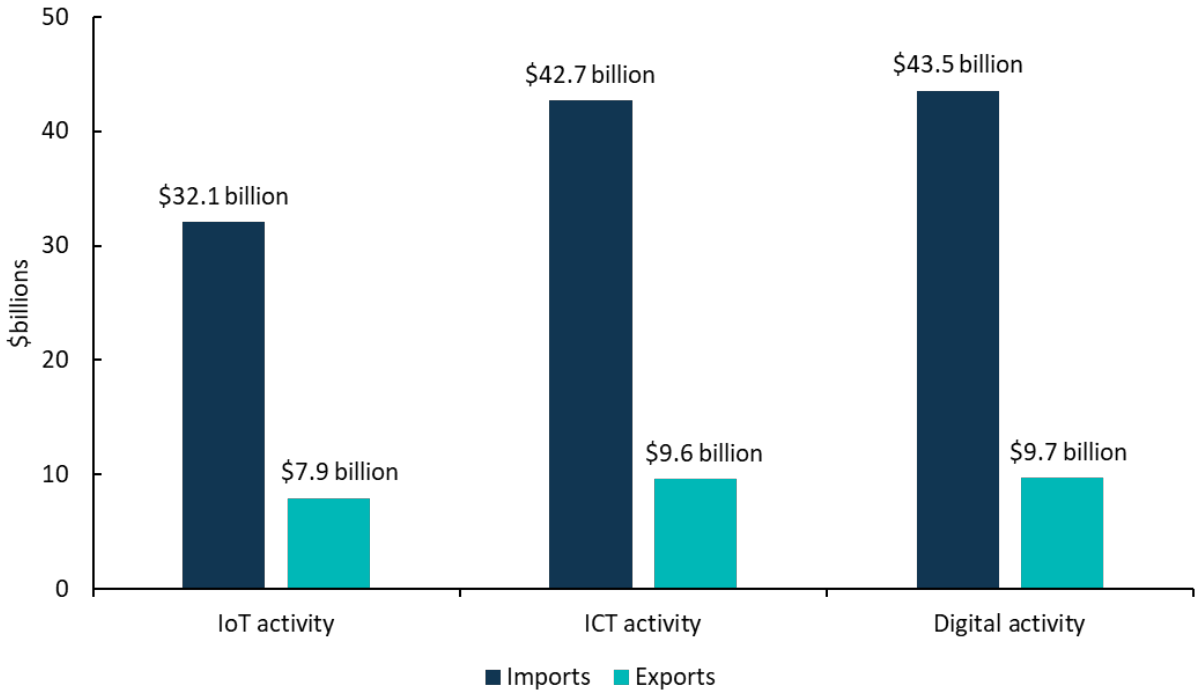


Source: ABS cat. 5215, 5217; BCAR estimates.

Support services—such as data storage, design of hardware and software, and development services—was the main driver of IoT and ICT activity's growth in domestic output. For digital activity, construction in telecommunications infrastructure was the largest contributor to growth and was driven by the continued rollout of the National Broadband Network (NBN).

The contribution of international trade to digitalised products shows that imports to Australia were around four times larger than exports for each activity (Figure 3). Despite a weakening Australian dollar, imports continued to increase, driven by growth in goods-based imports such as communications equipment. Exports for digitalised products, while much lower than imports, also increased and were driven by growth in services-based exports such as support services.

Figure 3. IoT, ICT and digital activity estimates, imports and exports in 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Measuring digitalised activities

Economic analysis of the value of digital technologies has been limited in both national and international contexts. This is particularly evident in efforts to measure IoT activity—where there is no accepted definition of IoT or of the economic value from the production of IoT-related goods and services (IoT activity). As is the case generally for the analysis of technologies, economic attribution that comes as a direct result of IoT can be difficult to quantify. This is because technologies act as enablers, both within and across industries, and are used in conjunction with other emerging technologies—in IoT's case, with artificial intelligence, cloud and edge computing. Caution should, therefore, be taken when attributing the direct impact of digital technologies on economic growth and productivity, particularly for emerging technologies such as IoT.

As international organisations continue to work towards delivering an international standard for measuring digital activity, the Bureau of Communications and Arts Research (BCAR) estimates should be considered experimental. These estimates aim to provide a resource for government and industry on the role and influence of digitalised parts of the economy and contribute to the discussion on how to measure these activities within the Australian economy.

Box 1: Defining IoT activity, ICT activity and digital activity

The BCAR defines IoT activity as the transactions of goods and services in the economy that enable an internet connection. This can range from tangible products (such as semi-conductors and sensors) to intangibles (such as software publishing). This definition refers to economic activity from the production of final goods and services that underpin an internet connection. These goods and services were based on the product categories used in Australia's national accounts.

ICT activity and digital activity are broader measures of the digital goods and services in the economy. ICT activity includes goods that capture, store, transmit and display data and information electronically (such as computers and television receivers) and services that facilitate the use of these goods (such as computer system design services, and digital media).

Digital activity is an even more expansive measure of digitalisation that includes both ICT activity and IoT activity. Digital activity includes all components within digital-enabling infrastructure and digital media, as well as e-commerce.

For each measure, only transactions for final goods and services are included. These measures do not include the value or the accumulation of assets or activity that has occurred at intermediate phases of production. This is to avoid double counting and to ensure that only the direct contribution to the economy is included.

The estimates provided in this paper were developed using the well-established approach of creating a 'satellite account' which enables economic activities to be measured for particular areas of interest using the Australian System of National Accounts. The BCAR has previously used this approach to estimate the economic contribution of cultural and creative activity to Australia's economy, using a methodology developed by the Australian Bureau of Statistics (ABS).

The methodology adopts the framework developed by the US Bureau of Economic Analysis (BEA) to define and measure the digital economy.[1] This methodology is applied to Australia's national accounts framework to estimate the value of IoT activity, ICT activity and digital activity.

11. Measuring the digitalisation of Australia's economy, 2012–13 to 2016–17

While this approach is broadly consistent with the ABS measure of digital activity,[2] the approach presented in this paper also includes construction in telecommunications infrastructure to capture the significant economic activity involved in telecommunications infrastructure, including the NBN rollout.

The following section provides an overview of the framework and compares the contribution of IoT, ICT and digital activity in nominal (current prices) and volume (price adjusted) terms, and how the price of digitalised goods and services has changed over time. The section also shows how digitalised activities compare with other key sectors of the economy. The paper then presents estimates of domestic output from these activities, which shows their significance to Australian production. The paper concludes with a detailed examination of the role of digital goods and services in Australia's trade.

The appendices present a more detailed breakdown of IoT activity, ICT activity and digital activity. Appendix A and Appendix B provide estimates by component (e.g. hardware, software) for domestic output and international trade, respectively. Appendix C presents estimates by industry division in current prices and volume measures. Appendix D, Appendix E and Appendix F provide a detailed explanation of the methodology and scope.

The economic value of IoT, ICT, and digital activity

The approach used in this paper takes the framework developed by the BEA to measure the size of the digital economy. It extends and adapts the BEA definition and scope to measure the value of digitalisation for the Australian economy over the period 2012–13 to 2016–17. This framework utilises Australian data which requires additional assumptions (outlined in Appendix D) which differ from established classifications and processes within Australia's national accounts. Therefore, the estimates shown in this paper should be considered experimental at this stage.

The paper provides estimates for three measures of digitalisation.

- IoT activity is defined in this analysis as the final goods and services produced that enable an internet connection. Using the BEA framework of digital economy goods and services, IoT activity consists of hardware, software, telecommunications, internet service providers (ISPs), support services and big data. IoT activity is a subset of both ICT activity and digital activity.
- ICT activity is defined as goods that capture, store, transmit and display data and information electronically and services that facilitate the use of these goods. ICT activity is a subset of digital activity, and includes digital enabling infrastructure (but excludes construction in telecommunications infrastructure) and digital media.
- Digital activity consists of three broad categories: digital enabling infrastructure, e-commerce and digital media.

The definitions of IoT, ICT and digital activity are categorised using product classifications presented in the input-output tables that are part of the Australian national accounts. These tables are detailed in Appendix E.

In this paper, the BCAR has estimated the economic contribution of IoT, ICT and digital activity by measuring their gross value added (GVA). GVA is a measure of the contribution to domestic production made by an individual producer, industry or sector. This is the value of output less the value of the goods and services used up in the process of production. By excluding net taxes, GVA provides a more accurate measure of economic activity by industry than does gross domestic product (GDP).

In line with national accounts reporting, the BCAR's estimates of the economic contribution of digitalisation are provided in both current prices and volume terms. Including GVA estimates for both series offer insights into the role of price changes within the digitalised economy.

Economic contribution in current prices

Current prices (or nominal terms) measure the value of goods and services based on their prices at the time of the transaction. For example, estimates for financial year 2016–17 are valued using that financial year's prices and are not adjusted for inflation.[3]

Current prices are the most common way to measure the monetary value of economic activity as it shows the influence of price changes over time. The role of price is particularly important for measuring digitalisation, as prices in Australia for digitalised goods and services have fallen over the period analysed.

As shown in Table 1 and Figure 4, the economic contribution in current price terms shows:

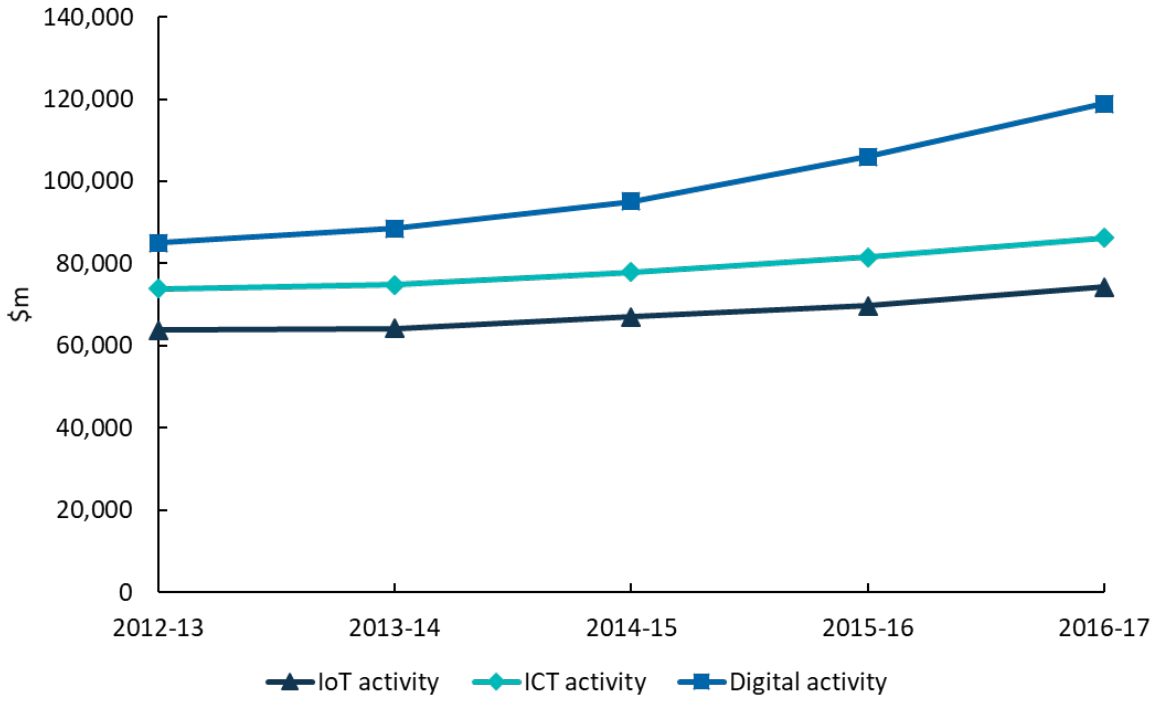
- IoT activity increased by $10.5 billion or 16.5 per cent, from $63.8 billion in 2012–13 to $74.3 billion in 2016–17
- ICT activity increased by $12.3 billion or 16.6 per cent, from $73.9 billion in 2012–13 to $86.2 billion in 2016–17
- Digital activity increased by $33.9 billion or 39.9 per cent, from $85.0 billion in 2012–13 to $118.9 billion in 2016–17.

Table 1. IoT, ICT and digital activity GVA, 2012–13 and 2016–17, current prices

Gross Value Added—current prices ($m)	2012–13	2016–17	% change
IoT activity	63,777	74,284	16.5
As a share of GVA (%)	4.4	4.5	-
ICT activity	73,915	86,216	16.6
As a share of GVA (%)	5.1	5.2	-
Digital activity	84,986	118,917	39.9
As a share of GVA (%)	5.9	7.2	-

Source: ABS cat. 5215, 5217; BCAR estimates.

Figure 4. IoT, ICT and digital activity GVA, 2012–13 to 2016–17, current prices

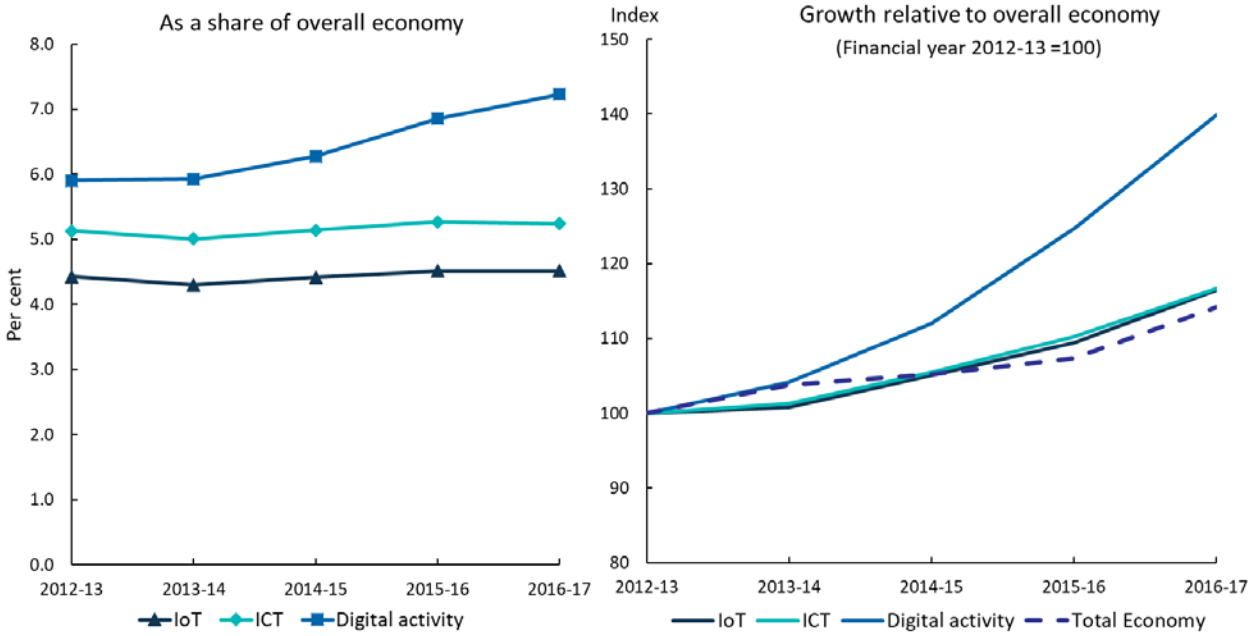


Source: ABS cat. 5215, 5217; BCAR estimates.

As a share of the economy, all three activities grew over the period 2012–13 and 2016–17. IoT and ICT activity both increased their shares of GVA by 0.1 percentage point, while digital activity increased by 1.3 percentage points over the period (Figure 5, left panel).

Growth in IoT, ICT and digital activity have outpaced growth in the economy overall between 2014–15 and 2016–17. Growth in digital activity more than doubled the pace of the economy, increasing by 39.9 per cent, compared with economy-wide growth of 14.2 per cent over the period (Figure 5, right panel).

Figure 5. GVA as a share and growth relative to overall economy, current prices, 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.
Note: The dashed series represents GVA growth for the entire Australian economy relative to the base year.

Industry contributors to growth in digitalised activities

The main industry contributor to growth in IoT and ICT activity was the Information media and telecommunications (IMT) industry. For IoT activity, IMT increased from $29.6 billion in 2012–13 to $34.5 billion in 2016–17. For ICT activity, it increased from $38.9 billion to $45.5 billion over the period.

The IMT division is a critical enabler of digitalisation across the economy. This industry provides networks to support digital connectivity and to create, store, manage and analyse data from digital applications. As most goods and services produced by the IMT division are related to digitalised activities, the direct contribution of this industry is quite large. The growth within IMT was driven by telecommunications services, internet publishing, and broadcasting services, which have experienced increased demand due to the growing ubiquity of mobile and internet services.

For digital activity, growth also came from construction in telecommunications infrastructure. This construction includes the rollout of NBN infrastructure across Australia as well as private investment in telecommunications networks. Construction in telecommunications infrastructure increased by 227.6 per cent over the period, from $8.4 billion in 2012–13 to $27.5 billion in 2016–17.

Economic contribution in volume measures

Volume measures (or real terms) are inflation-adjusted estimates which capture economic activity for a given period once price changes are removed. By keeping prices constant, these measures better reflect how much goods and services are produced over time. Volume measures are presented as changes in GVA over time (GVA growth rates).

In volume measures, growth in the economic contribution of digitalisation was much greater than when measured in current prices. The higher rates of GVA growth in volume measures indicate a fall in the prices of digitalised goods and services over the period which have partially offset growth in the value of digitalisation.

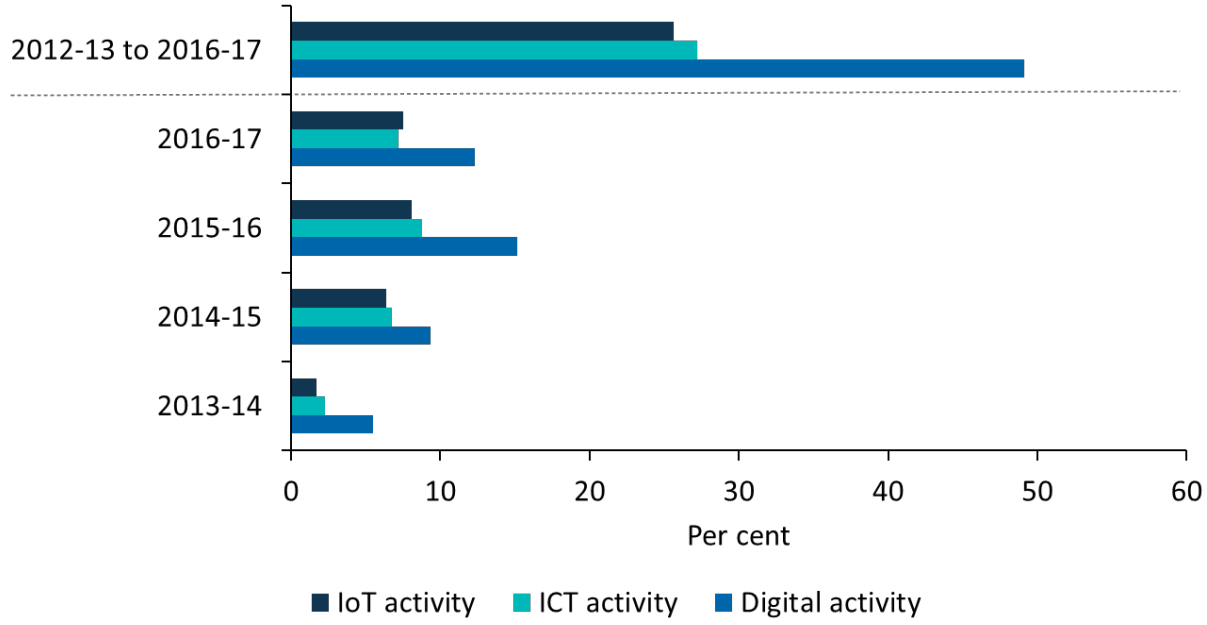
As shown in Table 2 and Figure 6, IoT activity in volume measures grew by 7.5 per cent in 2016–17 and by 25.6 per cent from 2012–13 to 2016–17. ICT activity experienced similar growth, increasing by 7.2 per cent in 2016–17 and by 27.2 per cent over the entire period analysed. Digital activity experienced the strongest growth of the three measures of digitalised activities, growing by 12.3 per cent in 2016–17 and by 49.1 per cent over the same period.

Table 2. GVA growth rate of IoT, ICT and digital activity, from 2012–13 to 2016–17, volume measures

Gross Value Added growth rate (%)	IoT activity	ICT activity	Digital activity
2013–14	1.7	2.2	5.5
2014–15	6.4	6.7	9.3
2015–16	8.1	8.8	15.2
2016–17	7.5	7.2	12.3
2012–13 to 2016–17	25.6	27.2	49.1

Source: ABS cat. 5215, 5217, 5204; BCAR estimates.

Figure 6. GVA growth rate, 2012–13 to 2016–17, volume measures

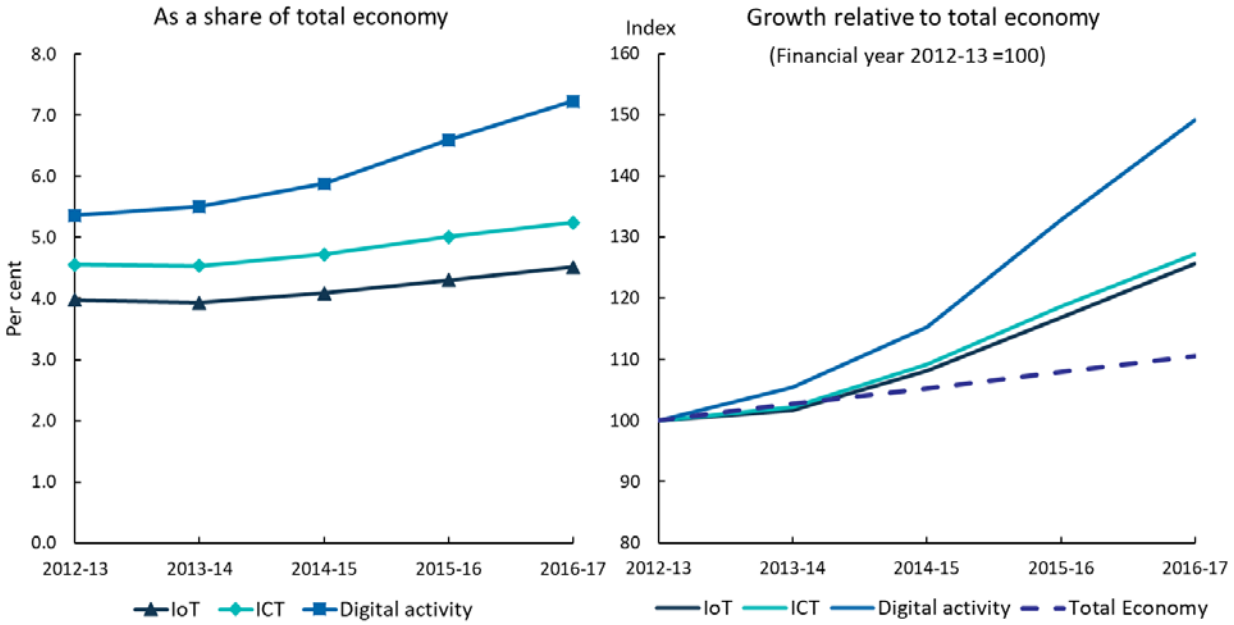


Source: ABS cat. 5215, 5217, 5204; BCAR estimates.

As a share of the economy, all three activities grew by more in volume measures than in current prices from 2012–13 to 2016–17. During this period, IoT activity's share of the economy increased by 0.5 percentage points, ICT activity increased by 0.7 percentage points, while digital activity increased by 1.9 percentage (Figure 7, left panel).

Growth rates for IoT and ICT activity were double the pace of growth in the economy, while growth in digital activity was more than quadruple the growth rate for the economy (Figure 7, right panel).

Figure 7. GVA as a share and growth relative to overall economy, volume measures, 2012–13 to 2016–17



Source: ABS cat. 5215, 5217, 5204; BCAR estimates.
Note: The dashed series represents GVA growth for the entire Australian economy relative to the base year.

The drivers of growth for the three measures of digitalisation in volume measures are for the same reasons as those described in current prices. Digital activity was primarily driven by construction in telecommunications infrastructure and the IMT industry, while growth in IoT activity and ICT activity was driven by the IMT industry.

Change in prices

Implicit price deflators (IPD) capture the change in prices and are measured as the differences between current prices and volume measures. These price deflators reveal that the prices for each measure of digitalisation have declined every year from 2012–13 to 2016–17 (Table 3 and Figure 8). During this period, prices declined by an average of 2.0 per cent per year for IoT activity, 2.3 per cent for ICT activity, and 1.7 per cent for digital activity.

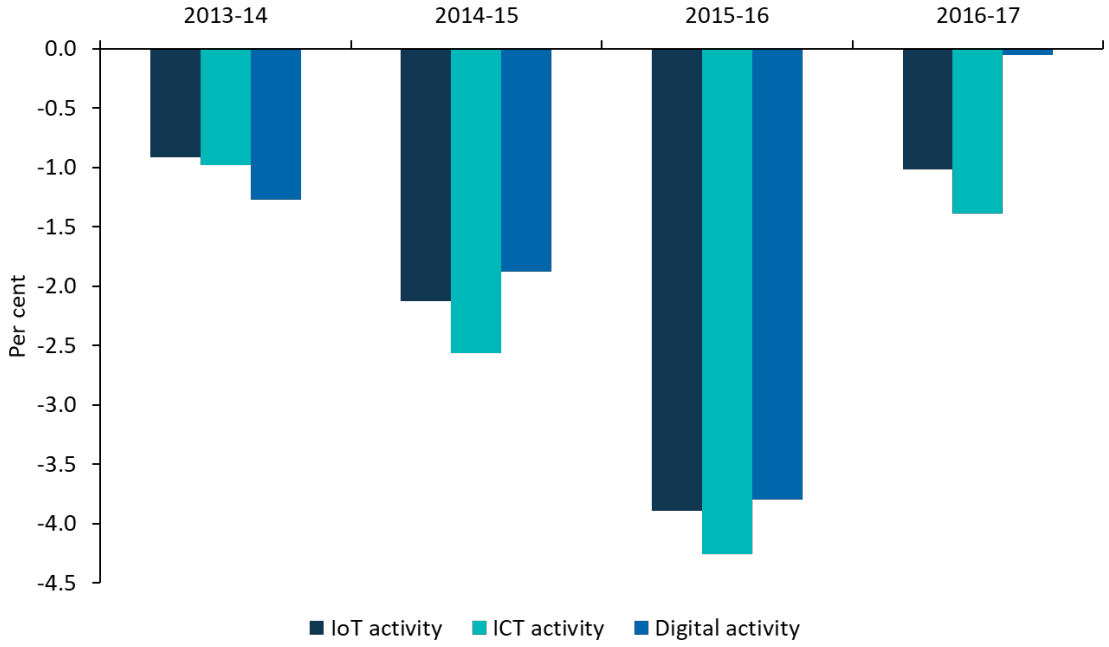
Table 3. IoT, ICT and digital activity GVA, implicit price deflator (IPD), 2012–13 to 2016–17

IPD Movement	2012–13	2013–14	2014–15	2015–16	2016–17	Compound annual growth rate
IoT activity						
Current prices ($m)	63,777	64,258	66,980	69,767	74,284	
Current prices movement (%)		0.8	4.2	4.2	6.5	3.9
Volume measures movement (%)		1.7	6.4	8.1	7.5	5.9
IoT activity IPD movement (%)		-0.9	-2.1	-3.9	-1.0	-2.0
ICT activity						
Current prices ($m)	73,915	74,843	77,967	81,498	86,216	
Current prices movement (%)		1.3	4.2	4.5	5.8	3.9
Volume measures movement (%)		2.2	6.7	8.8	7.2	6.2
ICT activity IPD movement (%)		-1.0	-2.6	-4.3	-1.4	-2.3
Digital activity						
Current prices ($m)	84,986	88,544	95,151	105,959	118,917	
Current prices movement (%)		4.2	7.5	11.4	12.2	8.8
Volume measures movement (%)		5.5	9.3	15.2	12.3	10.5
Digital activity IPD movement (%)		-1.3	-1.9	-3.8	-0.1	-1.7

Source: ABS cat. 5215, 5217; BCAR estimates Source: ABS cat. 5215, 5217, 5204; BCAR estimates.

Price declines for digitalisation are likely to be driven by efficiencies in network infrastructure including the rollout of 4G and the NBN and by strong domestic price competition in telecommunications services from providers aiming to increase market share, largely supported by the growing ubiquity of smartphones.[4]

Figure 8. Implicit price deflator movement, 2013–14 to 2016–17



Source: ABS cat. 5215, 5217, 5204; BCAR estimates.

Comparison with Australian industries

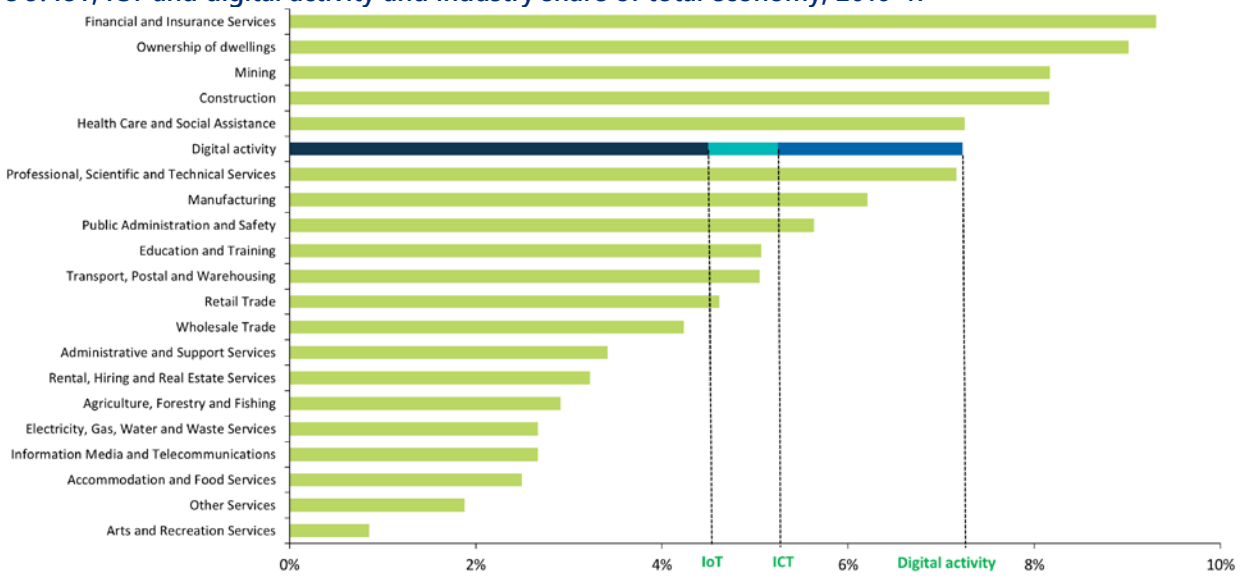
The Australian System of National Accounts lists 19 industries in the Australian economy. When added together with ownership of dwellings, the activity in these industries equals the total amount of final goods and services produced in the economy in a given period.

The measures of digitalisation, on the other hand, include output produced by these 19 industries across the economy. As activity from digitalisation is already contained within these industries, caution should be used when comparing the measures of digitalisation to these industry shares.

In 2016–17, the digitalisation measures in Figure 9 show:

- IoT activity (4.5 per cent of GVA) would sit alongside retail trade (4.6 per cent) and wholesale trade (4.2 per cent)
- ICT activity (5.2 per cent of GVA) would sit between public administration and safety (5.6 per cent) and education and training (5.1 per cent)
- Digital activity (7.2 per cent to GVA) is comparable to healthcare and social assistance (7.3 per cent of GVA) and professional, scientific and technical services (7.2 per cent).

Figure 9. IoT, ICT and digital activity and industry share of total economy, 2016–17



Source: ABS cat. 5204, 5215, 5217; BCAR estimates.
Note: The industry shares (shown in light green) already contain activity from digitalisation. Caution should therefore be used when comparing IoT, ICT and digital activity (shown in blue) to these industry shares.

Further information on the disaggregated estimates of IoT, ICT and digital activity GVA by industry division can be found in Appendix C.

Domestic output

Domestic output represents total Australian production in the economy. This is a much broader measure of economic activity than GVA as it includes not only the final goods and services produced in the economy but the goods and services used up in the process of production.

The estimates show that digitalised goods and services are important inputs to Australian production. Domestic output for the three measures of digitalisation were more than double the size of the equivalent GVA measures over the period 2012–13 to 2016–17, while growth rates for digitalisation remained similar for both output and GVA.

As shown in Table 4, domestic output in current price terms shows:

- IoT activity increased by $19.5 billion or 15.1 per cent, from $129.1 billion in 2012–13 to $148.6 billion in 2016–17
- ICT activity increased by $22.8 billion or 15.2 per cent, from $149.6 billion in 2012–13 to $172.4 billion in 2016–17
- Digital activity increased by $65.8 billion or 38.2 per cent, from $172.0 billion in 2012–13 to $237.8 billion in 2016–17.

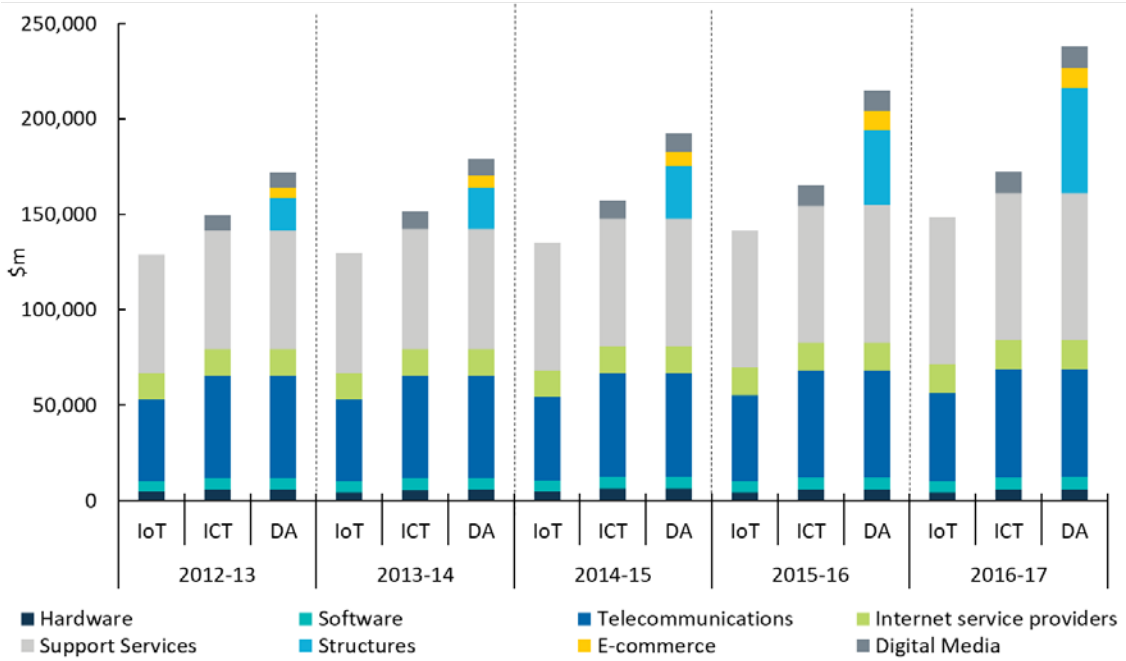
Table 4. Domestic output of IoT, ICT and digital activity, 2012–13 to 2016–17

Domestic output	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	129,095	129,929	135,339	141,502	148,557	19,461	15.1%
ICT activity	149,616	151,333	157,538	165,295	172,419	22,803	15.2%
Digital activity	172,026	179,036	192,260	214,906	237,818	65,791	38.2%

Source: ABS cat. 5215, 5217; BCAR estimates.

The main drivers of growth in domestic output over the period were in support services and structures (Figure 10). Support services for the maintenance and provision of digital infrastructure, such as information storage and retrieval and hardware and software design services, was the main driver of growth for both IoT activity and ICT activity. While support services was also important for digital activity, growth in domestic output for digital activity was driven by the construction of telecommunications infrastructure. This growth was from increased investment in telecommunications infrastructure over the period, which included the continued rollout of the NBN and the expansion of 4G mobile services across Australia.

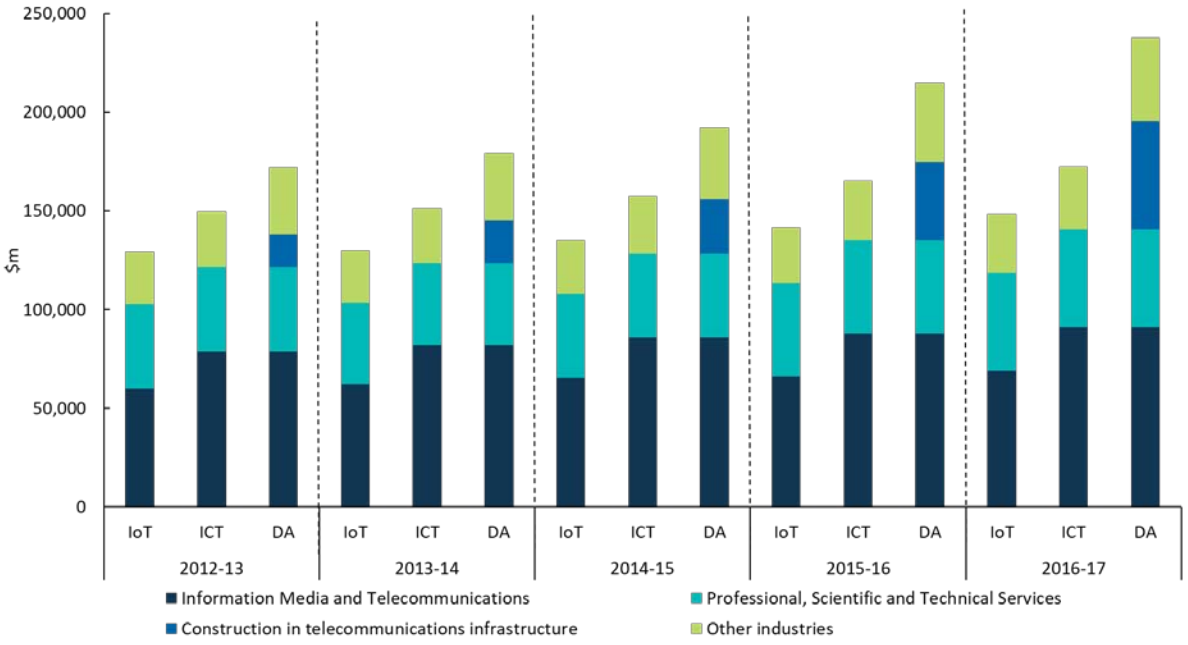
Figure 10. Domestic output of IoT, ICT and digital activity (DA), by component, 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

In terms of industry divisions, IMT was the main driver of domestic output growth for both IoT activity and ICT activity over the period from 2012–13 to 2016–17, with increases of $9.3 billion and $12.2 billion, respectively (Figure 11). Professional, scientific and technical services (PSTS) was the next largest contributor, with an increase of $7.0 billion for both IoT activity and ICT activity over the period. These two industry divisions combined represented approximately 80 per cent of IoT and ICT activity. For digital activity, output growth was driven by construction in telecommunications infrastructure, such as the NBN and 4G networks, with an increase of $38.0 billion over the period.

Figure 11. Domestic output by selected industry divisions, 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Further information on disaggregated estimates of domestic output by components (types of related goods and services) and industry divisions can be found in Appendix A and Appendix C.

International trade

International trade plays an important role in Australia's economy. Australia is a relatively open, trade-exposed country and changes in the global demand for Australian exports can have significant implications for the economy.[5]

Australia imports more communications technology than it exports and this gap continues to widen. Exports of these digitalised activities are also growing, particularly for services-based exports, but at a slower pace than imports.

Box 2: Factors affecting the adoption of communications technology

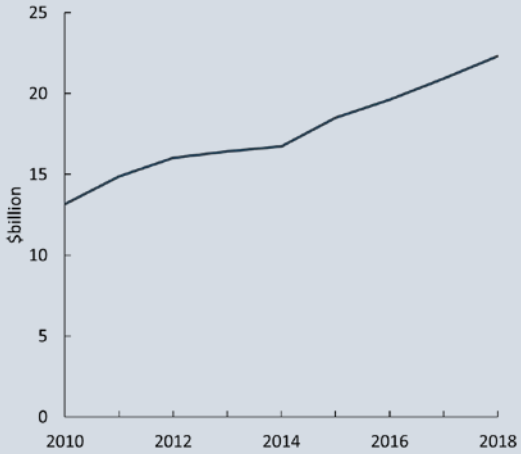
Australian businesses are moving their operations towards digitalised activities to enhance their productivity and access larger markets. Technological advances have also increased competition and added further pressure on businesses to innovate.

One way businesses have responded is by investing capital in intellectual property products, such as in computer software, which increased from $13.2 billion in 2009-10 to $22.3 billion in 2017-18 (Figure 12).

The growing digitalisation of industries has increased the demand for communications equipment.

The growth in imports has occurred despite the weaker Australian dollar.

Figure 12. Computer software, gross fixed capital formation, 2009-10 to 2017-18, current prices



Source: ABS cat. 5204.0

Over the period analysed, the Australian dollar depreciated from USD$0.93 in 2012–13 to USD$0.77 in 2016–17 (Figure 13).

Figure 13. Australian dollar against the USD, 2010 to 2018

Source: Reserve Bank of Australia, Exchange Rates.

A weaker Australian dollar has improved conditions for local manufacturers of communications technology products. While imports have become relatively more expensive, Australian exports have become comparatively cheaper and therefore more competitive in foreign markets.

Despite these improved conditions for export, Australia continues to buy more communications technology products from overseas. Australian exporters have focused on support services and the manufacture of niche goods at much lower volumes, which has bolstered export demand.

Net imports (imports less exports) for IoT, ICT and digital activity increased significantly between 2012–13 and 2016–17.

As shown in Table 5 and Figure 14, net imports for products relating to:

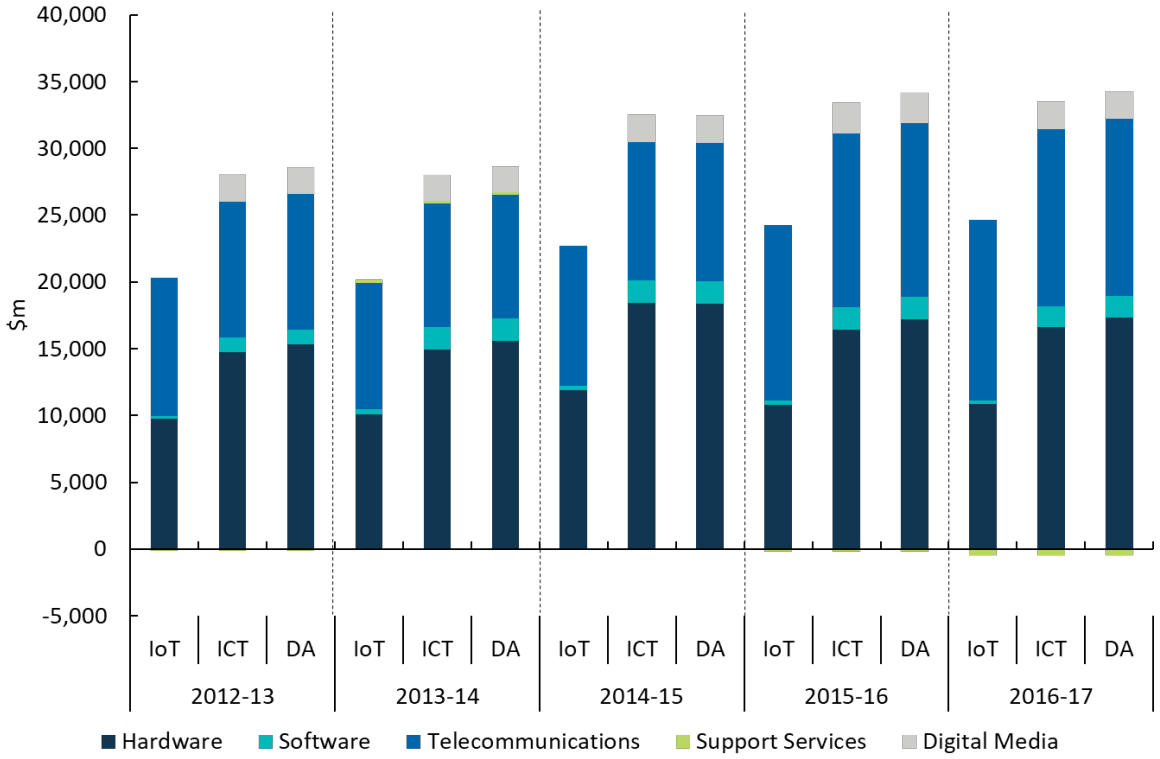
- IoT activity increased by $4.0 billion or 19.8 per cent, from $20.2 billion in 2012–13 to $24.2 billion in 2016–17.
- ICT activity increased by $5.1 billion or 18.3 per cent, from $27.9 billion in 2012–13 to $33.1 billion in 2016–17.
- Digital activity increased by $5.3 billion or 18.7 per cent, from $28.5 billion in 2012–13 to $33.8 billion in 2016–17.

Table 5. Net imports of products relating to IoT, ICT and digital activity, 2012–13 to 2016–17

Total net imports	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	20,164	20,148	22,672	24,075	24,156	3,992	19.8%
ICT activity	27,938	28,005	32,466	33,209	33,050	5,111	18.3%
Digital activity	28,488	28,648	32,417	33,962	33,814	5,325	18.7%

Source: ABS cat. 5215, 5217; BCAR estimates.

Figure 14. Net imports of IoT, ICT and digital activity (DA), by component, 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Digitalised activities are expected to continue to become more global, with imports accounting for an increasing share of domestic demand and exports accounting for an increasing share of industry revenue.[6] The increased trade in digitalised products is driven by technological change which has greatly reduced costs, particularly for trading services. Advances in software and ICT are changing the

ways of doing business and have helped to overcome financial and language barriers, allowing for a wider range of firms and consumers to come together.[7]

Further information on disaggregated estimates of international trade by different types of products for IoT, ICT and digital activity can be found in Appendix B.

Imports

Imports of all three measures of digitalised activities have experienced strong growth over the period. Imports of digitalised goods and services have provided opportunities for Australian businesses to improve productivity and access specialist technologies used in some foreign products.[8]

As shown in Table 6 and Figure 15, imports relating to:

- IoT activity increased by $6.0 billion or 22.8 per cent, from $26.1 billion in 2012–13 to $32.1 billion in 2016–17.
- ICT activity increased by $7.6 billion or 21.6 per cent, from $35.1 billion in 2012–13 to $42.7 billion in 2016–17.
- Digital activity increased by $7.8 billion or 21.9 per cent, from $35.7 billion in 2012–13 to $43.5 billion in 2016–17.

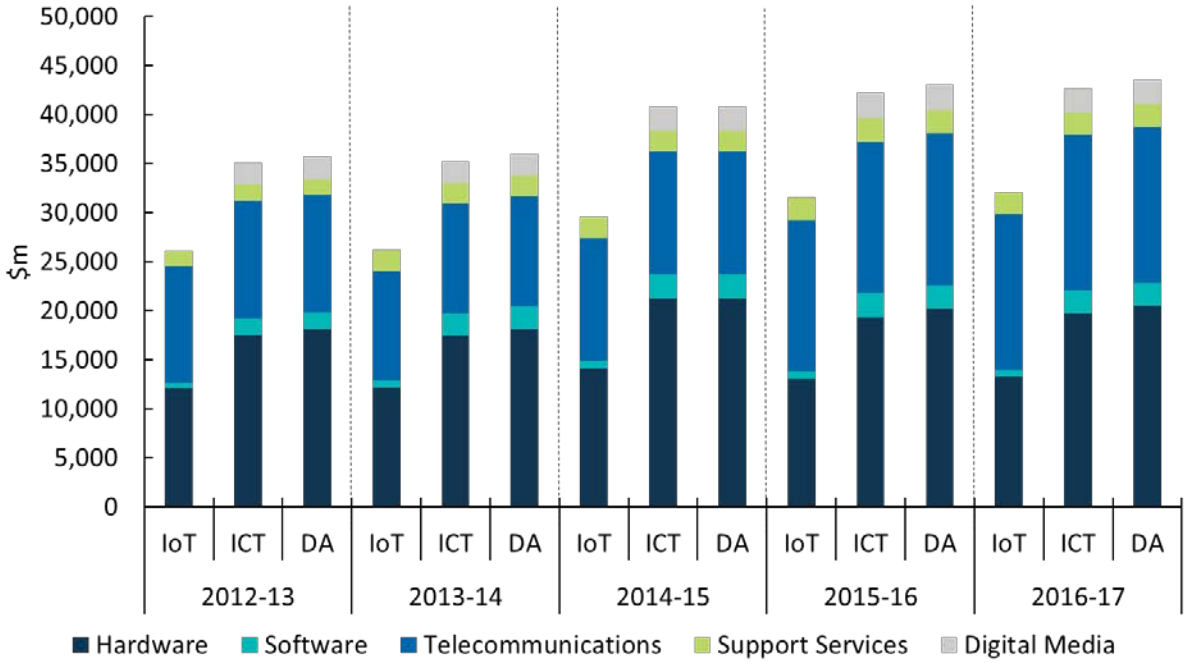
Table 6. Imports of IoT, ICT and digital activity products, 2012–13 to 2016–17

Imports total	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	26,128	26,197	29,537	31,555	32,086	5,958	22.8%
ICT activity	35,089	35,247	40,738	42,246	42,674	7,585	21.6%
Digital activity	35,674	35,944	40,738	43,046	43,489	7,814	21.9%

Source: ABS cat. 5215, 5217; BCAR estimates.

The growth in imports was driven mainly by telecommunications products, such as fixed and wireless networks and services, and hardware products, such as computer systems, monitors and other peripherals.

Figure 15. Imports of IoT, ICT and digital activity (DA), by component, 2012–13 to 2016–17[i]



Source: ABS cat. 5215, 5217; BCAR estimates.

Exports

Exports of digitalised goods and services are relatively small compared with imports. However, for all three measures of digitalised activities, exports have increased significantly over the 5-year period analysed which has coincided with the prolonged weakness of the Australian dollar.[9]

Advances in technology are an important driver of digitalised exports. Significant improvements to battery and computing power have created new electronic devices that have led to a boom in software development for these devices as well as exports for IT consultancy and support services.[10]

Exports relating to IoT activity increased by $2.0 billion or 33.0 per cent, from $6.0 billion in 2012–13 to $7.9 billion in 2016–17. Exports for ICT and digital activity both increased by approximately $2.5 billion or 34.6 per cent over the period (Table 7).

Table 7. Exports of IoT, ICT and digital activity products, 2012–13 to 2016–17

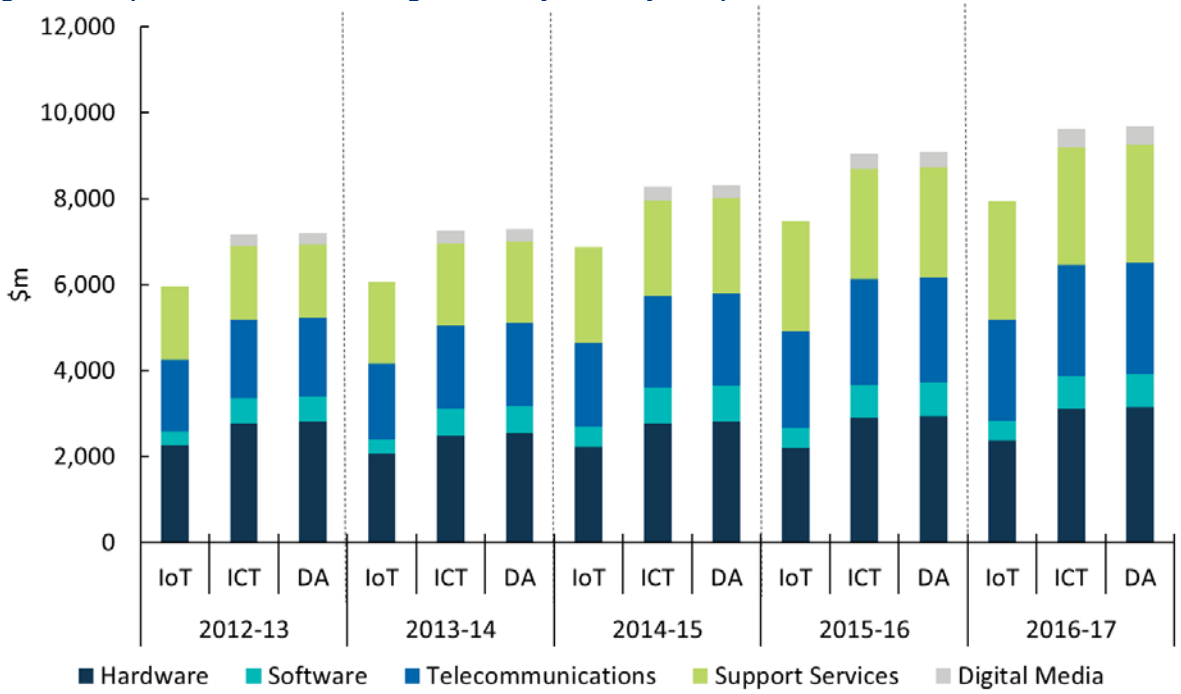
Exports total	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	5,964	6,048	6,865	7,480	7,930	1,966	33.0%
ICT activity	7,151	7,242	8,272	9,037	9,625	2,474	34.6%
Digital activity	7,186	7,296	8,321	9,084	9,675	2,489	34.6%

[i] No international trade exists for ISPs, structures, and E-commerce.

Source: ABS cat. 5215, 5217; BCAR estimates.

The growth in exports for all three measures of digitalisation was driven mainly by products relating to support services, which includes services to store and retrieve information, as well as computer support and design of hardware and software (Figure 16).

Figure 16. Exports of IoT, ICT and digital activity (DA), by component, 2012–13 to 2016–17[ii]



Source: ABS cat. 5215, 5217; BCAR estimates.

[ii] No international trade exists for ISPs, structures, and E-commerce.

Appendix A. Domestic output by components

This section provides domestic output estimates of IoT, ICT and digital activity by the different components of digitalised products. All dollar values are reported in current prices.

Hardware

Hardware includes goods that constitute a computer system, such as monitors, hard drives, semi-conductors, wireless communications products, and audio and visual equipment.

Domestic output of hardware remained relatively flat over the period. Output declined in IoT and ICT activity while it rose for digital activity (Table 8 and Figure 17). IoT hardware output decreased by $239 million or 5.4 per cent, from $4.4 billion in 2012–13 to $4.2 billion in 2016–17. ICT hardware decreased by $33 million or 0.6 per cent, while digital activity hardware increased by $20 million or 0.3 per cent over the period.

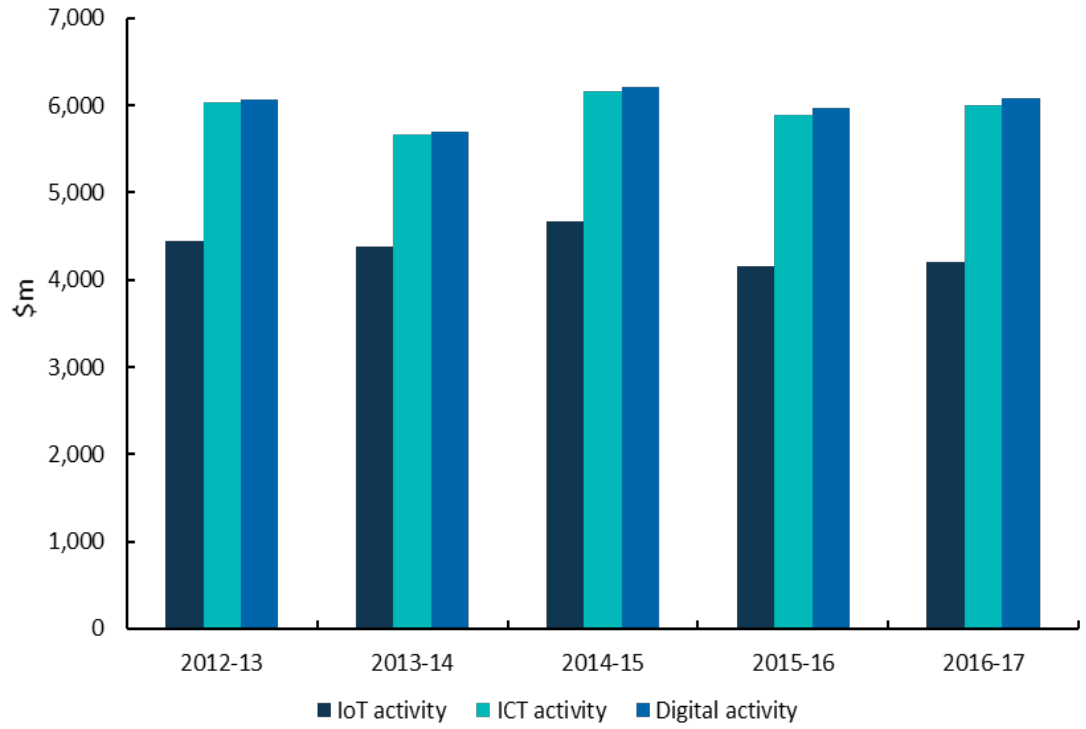
Demand increased for laptops, notebooks and other computer hardware and peripherals, although there was also pressure on local producers from low cost imports of computer hardware. The changes in output also do not account for the significant improvements in the quality and features of communications technology over the period. For example, while a smartphone may have more storage capacity, applications and capability, it has not resulted in a material change in cost to the consumer.

Table 8. Domestic output of hardware, 2012–13 to 2016–17

Domestic output by component Hardware	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	4,444	4,375	4,668	4,157	4,205	-239	-5.4%
ICT activity	6,031	5,657	6,168	5,882	5,998	-33	-0.6%
Digital activity	6,067	5,695	6,202	5,969	6,087	20	0.3%

Source: ABS cat. 5215, 5217; BCAR estimates.

Figure 17. Domestic output of hardware, 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Software

Software includes programs and other operating information used by devices such as personal computers and commercial servers as well as the services that facilitate these programs.[iii]

Domestic output of software products for IoT activity grew by $331 million or 6.0 per cent, from $5.5 billion in 2012–13 to $5.8 billion in 2016–17. For both ICT and digital activity (which include identical product groups), domestic output of software products increased by $500 million or 8.6 per cent, from $5.8 billion to $6.3 billion over the period (Table 9 and Figure 18).

The increase in domestic output of software in IoT, ICT and digital activity was primarily driven by strong growth in software publishing, including the demand stemming from enhanced connectivity and new technologies.[11] In particular, manufacturers have taken advantage of faster and more prevalent broadband connectivity to create software services such as application development.[12] This has coincided with more consumers buying smartphones with greater processing power.

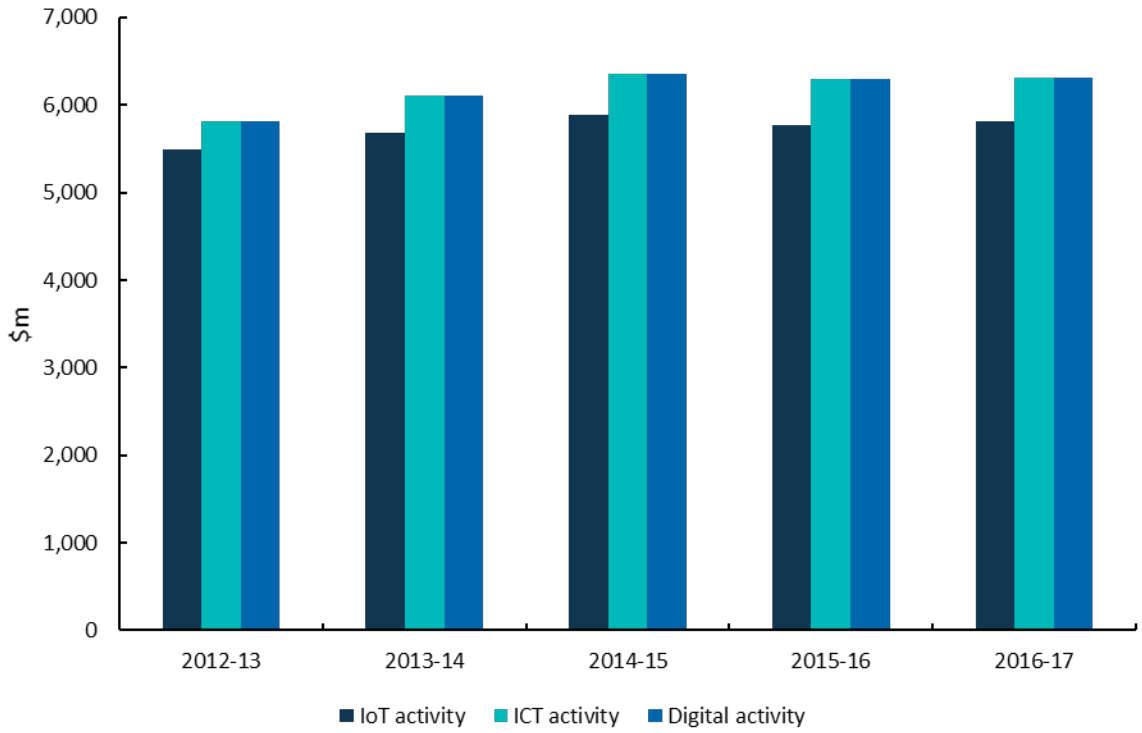
[iii] Some software, such as open source software, does not have a direct monetary value and would not be captured in these measures. Economic transactions may be generated indirectly through advertising which would be captured elsewhere in the national accounts.

Table 9. Domestic output of software,[iv] 2012–13 to 2016–17

Domestic output by component Software	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	5,489	5,678	5,882	5,775	5,820	331	6.0%
ICT activity	5,817	6,104	6,357	6,296	6,317	500	8.6%
Digital activity	5,817	6,104	6,357	6,296	6,317	500	8.6%

Source: ABS cat. 5215, 5217; BCAR estimates.

Figure 18. Domestic output of software,[iv] 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Telecommunications

Telecommunications products include goods and services that enable the transmission of information by fixed-line and wireless networks, broadcasting and satellite.

Domestic output of telecommunications products for IoT activity increased by $3.2 billion or 7.5 per cent, from $43.1 billion in 2012–13 to $46.3 billion in 2016–17. For both ICT and digital activity (which include identical product groups) domestic output in telecommunications increased by $3.0 billion or 5.7 per cent over the period, from $53.7 billion to $56.7 billion (Table 10 and Figure 19).

[iv] Domestic output of software products for ICT and digital activity are identical since all software products have been identified as in scope for the two activities. A product table can be found in Appendix E.

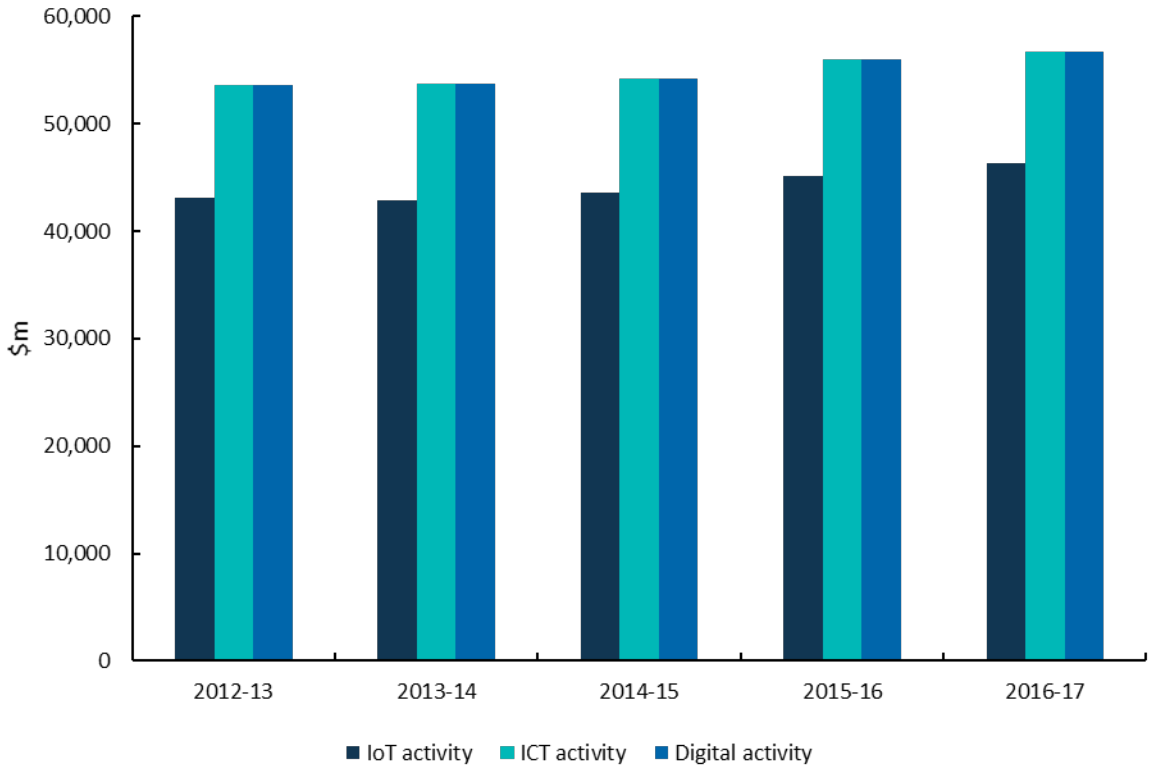
The growth in domestic output of telecommunications was driven mainly by telecommunications services. These services grew strongly as a result of the greater uptake of fixed and mobile broadband in Australia.

Table 10. Domestic output of telecommunications,[v] 2012–13 to 2016–17

Domestic output by component Telecommunications	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	43,114	42,883	43,561	45,108	46,333	3,219	7.5%
ICT activity	53,654	53,716	54,157	55,952	56,695	3,041	5.7%
Digital activity	53,654	53,716	54,157	55,952	56,695	3,041	5.7%

Source: ABS cat. 5215, 5217; BCAR estimates.

Figure 19. Domestic output of telecommunications,[v] 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

[v] Domestic output of telecommunications products for ICT and digital activity are identical since all telecommunications products have been identified as in scope for the two activities. A product table can be found in Appendix E.

Internet service providers (ISPs)

Internet service providers (ISPs) includes internet connectivity, access and search services.

Domestic output of ISPs for IoT, ICT and digital activity (which all include identical product groups) increased by $1.3 billion or 9.7 per cent, from $13.8 billion in 2012–13 to $15.1 billion in 2016–17 (Table 11 and Figure 20).

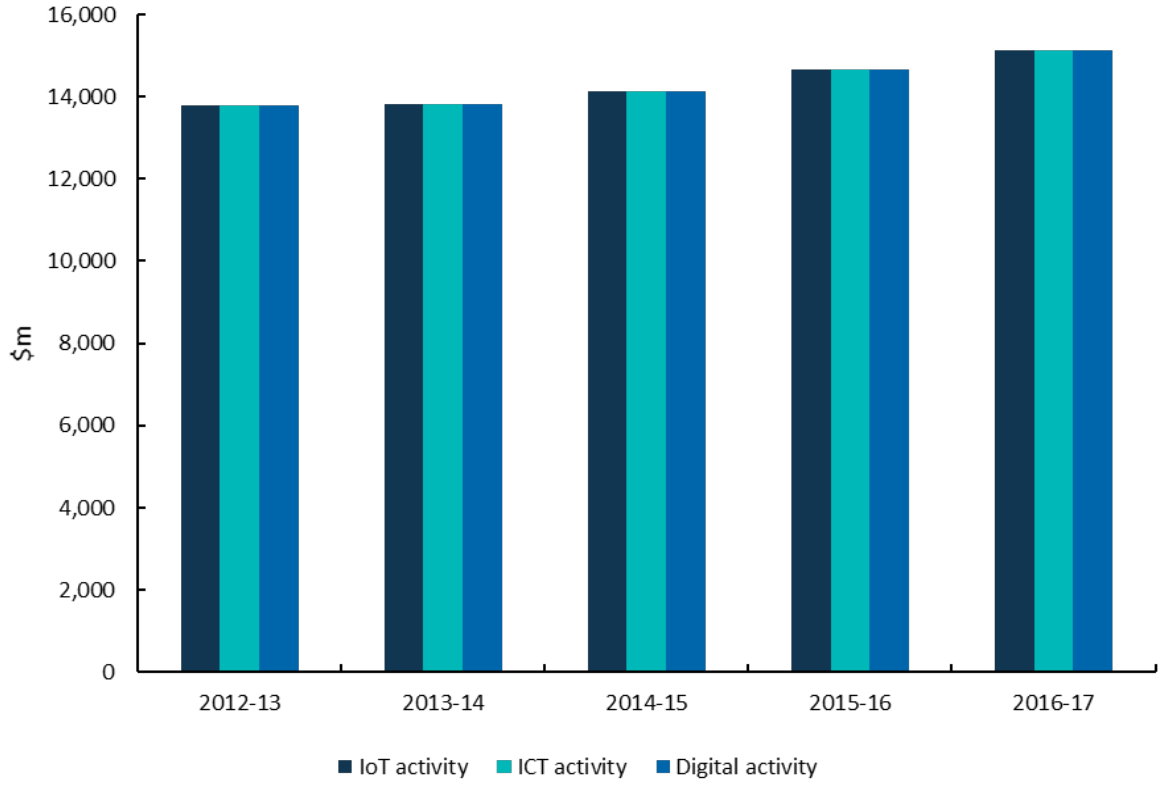
Output in ISPs grew as consumers upgraded their broadband connections,[13] while the rollout of the NBN and other network infrastructure increased access to high-speed internet over the period.

Table 11. Domestic output of ISPs,[vi] 2012–13 to 2016–17

Domestic output by component Internet service providers	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	13,794	13,814	14,122	14,651	15,126	1,331	9.7%
ICT activity	13,794	13,814	14,122	14,651	15,126	1,331	9.7%
Digital activity	13,794	13,814	14,122	14,651	15,126	1,331	9.7%

Source: ABS cat. 5215, 5217; BCAR estimates.

Figure 20. Domestic output of ISPs,[vi] 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

[vi] Domestic output of ISPs for IoT, ICT and digital activity are identical since all ISPs products have been identified as in scope for those activities. A product table can be found in Appendix E.

Support services

The support services component includes products and services that store and retrieve information, perform data processing, web hosting and computer support, as well as services for the design of hardware and software.

Domestic output of support services grew significantly for IoT, ICT and digital activity (which all include identical product groups) by $14.8 billion or 23.8 per cent, from $62.3 billion in 2012–13 to $77.1 billion in 2016–17 (Table 12 and Figure 21).

The increased output of support services was driven by services relating to computer system design.[14] The internet has enabled the transfer of growing amounts of data which has boosted demand for data processing and web hosting services by both consumers and businesses. Similarly, computer system design services grew over the period because businesses required more regular upgrades and enhancements to their IT infrastructure and systems.[15]

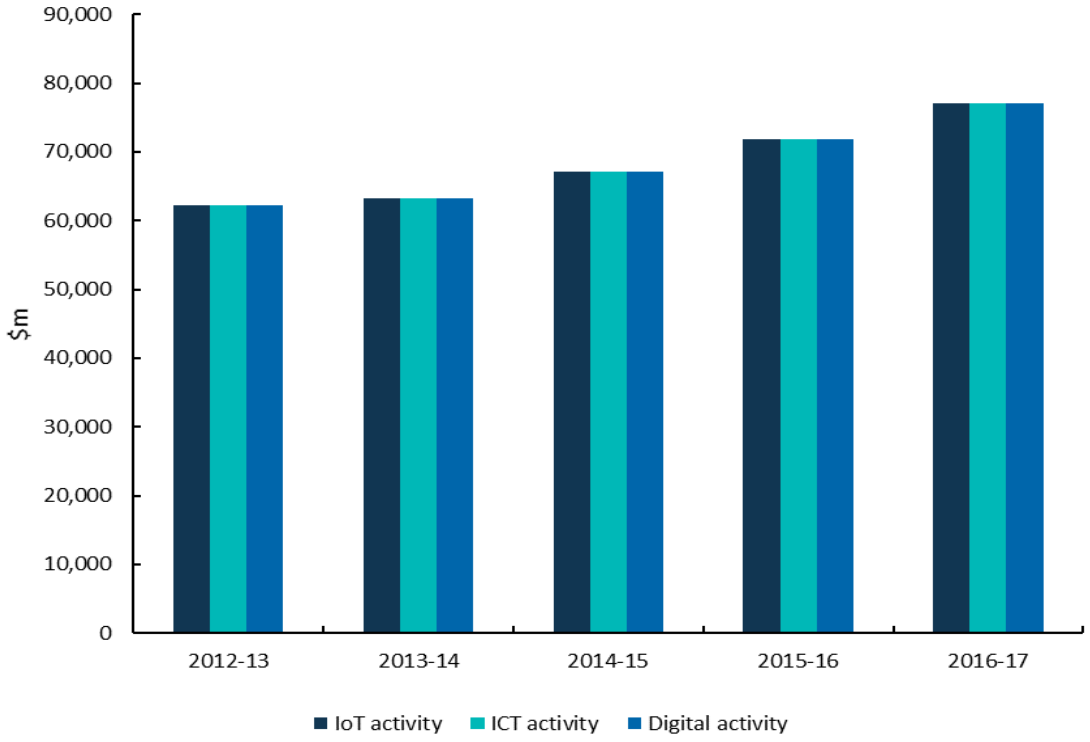
Table 12. Domestic output of support services,[vii] 2012–13 to 2016–17

Domestic output by component Support services	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	62,255	63,180	67,105	71,811	77,073	14,819	23.8%
ICT activity	62,255	63,180	67,105	71,811	77,073	14,819	23.8%
Digital activity	62,255	63,180	67,105	71,811	77,073	14,819	23.8%

Source: ABS cat. 5215, 5217; BCAR estimates.

[vii] Domestic output of support services for IoT, ICT and digital activity are identical since all support services related products have been identified as in scope for those activities. A product table can be found in Appendix E.

Figure 21. Domestic output of support services,[vii] 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Structures

The structures component captures the construction of telecommunications infrastructure. This is in scope only for digital activity. A detailed explanation for its inclusion can be found in Appendix D.

Domestic output of structures increased significantly over the period, growing by $38.0 billion or 223.6 per cent, from $17.0 billion in 2012–13 to $54.9 billion in 2016–17 (Table 13 and Figure 22).

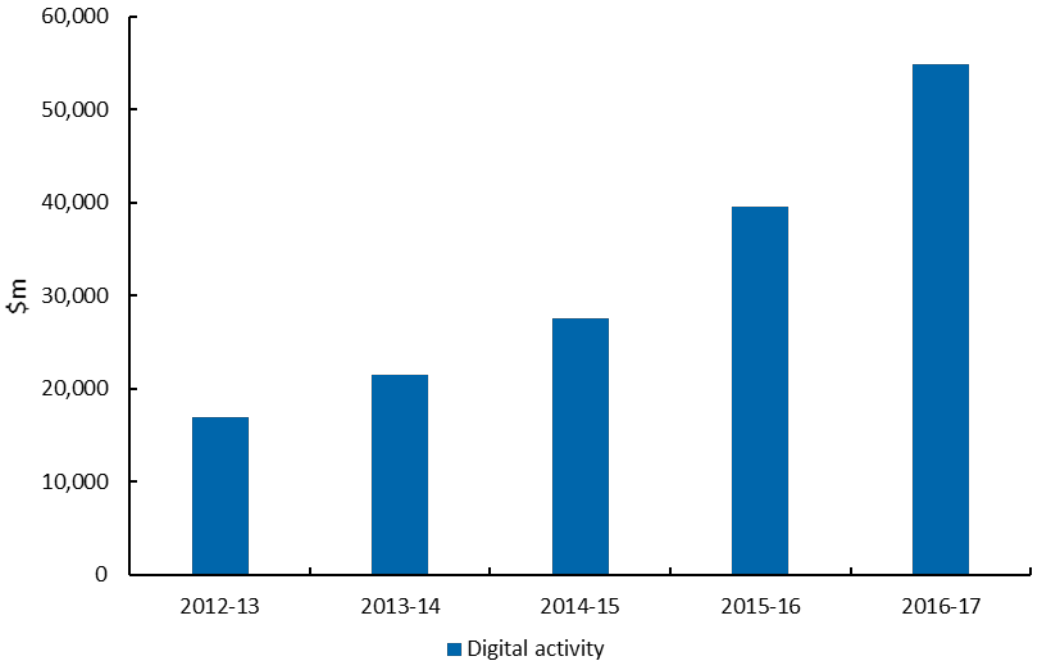
The growth in structures was driven by increased private and public investment in telecommunications infrastructure. In particular, the continued rollout of the NBN over the period included the installation of fibre-optic and fixed wireless infrastructure across Australia.[16] There was also a significant expansion of mobile infrastructure during the period, such as the 4G mobile networks rolled out by private network operators.

Table 13. Domestic output of structures, 2012–13 to 2016–17

Domestic output by component Structures	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	-	-	-	-	-	-	-
ICT activity	-	-	-	-	-	-	-
Digital activity	16,975	21,551	27,537	39,516	54,934	37,959	223.6%

Source: ABS cat. 5215, 5217; BCAR estimates.

Figure 22. Domestic output of structures, 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

E-commerce

E-commerce captures both online wholesale and retail transactions. E-commerce is included only for digital activity.

E-commerce grew significantly over the period, increasing by $5.0 billion or 92.2 per cent, from $5.4 billion in 2012–13 to $10.4 billion in 2016–17 (Table 14 and Figure 23).

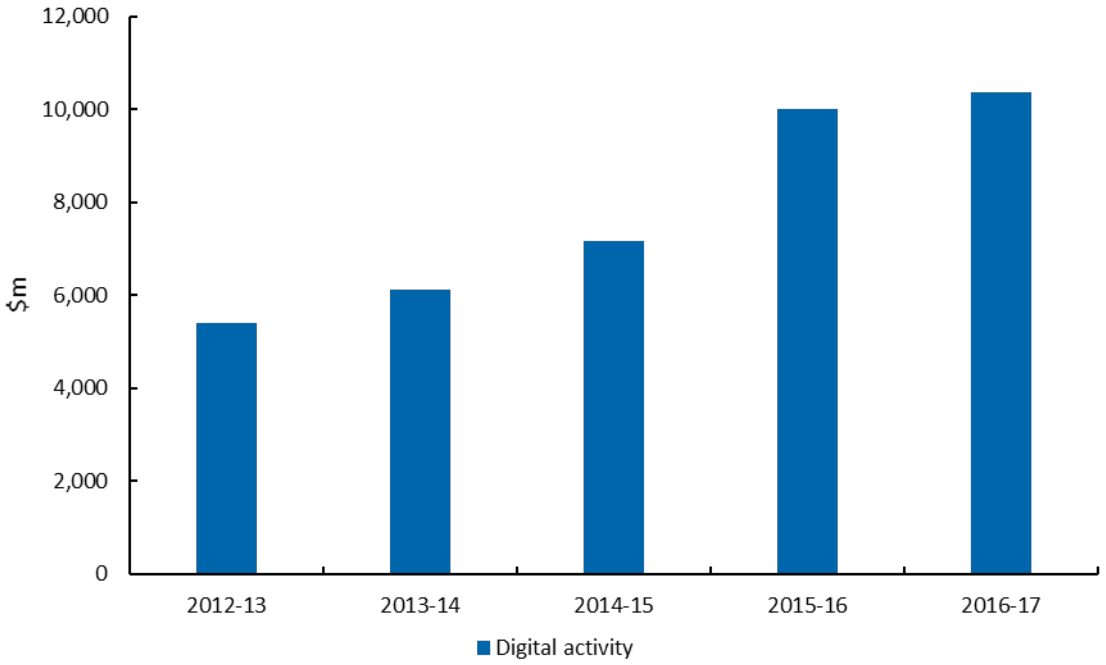
Online transactions were the primary driver of e-commerce over the period due to increased consumer demand for online shopping. In addition, growth was assisted by expanded internet coverage and more businesses providing e-commerce services.

Table 14. Domestic output of e-commerce, 2012–13 to 2016–17

Domestic output by component	2012–13	2013–14	2014–15	2015–16	2016–17	Change from 2012–13 to 2016–17	Change from 2012–13 to 2016–17
E-commerce	**$m**	**$m**	**$m**	**$m**	**$m**	**$m**	**%**
IoT activity	-	-	-	-	-	-	-
ICT activity	-	-	-	-	-	-	-
Digital activity	5,400	6,115	7,151	10,007	10,376	4,977	92.2%

Source: ABS cat. 5215, 5217; BCAR estimates.

Figure 23. Domestic output of e-commerce, 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Digital media

Digital media includes access to digital platforms and big data and is in scope for both ICT and digital activity.

Domestic output of digital media in both ICT and digital activity (which include identical product groups) increased by $3.1 billion or 39.0 per cent, from $8.1 billion in 2012–13 to $11.2 billion in 2016–17 (Table 15 and Figure 24).

Growth in digital media was driven primarily by internet publishing and broadcasting services. Newspaper publishers and broadcasting services have expanded their digital platforms over the period, although there has also been a rise in free and global digital media content available. Consumers have also demanded more digital media and online video streaming including through the widespread use of smartphones.[17]

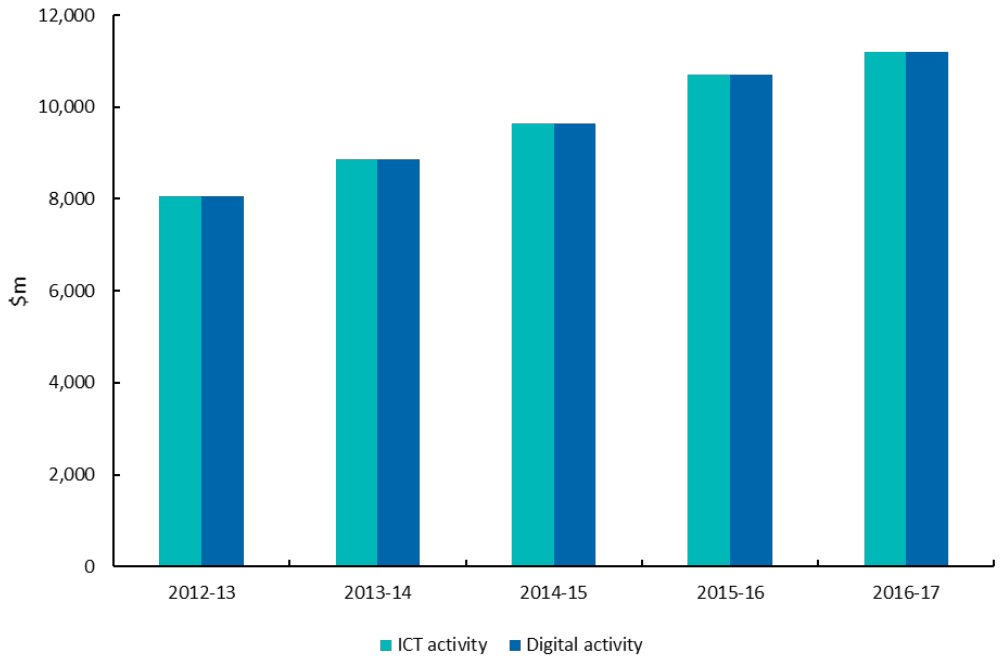
The second-largest contributor to growth in digital media was motion picture and video production. Output in this area has been boosted by the Australian Government's financial incentives to attract international producers to film and conduct post-production in Australia.[18]

Table 15. Domestic output of digital media,[viii] 2012–13 to 2016–17

Domestic output by component Digital media	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	-	-	-	-	-	-	-
ICT activity	8,065	8,862	9,629	10,704	11,210	3,145	39.0%
Digital activity	8,065	8,862	9,629	10,704	11,210	3,145	39.0%

Source: ABS cat. 5215, 5217; BCAR estimates.

Figure 24. Domestic output of digital media,[viii] 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

[viii] Domestic output of digital media products for ICT and digital activity are identical since all digital media products have been identified as in scope for those activities. A product table can be found in Appendix E.

Appendix B. International trade by components

This section provides estimates of imports and exports relating to IoT, ICT and digital activity by the components of digitalised products. All dollar values are reported in current prices.

Imports

Hardware

Imports of hardware products for IoT, ICT and digital activity have experienced growth from 2012–13 to 2016–17. IoT imports of hardware increased by $1.2 billion or 10.1 per cent, from $12.0 billion in 2012–13 to $13.2 billion in 2016–17. ICT imports of hardware products increased by $2.2 billion or 12.4 per cent, from $17.5 billion to $19.7 billion; and the imports of hardware products for digital activity increased by $2.4 billion or 13.2 per cent, from $18.1 billion to $20.5 billion over the period (Table 16 and Figure 25).

Imports of hardware products in all three activities peaked in 2014–15, driven by increased demand for laptops, notebooks, and other computer hardware and peripherals. Australia imports most of these products from China, the United States, Malaysia and Singapore. Despite the weaker Australian dollar, low cost imports of hardware products continued to dominate the market.

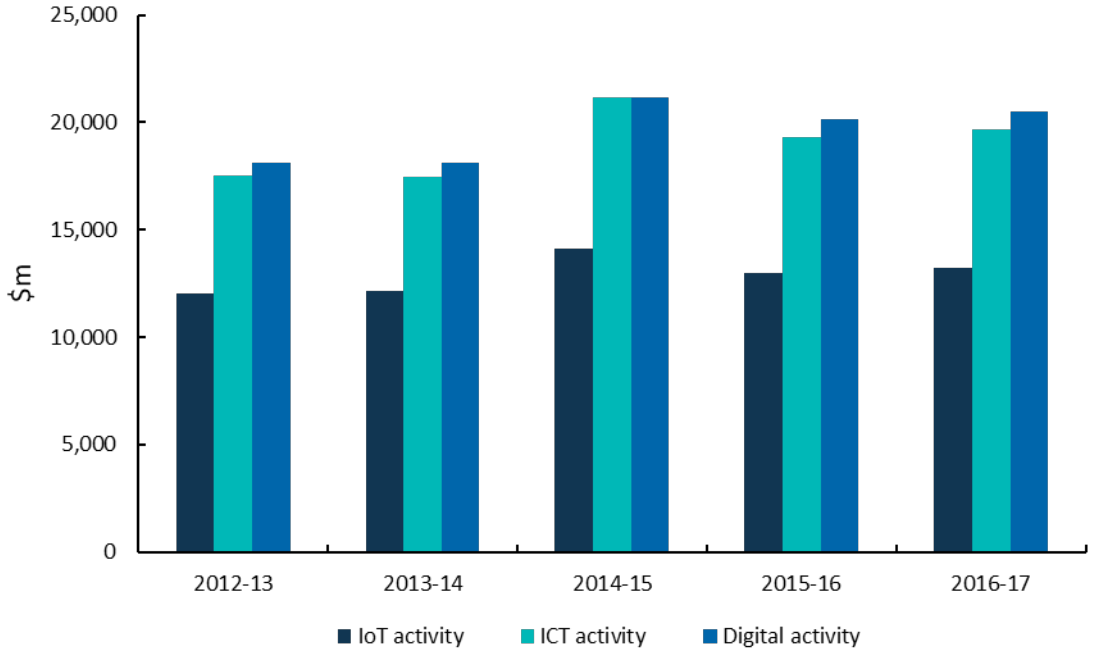
Table 16. Imports of hardware,[ix] 2012–13 to 2016–17

Domestic output by component Hardware	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	12,028	12,142	14,140	12,997	13,246	1,218	10.1%
ICT activity	17,528	17,431	21,181	19,333	19,696	2,168	12.4%
Digital activity	18,113	18,128	21,181	20,133	20,510	2,397	13.2%

Source: ABS cat. 5215, 5217; BCAR estimates.

[ix] Hardware products for ICT and digital activity differ only by the product category of vending, monetary, and office machinery. This has been identified as out of scope for ICT activity but in scope for digital activity. Detail on the imports of vending, monetary and office machinery has been made confidential in the ABS Input-Output Tables (Product Details), 2014–15 (cat. no. 5215.0), which has resulted in hardware imports of ICT and digital activity to be identical for that year. A product table can be found in Appendix E.

Figure 25. Imports of hardware,[ix] 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Software

Imports of software products relating to IoT, ICT and digital activity have grown significantly over the period analysed. IoT software imports increased by $193 million or 37.0 per cent, from $522 million in 2012–13 to $715 million in 2016–17. ICT and digital activity imports of software products both increased by $654 million or 38.6 per cent, from $1.7 billion to $2.3 billion over the period (Table 17 and Figure 26).

Growth in software imports was driven mainly by products relating to software publishing services. These products are highly tradable with large foreign software companies able to tailor software to the Australian market.[19]

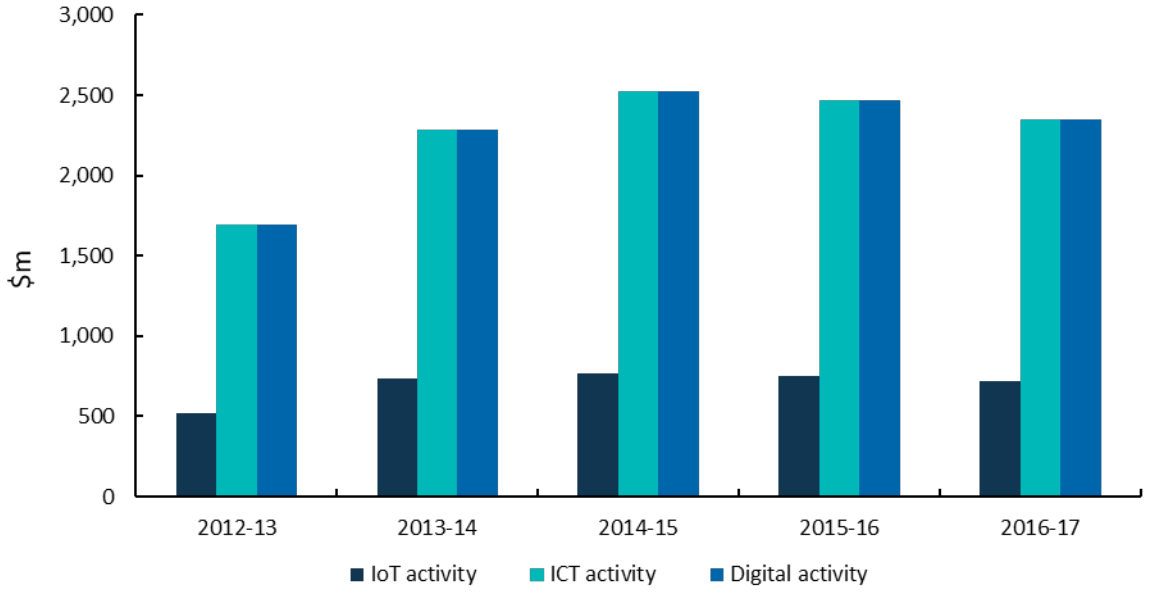
Table 17. Imports of software,[x] 2012–13 to 2016–17

Imports by component Software	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	522	733	764	751	715	193	37.0%
ICT activity	1,694	2,288	2,526	2,465	2,347	654	38.6%
Digital activity	1,694	2,288	2,526	2,465	2,347	654	38.6%

Source: ABS cat. 5215, 5217; BCAR estimates.

[x] Imports of software products for ICT and digital activity are identical since all software products have been identified as in scope for the two activities. A product table can be found in Appendix E.

Figure 26. Imports of software,[x] 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Telecommunications

Imports of telecommunications products in IoT, ICT and digital activity increased by $3.9 billion or 32.2 per cent over the period, from $12.0 billion in 2012–13 to $15.9 billion in 2016–17 (Table 18 and Figure 27).

Import growth has been driven by the falling prices of telecommunications products over the period. Overseas manufacturers of telecommunications products tend to have lower costs which has encouraged Australian businesses to import these products. These manufacturers have benefited from producing goods at scale over the period including mobile phones and other communications equipment.[20]

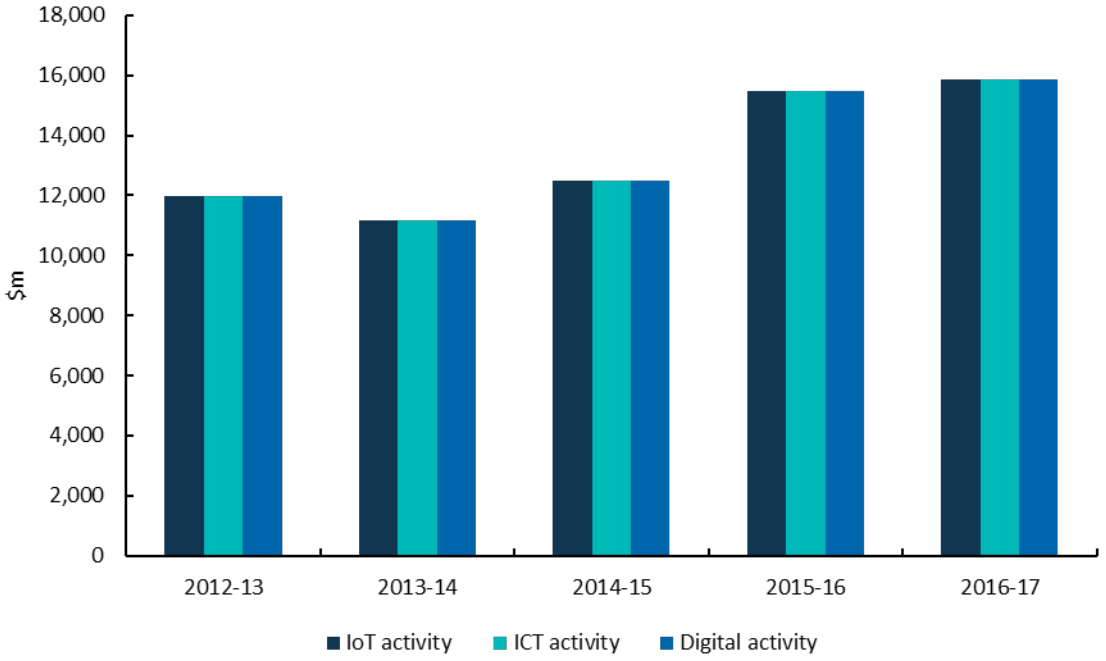
Table 18. Imports of telecommunications,[xi] 2012–13 to 2016–17

Imports by component Telecommunications	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	11,993	11,183	12,471	15,454	15,852	3,858	32.2%
ICT activity	11,993	11,183	12,471	15,454	15,852	3,858	32.2%
Digital activity	11,993	11,183	12,471	15,454	15,852	3,858	32.2%

Source: ABS cat. 5215, 5217; BCAR estimates.

[xi] Imports of telecommunications products for ICT and digital activity are identical since all telecommunications products have been identified as in scope for the two activities. Additionally, telecommunications products relating to radio broadcasting services, free-to-air television broadcasting services, and cable (pay TV) and other subscription broadcasting services are in scope of ICT and digital activity but out of scope for IoT. However, Australia does not import those products, and this has resulted in imports of telecommunications products for IoT being identical with ICT and digital activity. A product table can be found in Appendix E.

Figure 27. Imports of telecommunications,[xi] 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Support services

Imports of support services have increased by $689 million or 43.5 per cent in IoT, ICT and digital activity, from $1.6 billion in 2012–13 to $2.3 billion in 2016–17. The growth was mainly driven by services relating to computer system design (Table 19 and Figure 28).

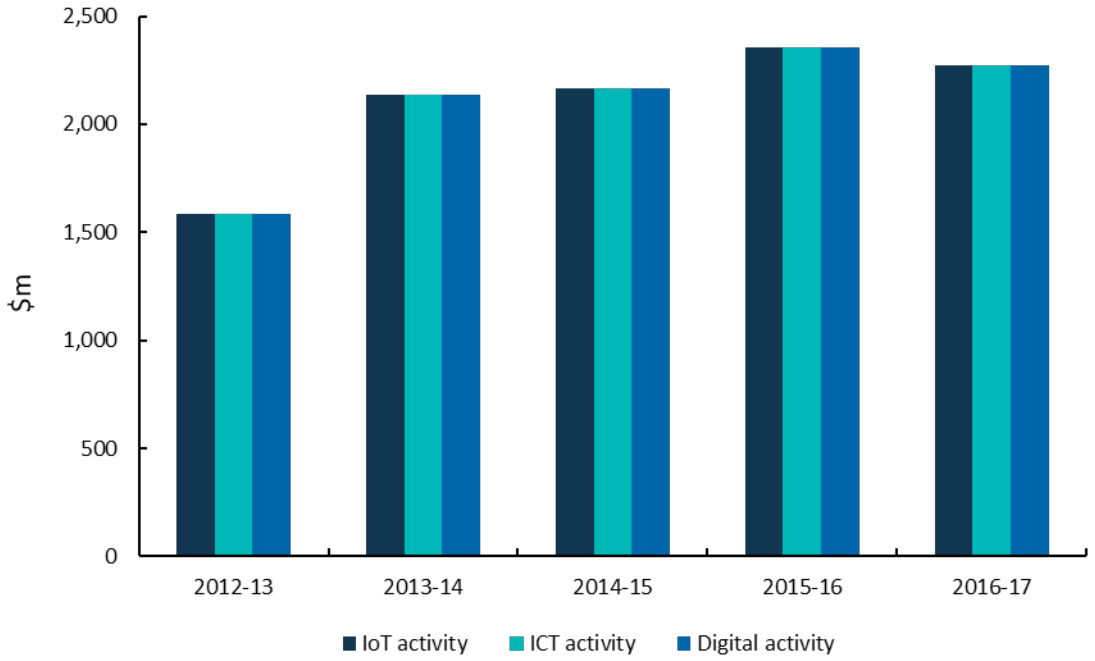
Import growth has been affected by the increased outsourcing of labour-intensive software development. Businesses contract or subcontract work to foreign firms to produce these services at lower prices.[21]

Table 19. Imports of support services,[xii] 2012–13 to 2016–17

Imports by component Support services	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	1,584	2,138	2,163	2,353	2,273	689	43.5%
ICT activity	1,584	2,138	2,163	2,353	2,273	689	43.5%
Digital activity	1,584	2,138	2,163	2,353	2,273	689	43.5%

Source: ABS cat. 5215, 5217; BCAR estimates.

Figure 28. Imports of support services,[xii] 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Digital media

Digital media is in scope for ICT and digital activity only. Imports of digital media for ICT and digital activity increased by $216 million or 9.4 per cent, from $2.3 billion in 2012–13 to $2.5 billion in 2016–17 (Table 20 and Figure 29). This growth was driven primarily by motion picture and sound recording.

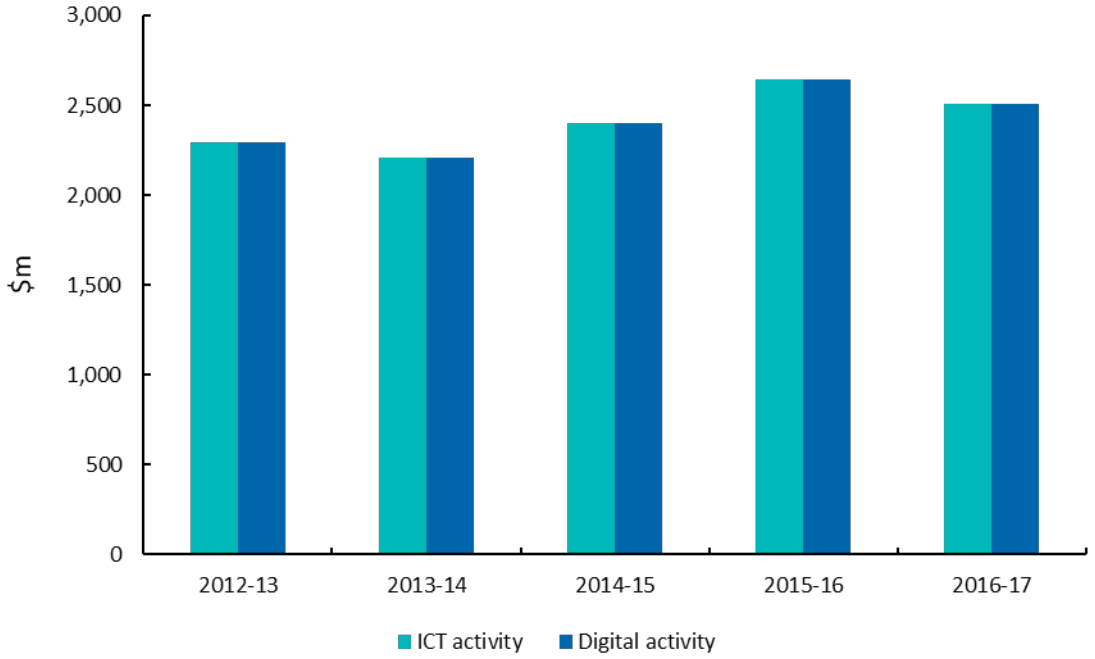
Table 20. Imports of digital media,[xiii] 2012–13 to 2016–17

Imports by component Digital media	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	-	-	-	-	-	-	-
ICT activity	2,290	2,207	2,398	2,641	2,506	216	9.4%
Digital activity	2,290	2,207	2,398	2,641	2,506	216	9.4%

Source: ABS cat. 5215, 5217; BCAR estimates.

[xii] Imports of support services for IoT, ICT and digital activity are identical since all support services related products have been identified as in scope for those activities. A product table can be found in Appendix E.
[xiii] Imports of digital media products for ICT and digital activity are identical since all digital media products have been identified as in scope for those activities. A product table can be found in Appendix E.

Figure 29. Imports of digital media,[xiii] 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Exports

Hardware

Exports of hardware products in IoT, ICT and digital activity have increased over the period. IoT exports of hardware increased by $122 million or 5.4 per cent, from $2.3 billion in 2012–13 to $2.4 billion in 2016–17. ICT exports of hardware increased by $336 million or 12.1 per cent, from $2.8 billion to $3.1 billion, while digital activity exports of hardware activity increased by $351 million or 12.5 per cent, from $2.8 billion to $3.2 billion over the period (Table 21 and Figure 30).

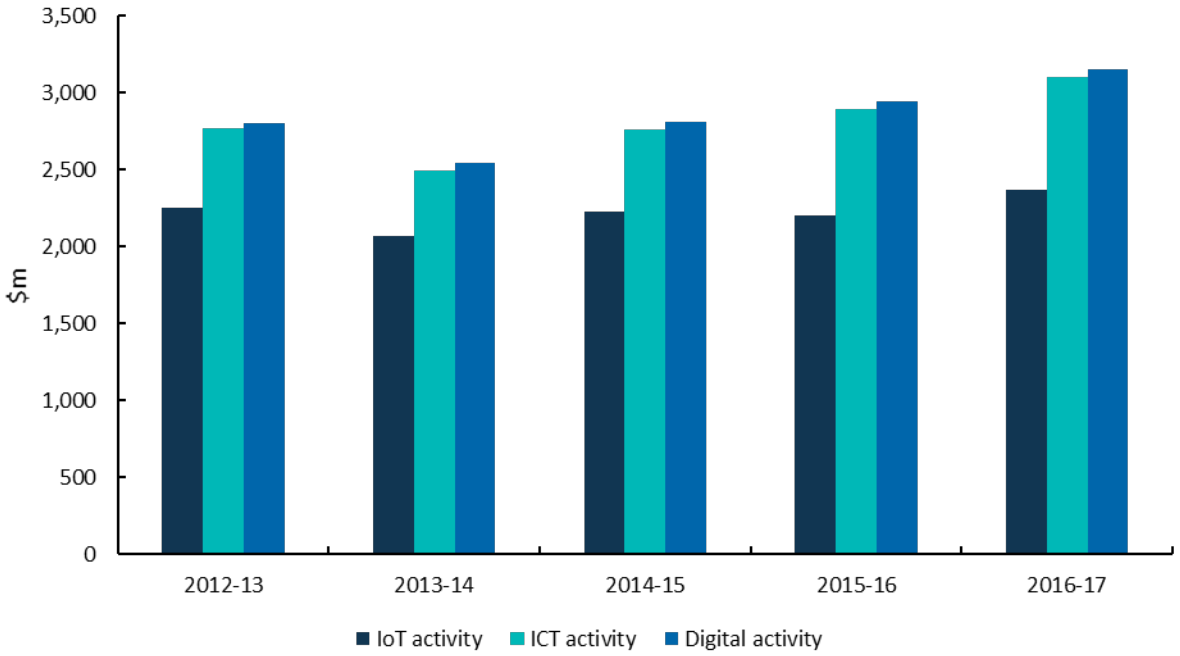
Local hardware manufacturers compete globally for export sales but have benefited from the weaker Australian dollar over the period. At the same time, exporters have focused on producing niche goods at much lower volumes, which has bolstered export demand.[22]

Table 21. Exports of hardware, 2012–13 to 2016–17

Exports by component Hardware	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	2,250	2,067	2,228	2,205	2,372	122	5.4%
ICT activity	2,766	2,490	2,763	2,897	3,102	336	12.1%
Digital activity	2,801	2,544	2,812	2,944	3,152	351	12.5%

Source: ABS cat. 5215, 5217; BCAR estimates.

Figure 30. Exports of hardware, 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Software

Exports of software products increased in IoT, ICT and digital activity from 2012–13 to 2016–17. IoT software exports increased by $125 million or 39.0 per cent, from $320 million in 2012–13 to $445 million in 2016–17. Both ICT and digital activity exports of software products increased by $170 million or 28.7 per cent, from $593 million to $764 million over the period (Table 22 and Figure 31). Exports of software publishing services, which are measured by trade in software licensing, was a primary driver over the period.

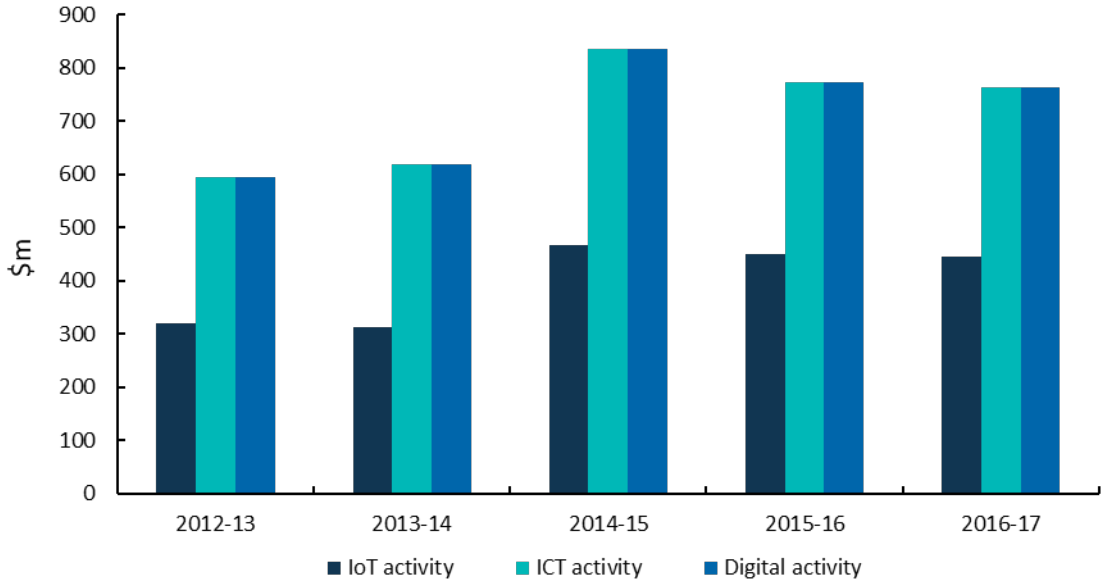
Table 22. Exports of software,[xiv] 2012–13 to 2016–17

Exports by component Software	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	320	313	467	451	445	125	39.0%
ICT activity	593	619	836	774	764	170	28.7%
Digital activity	593	619	836	774	764	170	28.7%

Source: ABS cat. 5215, 5217; BCAR estimates.

[xiv] Exports of software products for ICT and digital activity are identical since all software products have been identified as in scope for the two activities. A product table can be found in Appendix E.

Figure 31. Exports of software,[xiv] 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Telecommunications

Exports of telecommunications products have grown in IoT, ICT and digital activity from 2012–13 to 2016–17. IoT exports of telecommunications products increased by $684 million or 40.5 per cent, from $1.7 billion in 2012–13 to $2.4 billion in 2016–17, while exports of telecommunications products for both ICT and digital activity increased by $760 million or 41.6 per cent, from $1.8 billion to $2.6 billion over the period (Table 23 and Figure 32).

The growth of telecommunications exports was primarily due to the weaker Australian dollar which improved the price competitiveness of these exports. Consumer demand for telecommunications products has also increased internationally, further expanding exports.[23]

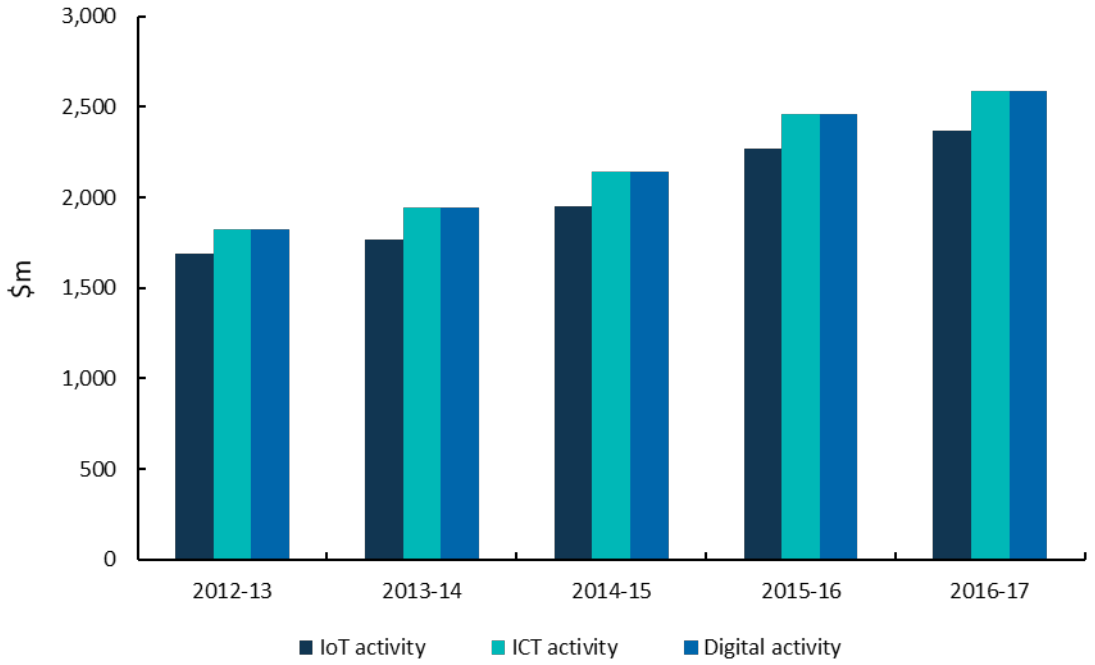
Table 23. Exports of telecommunications,[xv] 2012–13 to 2016–17

Exports by component Telecommunications	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	1,686	1,769	1,952	2,269	2,370	684	40.5%
ICT activity	1,825	1,946	2,140	2,459	2,585	760	41.6%
Digital activity	1,825	1,946	2,140	2,459	2,585	760	41.6%

Source: ABS cat. 5215, 5217; BCAR estimates.

[xv] Exports of telecommunications products for ICT and digital activity are identical since all telecommunications products have been identified as in scope for the two activities. A product table can be found in Appendix E.

Figure 32. Exports of telecommunications,[xv] 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Support services

Exports of support services increased by $1.0 billion or 60.6 per cent in IoT, ICT and digital activity, from $1.7 billion in 2012–13 to $2.7 billion in 2016–17 (Table 24 and Figure 34). This export growth has been driven by services relating to computer system design. This growth is due in part to the increased demand for data processing and cloud services.

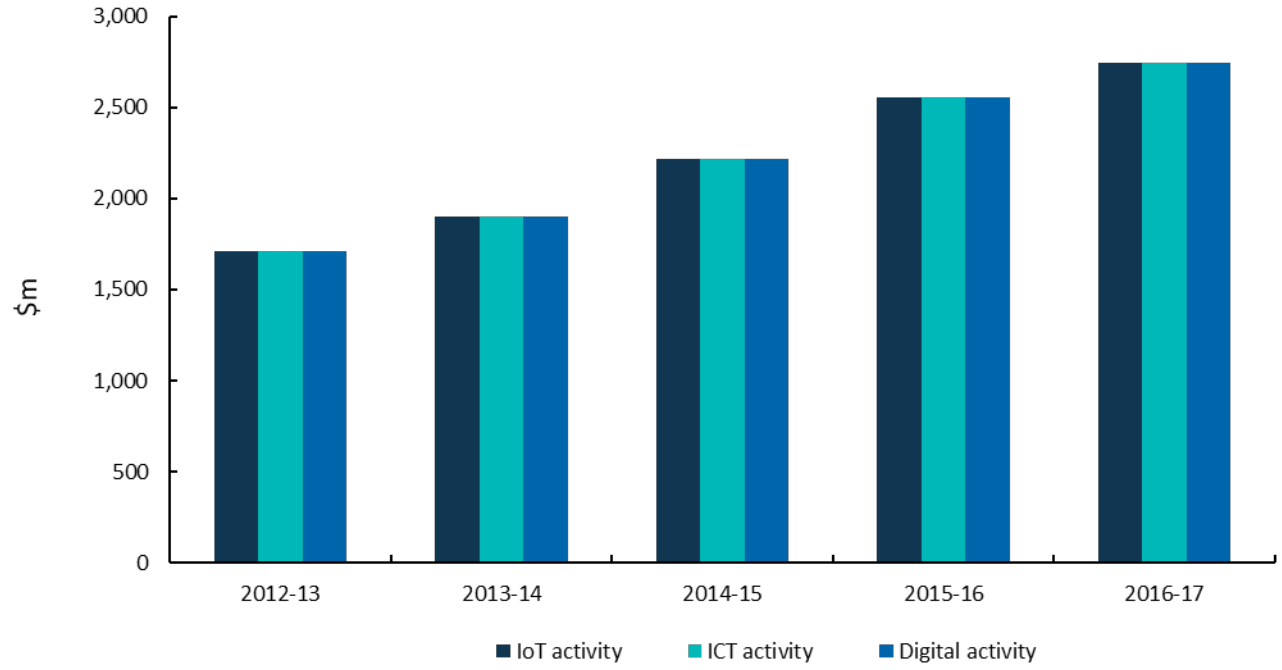
Table 24. Exports of support services,[xvi] 2012–13 to 2016–17

Exports by component Support services	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	1,708	1,899	2,217	2,556	2,743	1,036	60.6%
ICT activity	1,708	1,899	2,217	2,556	2,743	1,036	60.6%
Digital activity	1,708	1,899	2,217	2,556	2,743	1,036	60.6%

Source: ABS cat. 5215, 5217; BCAR estimates.

[xvi] Exports of support services for IoT, ICT and digital activity are identical since all support services related products have been identified as in scope for those activities. A product table can be found in Appendix E.

Figure 33. Exports of support services,[xvi] 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Digital media

Digital media is in scope for ICT and digital activity only. Exports of digital media in ICT and digital activity increased by $172 million or 66.6 per cent, from $259 million in 2012–13 to $431 million in 2016–17 (Table 25 and Figure 34). Export growth was due largely to motion picture theatre services and activities related to the acquiring, registering and selling of music copyrights.

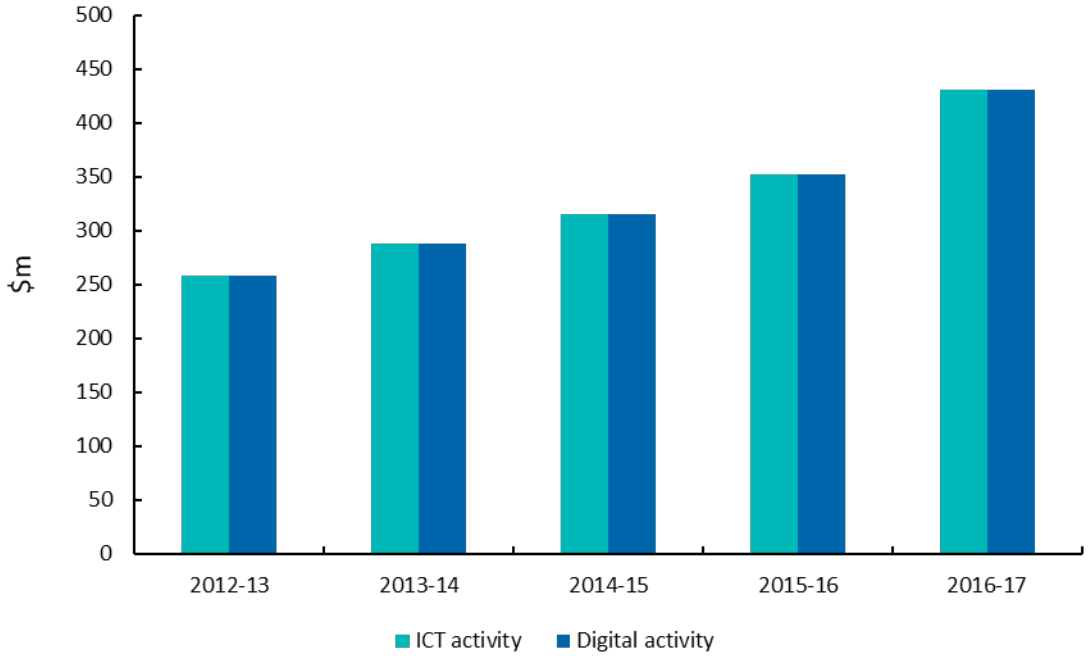
Table 25. Exports of digital media,[xvii] 2012–13 to 2016–17

Exports by component Digital media	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
IoT activity	-	-	-	-	-	-	-
ICT activity	1,708	1,899	2,217	2,556	2,743	1,036	60.6%
Digital activity	1,708	1,899	2,217	2,556	2,743	1,036	60.6%

Source: ABS cat. 5215, 5217; BCAR estimates.

[xvii] Exports of digital media products for ICT and digital activity are identical since all digital media products have been identified as in scope for those activities. A product table can be found in Appendix E.

Figure 34. Exports of digital media,[xvii] 2012–13 to 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Appendix C. IoT, ICT and digital activity by division

This section provides estimates of IoT, ICT and digital activity by industry division to show how much each industry contributes to digitalisation in the Australian economy.

GVA by industry division is reported in both current prices and volume terms while domestic output is reported only in current prices.

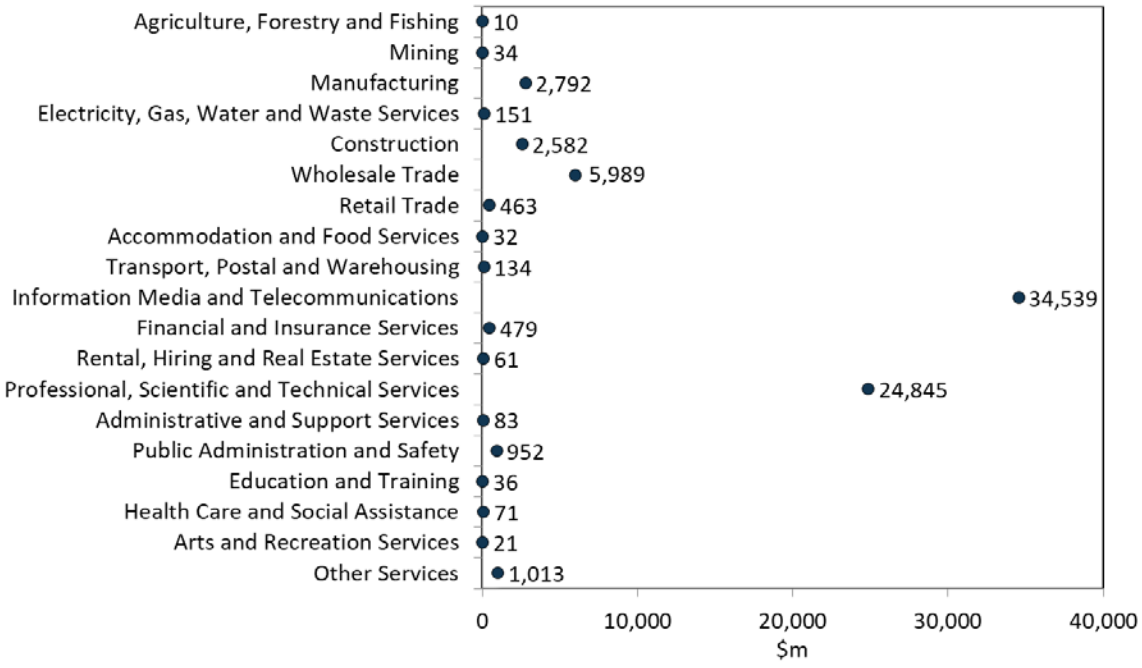
Activity by industry division, current prices

IoT activity—current prices

IoT activity was $74.3 billion, or 4.5 per cent of economic activity in 2016–17. IoT activity increased by 16.5 per cent, or $10.5 billion from 2012–13 to 2016–17. As a share of economic activity, IoT activity increased from 4.4 per cent in 2012–13 to 4.5 per cent in 2016–17.

IoT activity in Information media and telecommunications (IMT) was the largest contributor, valued at $34.5 billion in 2016–17, or 46.5 per cent of total IoT activity (Figure 35).

Figure 35. IoT activity by industry division, 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

IoT activity in IMT increased by $5.0 billion or 16.9 per cent from 2012–13 (Table 26). As a share of IoT activity, IMT increased from 46.3 per cent in 2012–13 cent to 46.5 per cent in 2016–17. Telecommunications services was IMT's main driver with an increase of $2.7 billion or 10.8 per cent. This was primarily due to rising demand for wireless communications services and products.[24] Another important driver was internet publishing and broadcasting, which increased by $2.1 billion or 63.2 per cent over the period. This growth was driven by demand for online services as consumers and businesses continued to move online.[25]

The second largest industry division to contribute to IoT activity was Professional, scientific and technical services (PSTS) at $24.8 billion in 2016–17, or 33.4 per cent to total IoT activity. IoT activity in PSTS increased by $3.8 billion or 17.8 per cent, from 2012–13 and as a share of IoT activity from 33.1 per cent in 2012–13 to 33.4 per cent in 2016–17. Growth in PSTS was driven mainly by computer system design and related services, which grew by $3.6 billion or 17.1 per cent over the period. IoT activity in PSTS has steadily expanded as workplaces increase their use of computers and information technology.[26]

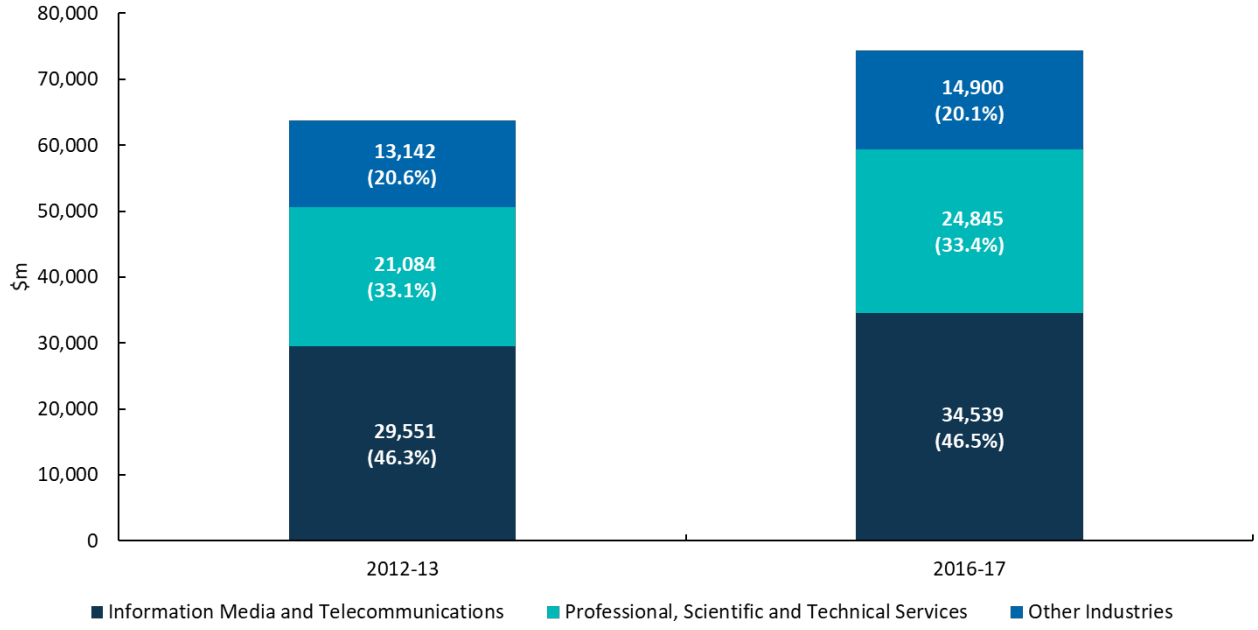
Table 26. IoT activity, GVA by division, 2012–13 to 2016–17, current prices

IoT activity by division	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
Agriculture, Forestry and Fishing	9	7	8	9	10	1	6.5
Mining	31	33	40	35	34	3	11.0
Manufacturing	2,274	2,070	2,284	2,681	2,792	518	22.8
Electricity, Gas, Water and Waste Services	73	92	129	115	151	78	107.9
Construction	1,922	2,179	2,204	2,388	2,582	660	34.3
Wholesale Trade	5,889	5,458	5,695	5,524	5,989	100	1.7
Retail Trade	419	384	381	467	463	44	10.5
Accommodation and Food Services	21	22	18	26	32	11	50.6
Transport, Postal and Warehousing	138	116	133	155	134	-4	-3.1
Information Media and Telecommunications	29,551	30,621	32,306	32,591	34,539	4,988	16.9
Financial and Insurance Services	300	289	365	390	479	178	59.3
Rental, Hiring and Real Estate Services	41	33	38	37	61	20	48.8
Professional, Scientific and Technical Services	21,084	20,559	21,126	23,269	24,845	3,760	17.8
Administrative and Support Services	55	54	67	70	83	28	50.5
Public Administration and Safety	785	899	977	962	952	167	21.3
Education and Training	20	26	24	31	36	16	79.7
Health Care and Social Assistance	53	62	58	53	71	18	33.4
Arts and Recreation Services	15	12	16	22	21	6	41.7
Other Services	1,097	1,341	1,111	943	1,013	-84	-7.6
Total	63,777	64,258	66,980	69,767	74,284	10,507	16.5
Share of total GVA (%)	4.4	4.3	4.4	4.5	4.5	-	-

Source: ABS cat. 5215, 5217; BCAR estimates.

IMT and PSTS comprised 79.9 per cent of total IoT activity in 2016–17, up from 79.4 per cent in 2012–13. In all other divisions, IoT activity grew by $1.8 billion or 13.4 per cent, from $13.1 billion in 2012–13 to $14.9 billion in 2016–17 (Figure 36).

Figure 36. IoT share of GVA by primary divisions, 2012–13 to 2016–17, current prices



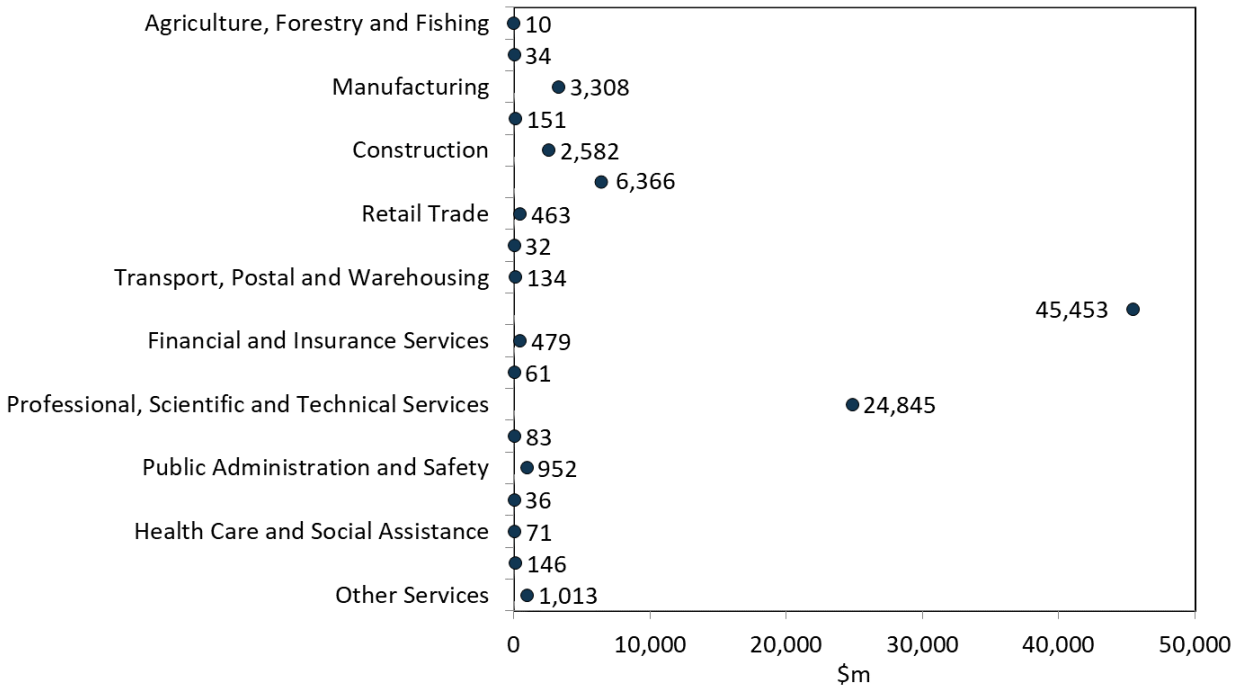
Source: ABS cat. 5215, 5217; BCAR estimates.

ICT activity—current prices

ICT activity was $86.2 billion, or 5.2 per cent of economic activity in 2016–17. ICT activity increased by 16.6 per cent or $12.3 billion, from 2012–13 to 2016–17. As a share of economic activity, ICT increased from 5.1 per cent in 2012–13 to 5.2 per cent in 2016–17.

IMT was the largest contributor to ICT activity, valued at $45.5 billion in 2016–17 or 52.7 per cent of ICT activity (Figure 37).

Figure 37. ICT activity by industry division, 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

ICT activity in IMT increased by $6.6 billion or 16.9 per cent over the period (Table 27). The IMT industry increased by 0.1 percentage points as a share of ICT activity, from 52.6 per cent in 2012–13 to 52.7 per cent in 2016–17.

PSTS was the second largest contributor to ICT activity at $24.8 billion in 2016–17, or 28.8 per cent of total ICT activity. ICT activity in PSTS increased by $3.8 billion or 17.8 per cent, from 2012–13 to 2016–17. PSTS increased as a share of ICT activity by 0.3 percentage points, from 28.5 per cent in 2012–13 to 28.8 per cent in 2016–17.

Table 27. ICT activity, GVA by division, 2012–13 to 2016–17, current prices

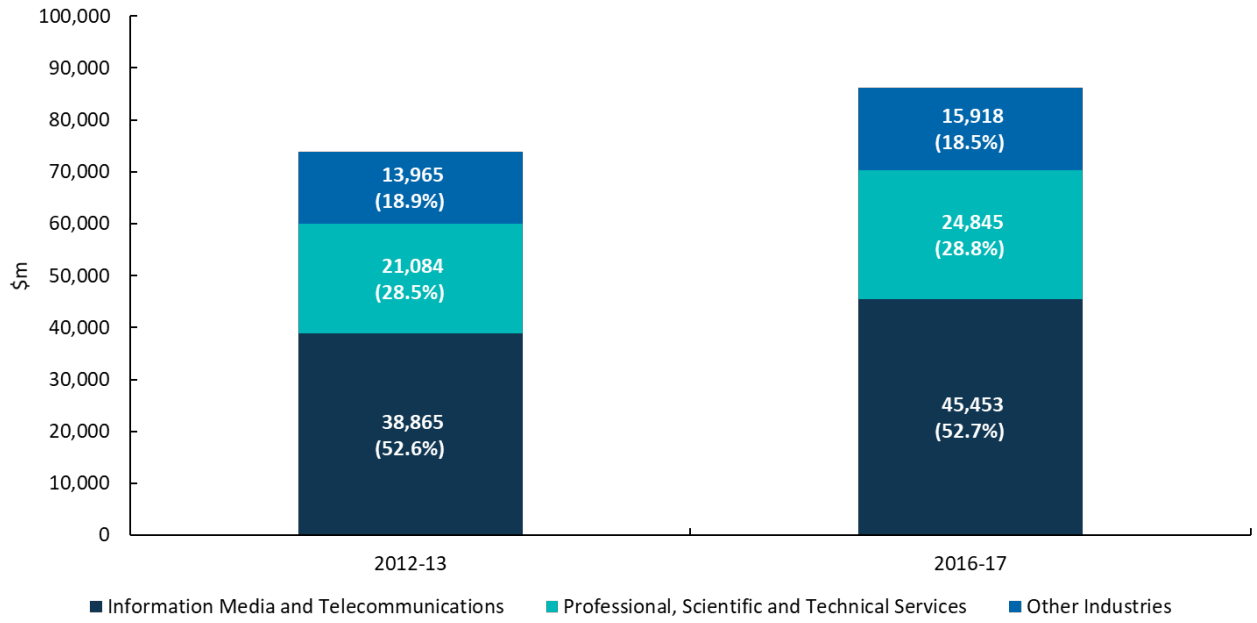
ICT activity by division	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
Agriculture, Forestry and Fishing	9	7	8	9	10	1	6.5
Mining	31	33	40	35	34	3	11.0
Manufacturing	2,832	2,452	2,787	3,178	3,308	476	16.8
Electricity, Gas, Water and Waste Services	73	92	129	115	151	78	107.9
Construction	1,922	2,179	2,204	2,388	2,582	660	34.3
Wholesale Trade	6,155	5,732	5,962	5,874	6,366	211	3.4
Retail Trade	419	384	381	467	463	44	10.5
Accommodation and Food Services	21	22	18	26	32	11	50.6
Transport, Postal and Warehousing	138	116	133	155	134	-4	-3.1

ICT activity by division	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
Information Media and Telecommunications	38,865	40,550	42,522	43,380	45,453	6,588	16.9
Financial and Insurance Services	300	289	365	390	479	178	59.3
Rental, Hiring and Real Estate Services	41	33	38	37	61	20	48.8
Professional, Scientific and Technical Services	21,084	20,559	21,126	23,269	24,845	3,760	17.8
Administrative and Support Services	55	54	67	70	83	28	50.5
Public Administration and Safety	785	899	977	962	952	167	21.3
Education and Training	20	26	24	31	36	16	79.7
Health Care and Social Assistance	53	62	58	53	71	18	33.4
Arts and Recreation Services	15	12	16	118	146	131	881.8
Other Services	1,097	1,341	1,111	943	1,013	-84	-7.6
Total	**73,915**	**74,843**	**77,967**	**81,498**	**86,216**	**12,301**	**16.6**
Share of total GVA (%)	**5.1**	**5.0**	**5.1**	**5.3**	**5.2**	**-**	**-**

Source: ABS cat. 5215, 5217; BCAR estimates.

IMT and PSTS comprised 81.5 per cent of total ICT activity in 2016–17, up from 81.1 per cent in 2012–13. In all other divisions, ICT activity grew by $2.0 billion or 14.0 per cent, from $14.0 billion in 2012–13 to $15.9 billion in 2016–17 (Figure 38).

Figure 38. ICT share of GVA by key divisions, 2012–13 to 2016–17, current prices



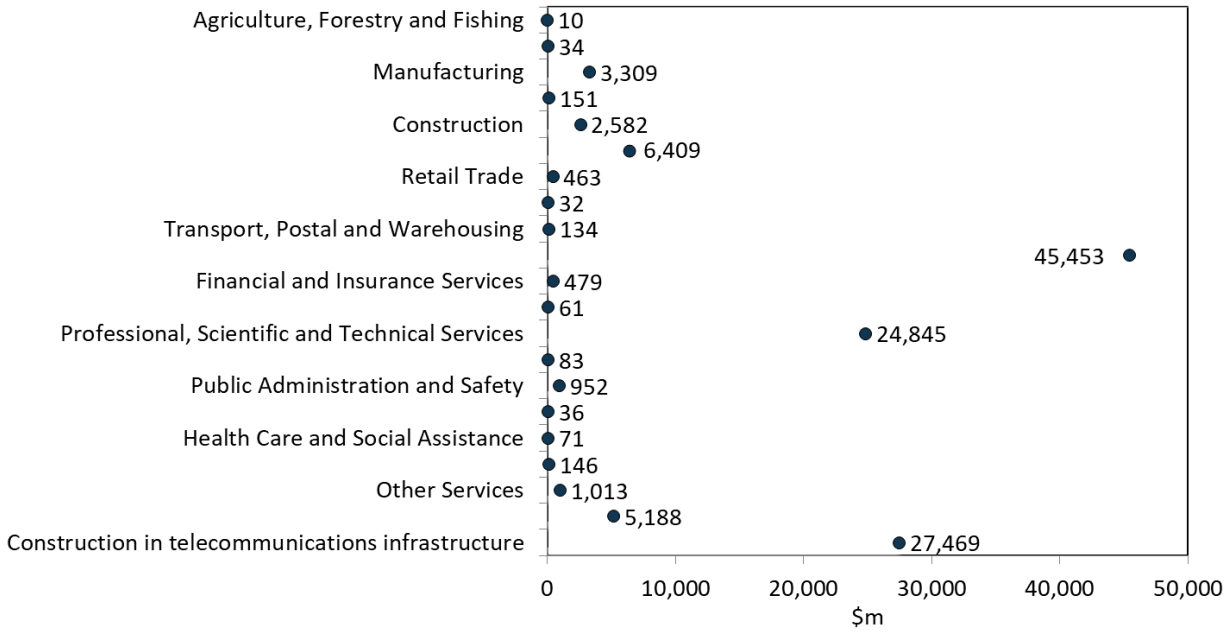
Source: ABS cat. 5215, 5217; BCAR estimates.

Digital activity—current prices

Digital activity was $118.9 billion, or 7.2 per cent of economic activity in 2016–17. Digital activity increased by 39.9 per cent, or $33.9 billion from 2012–13 to 2016–17. As a share of economic activity, digital activity increased from 5.9 per cent in 2012–13 to 7.2 per cent in 2016–17.

IMT was the largest contributor, valued at $45.5 billion in 2016–17, or 38.2 per cent of activity in digital activity (Figure 39).

Figure 39. Digital activity by industry division, 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Digital activity in IMT increased by $6.6 billion or 16.9 per cent from 2012–13 to 2016–17 (Table 28). The industry decreased by 7.5 percentage points as a share of digital activity, from 45.7 per cent in 2012–13 to 38.2 per cent in 2016–17.

The second largest contributor was construction in telecommunications infrastructure, which was $27.5 billion, or 23.1 per cent of digital activity in 2016–17. This construction activity was the largest driver of growth over the period, increasing by $19.1 billion or 227.6 per cent. As a share of digital activity, it increased from 9.9 per cent in 2012–13 to 23.1 per cent in 2016–17. This was driven by increased private and public investment in telecommunications infrastructure. In particular, it included the rollout of NBN infrastructure across Australia.[27]

PSTS was the third largest contributor, valued at $24.8 billion in 2016–17, or 20.9 per cent of digital activity. Digital activity in PSTS increased by $3.8 billion or 17.8 per cent from 2012–13 to 2016–17. However, the industry's share of digital activity decreased from 24.8 per cent in 2012–13 to 20.9 per cent in 2016–17.

Table 28. Digital activity, GVA by division, 2012–13 to 2016–17, current prices

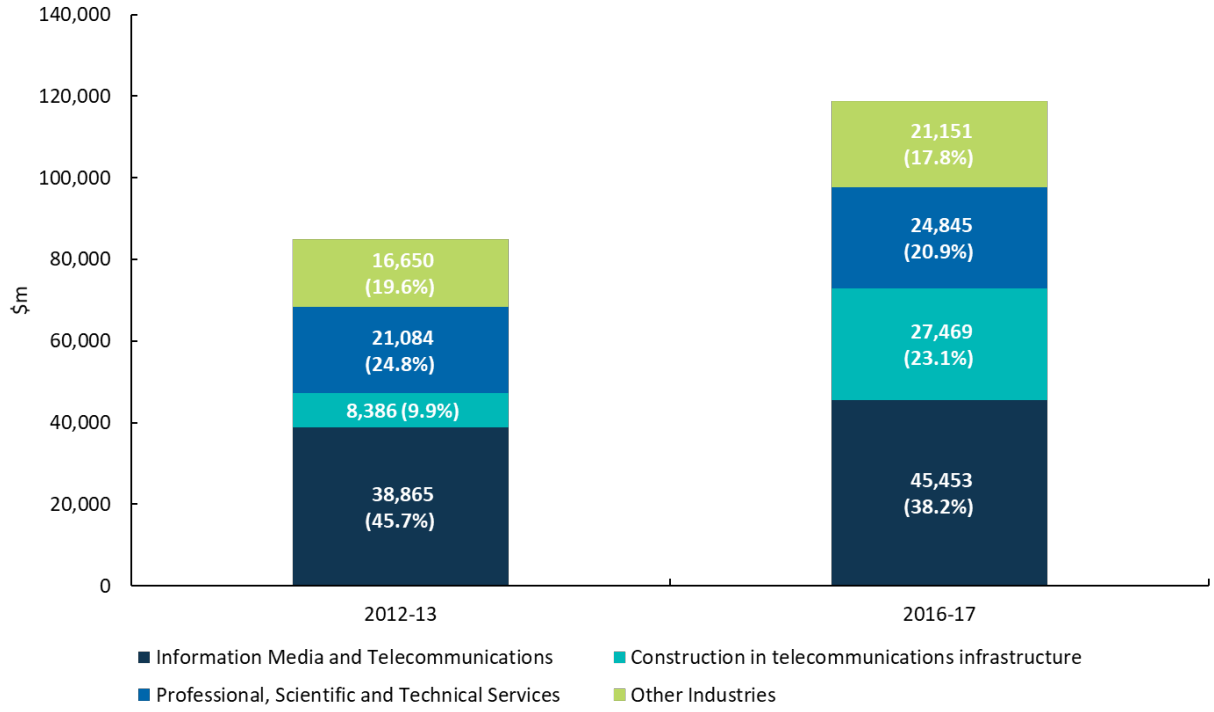
Digital activity by division	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
Agriculture, Forestry and Fishing	9	7	8	9	10	1	6.5
Mining	31	33	40	35	34	3	11.0
Manufacturing	2,833	2,453	2,787	3,180	3,309	476	16.8
Electricity, Gas, Water and Waste Services	73	92	129	115	151	78	107.9
Construction	1,922	2,179	2,204	2,388	2,582	660	34.3
Wholesale Trade	6,171	5,749	5,979	5,915	6,409	238	3.9
Retail Trade	419	384	381	467	463	44	10.5
Accommodation and Food Services	21	22	18	26	32	11	50.6
Transport, Postal and Warehousing	138	116	133	155	134	-4	-3.1
Information Media and Telecommunications	38,865	40,550	42,522	43,380	45,453	6,588	16.9
Financial and Insurance Services	300	289	365	390	479	178	59.3
Rental, Hiring and Real Estate Services	41	33	38	37	61	20	48.8
Professional, Scientific and Technical Services	21,084	20,559	21,126	23,269	24,845	3,760	17.8
Administrative and Support Services	55	54	67	70	83	28	50.5
Public Administration and Safety	785	899	977	962	952	167	21.3
Education and Training	20	26	24	31	36	16	79.7
Health Care and Social Assistance	53	62	58	53	71	18	33.4

Digital activity by division	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
Arts and Recreation Services	15	12	16	118	146	131	881.8
Other Services	1,097	1,341	1,111	943	1,013	-84	-7.6
Total	73,932	74,862	77,984	81,541	86,260	12,328	16.7
E-Commerce	2,668	3,024	3,539	4,934	5,188	2,521	94.5
Construction in telecommunications infrastructure	8,386	10,658	13,628	19,483	27,469	19,083	227.6
Total	**84,986**	**88,544**	**95,151**	**105,959**	**118,917**	**33,931**	**39.9**
Share of total GVA (%)	**5.9**	**5.9**	**6.3**	**6.9**	**7.2**	**-**	**-**

Source: ABS cat. 5215, 5217; BCAR estimates.

IMT, construction in telecommunications infrastructure and PSTS comprised 82.2 per cent of digital activity in 2016–17, up from 80.4 per cent in 2012–13. In all other divisions, digital activity grew by $4.5 billion or 27.0 per cent, from $16.7 billion in 2012–13 to $21.2 billion in 2016–17 (Figure 40).

Figure 40. Digital activity share of GVA by key divisions, 2012–13 to 2016–17, current prices



Source: ABS cat. 5215, 5217; BCAR estimates.

Activity by industry division, volume measures

IoT activity—volume measures

IoT activity increased by 25.6 per cent from 2012–13 to 2016–17. As a share of GVA, IoT increased by 0.5 percentage points, from 4.0 per cent to 4.5 per cent over the period (Table 29).

Table 29. IoT activity GVA share and growth rate, by division, 2012–13 to 2016–17, volume measures

IoT activity by division	Division share of IoT (%) 2012–13	Division share of IoT (%) 2013–14	Division share of IoT (%) 2014–15	Division share of IoT (%) 2015–16	Division share of IoT (%) 2016–17	2012–13 to 2016–17 growth rate %	2012–13 to 2016–17 contribution to growth %
Agriculture, Forestry and Fishing	0.0	0.0	0.0	0.0	0.0	-19.3	0.0
Mining	0.0	0.0	0.1	0.1	0.0	24.6	0.0
Manufacturing	4.1	3.6	3.7	4.0	3.8	14.9	0.6
Electricity, Gas, Water and Waste Services	0.1	0.1	0.2	0.2	0.2	109.7	0.1
Construction	3.6	4.0	3.7	3.6	3.5	20.2	0.7
Wholesale Trade	9.6	8.7	8.8	7.9	8.1	5.3	0.5
Retail Trade	0.7	0.6	0.6	0.7	0.6	12.4	0.1
Accommodation and Food Services	0.0	0.0	0.0	0.0	0.0	46.4	0.0
Transport, Postal and Warehousing	0.2	0.2	0.2	0.2	0.2	-8.4	0.0
Information Media and Telecommunications	41.7	43.5	45.5	45.4	46.5	40.2	16.7
Financial and Insurance Services	0.5	0.5	0.6	0.6	0.6	48.7	0.3
Rental, Hiring and Real Estate Services	0.1	0.1	0.1	0.1	0.1	43.9	0.0
Professional, Scientific and Technical Services	35.6	34.4	33.0	34.3	33.4	17.9	6.4
Administrative and Support Services	0.1	0.1	0.1	0.1	0.1	44.2	0.0
Public Administration and Safety	1.4	1.6	1.6	1.4	1.3	12.3	0.2
Education and Training	0.0	0.0	0.0	0.0	0.0	67.4	0.0
Health Care and Social Assistance	0.1	0.1	0.1	0.1	0.1	30.5	0.0
Arts and Recreation Services	0.0	0.0	0.0	0.0	0.0	33.4	0.0
Other Services	1.9	2.2	1.7	1.4	1.4	-9.0	-0.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**25.6**	**25.6**
IoT as a share of GVA (%)	**4.0**	**3.9**	**4.1**	**4.3**	**4.5**	**-**	**-**

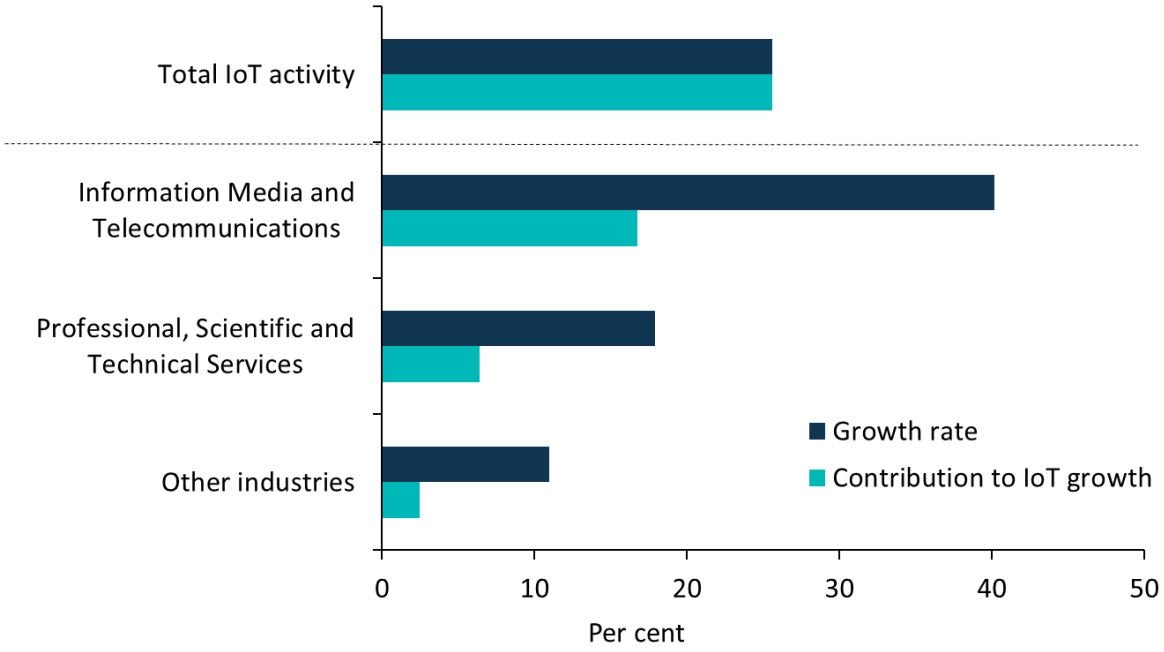
Source: ABS cat. 5215, 5217; BCAR estimates.

IMT was the largest contributor to this growth, adding 16.7 percentage points over the period. IoT activity in the IMT industry increased by 40.2 per cent over the period, and as a share of IoT activity, IMT increased by 4.8 percentage points, from 41.7 per cent in 2012–13 to 46.5 per cent in 2016–17 (Figure 41).

PSTS was the second largest contributor, adding 6.4 percentage points over the period. IoT activity in the PSTS industry increased by 17.9 per cent from 2012–13 to 2016–17. However, as a share of IoT activity, the PSTS industry decreased by 2.2 percentage points, from 35.6 per cent to 33.4 per cent over the period.

In all divisions excluding IMT and PSTS, the contribution to the growth in IoT activity was 2.5 percentage points.

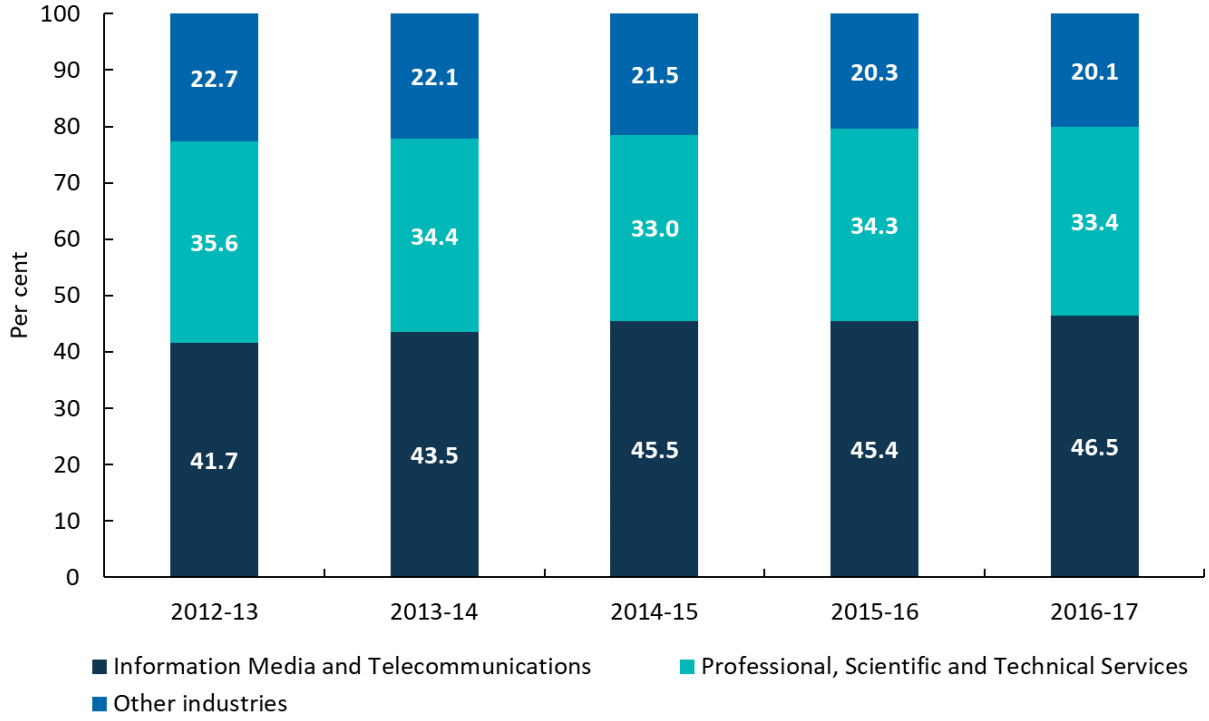
Figure 41. IoT activity GVA growth rate and contribution to the growth of key divisions, 2012–13 to 2016–17, volume measures



Source: ABS cat. 5215, 5217, 5204; BCAR estimates.

IMT and PSTS comprised 79.9 per cent of total IoT activity in 2016–17, up from 77.3 per cent in 2012–13 (Figure 42). In all divisions excluding IMT and PSTS, the share of IoT activity declined by 2.6 percentage points, from 22.7 per cent in 2012–13 to 20.1 per cent in 2016–17.

Figure 42. IoT share of GVA by key divisions, 2012–13 to 2016–17, volume measures



Source: ABS cat. 5215, 5217, 5204; BCAR estimates.

ICT activity—volume measures

ICT activity increased by 27.2 per cent from 2012–13 to 2016–17. As a share of GVA, ICT increased by 0.7 percentage points, from 4.6 per cent to 5.2 per cent over the period (Table 30).

Table 30. ICT activity GVA share and growth rate, by division, 2012–13 to 2016–17, volume measures

ICT activity by division	Division share of ICT (%) 2012–13	Division share of ICT (%) 2013–14	Division share of ICT (%) 2014–15	Division share of ICT (%) 2015–16	Division share of ICT (%) 2016–17	2012–13 to 2016–17 growth rate %	2012–13 to 2016–17 contribution to growth %
Agriculture, Forestry and Fishing	0.0	0.0	0.0	0.0	0.0	-19.3	0.0
Mining	0.0	0.0	0.1	0.1	0.0	24.6	0.0
Manufacturing	4.5	3.7	3.9	4.0	3.8	9.3	0.4
Electricity, Gas, Water and Waste Services	0.1	0.1	0.2	0.2	0.2	109.7	0.1
Construction	3.2	3.5	3.2	3.1	3.0	20.2	0.6
Wholesale Trade	8.8	7.9	7.9	7.2	7.4	7.1	0.6
Retail Trade	0.6	0.6	0.5	0.6	0.5	12.4	0.1
Accommodation and Food Services	0.0	0.0	0.0	0.0	0.0	46.4	0.0
Transport, Postal and Warehousing	0.2	0.2	0.2	0.2	0.2	-8.4	0.0

ICT activity by division	Division share of ICT (%) 2012–13	Division share of ICT (%) 2013–14	Division share of ICT (%) 2014–15	Division share of ICT (%) 2015–16	Division share of ICT (%) 2016–17	2012–13 to 2016–17 growth rate %	2012–13 to 2016–17 contribution to growth %
Information Media and Telecommunications	47.8	50.0	51.8	51.9	52.7	40.3	19.3
Financial and Insurance Services	0.5	0.4	0.5	0.5	0.6	48.7	0.2
Rental, Hiring and Real Estate Services	0.1	0.0	0.1	0.0	0.1	43.9	0.0
Professional, Scientific and Technical Services	31.1	29.9	28.5	29.4	28.8	17.9	5.6
Administrative and Support Services	0.1	0.1	0.1	0.1	0.1	44.2	0.0
Public Administration and Safety	1.3	1.4	1.4	1.2	1.1	12.3	0.2
Education and Training	0.0	0.0	0.0	0.0	0.0	67.4	0.0
Health Care and Social Assistance	0.1	0.1	0.1	0.1	0.1	30.5	0.0
Arts and Recreation Services	0.0	0.0	0.0	0.1	0.2	824.1	0.2
Other Services	1.6	1.9	1.5	1.2	1.2	-9.0	-0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**27.2**	**27.2**
ICT as a share of GVA (%)	**4.6**	**4.5**	**4.7**	**5.0**	**5.2**	**-**	**-**

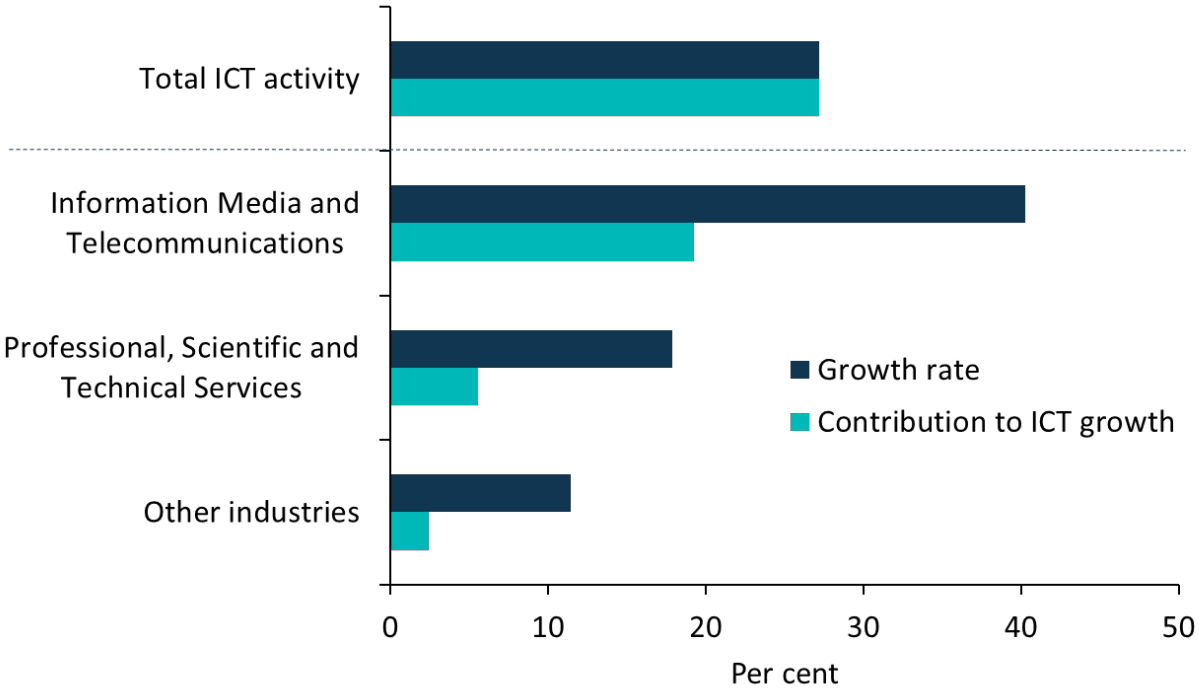
Source: ABS cat. 5215, 5217, 5204; BCAR estimates.

IMT was the largest contributor, adding 19.3 percentage points to this growth. ICT activity in the IMT industry increased by 40.3 per cent over the period (Figure 43). The industry's share of ICT activity increased by 4.9 percentage points, from 47.8 per cent in 2012–13 to 52.7 per cent in 2016–17.

PSTS was the second largest contributor to ICT activity, adding 5.6 percentage points to this growth. ICT activity in the PSTS industry increased by 17.9 per cent from 2012–13 to 2016–17. However, as a share of ICT activity, the industry share declined by 2.3 percentage points, from 31.1 per cent to 28.8 per cent over the period.

In all divisions excluding IMT and PSTS, the contribution to the growth in ICT activity was 2.4 percentage points.

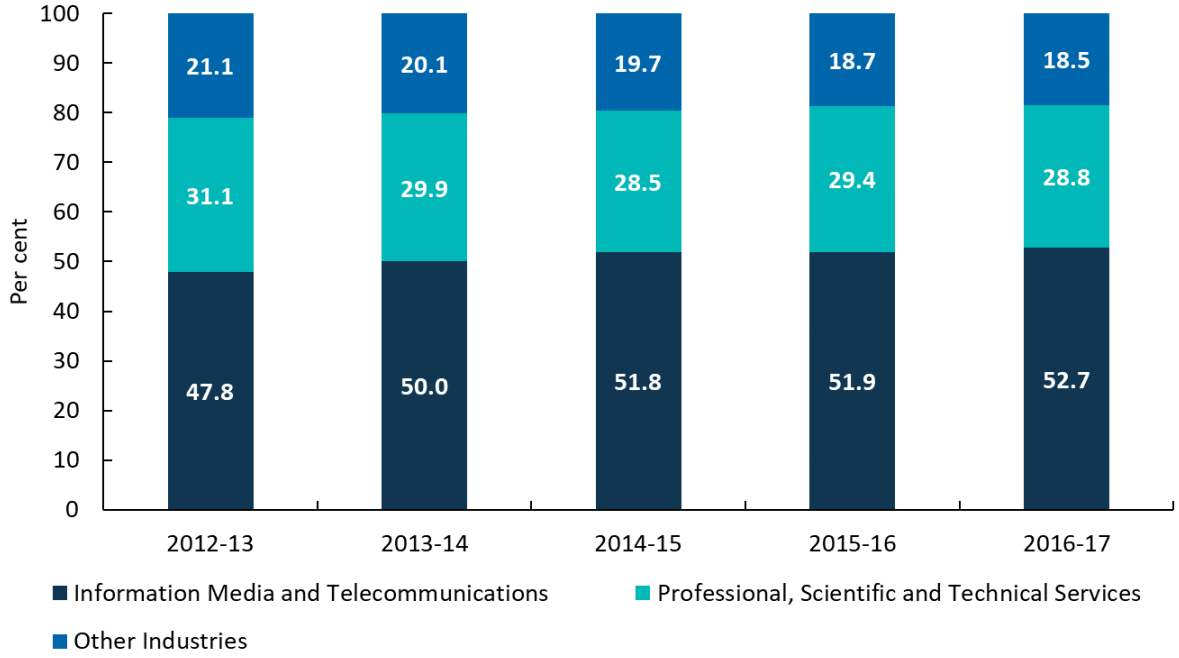
Figure 43. ICT GVA growth rate of key divisions, 2012–13 to 2016–17, volume measures



Source: ABS cat. 5215, 5217, 5204; BCAR estimates.

IMT and PSTS comprised 81.5 per cent of ICT activity in 2016–17, up from 78.9 per cent in 2012–13. In all divisions excluding IMT and PSTS, the share of ICT activity decreased by 2.6 percentage points, from 21.1 per cent in 2012–13 to 18.5 per cent in 2016–17.

Figure 44. ICT share of GVA by key divisions, 2012–13 to 2016–17, volume measures



Source: ABS cat. 5215, 5217, 5204; BCAR estimates.

Digital activity—volume measures

Digital activity increased by 49.1 per cent from 2012–13 to 2016–17 (Table 31). As a share of GVA, digital activity increased by 1.9 percentage points, from 5.4 per cent in 2012–13 to 7.2 per cent in 2016–17.

Table 31. Digital activity GVA share and growth rate, by division, 2012–13 to 2016–17, volume measures

Digital activity by division	Division share of digital activity (%) 2012–13	Division share of digital activity (%) 2013–14	Division share of digital activity (%) 2014–15	Division share of digital activity (%) 2015–16	Division share of digital activity (%) 2016–17	2012–13 to 2016–17 growth rate %	2012–13 to 2016–17 contribution to growth %
Agriculture, Forestry and Fishing	0.0	0.0	0.0	0.0	0.0	-19.3	0.0
Mining	0.0	0.0	0.0	0.0	0.0	24.6	0.0
Manufacturing	3.8	3.1	3.1	3.1	2.8	9.3	0.4
Electricity, Gas, Water and Waste Services	0.1	0.1	0.1	0.1	0.1	109.7	0.1
Construction	2.7	2.9	2.5	2.4	2.2	20.2	0.5
Wholesale Trade	7.5	6.5	6.4	5.5	5.4	7.6	0.6
Retail Trade	0.5	0.5	0.4	0.4	0.4	12.4	0.1
Accommodation and Food Services	0.0	0.0	0.0	0.0	0.0	46.4	0.0
Transport, Postal and Warehousing	0.2	0.1	0.1	0.1	0.1	-8.4	0.0
Information Media and Telecommunications	40.6	41.2	41.7	39.4	38.2	40.3	16.4
Financial and Insurance Services	0.4	0.4	0.4	0.4	0.4	48.7	0.2
Rental, Hiring and Real Estate Services	0.1	0.0	0.0	0.0	0.1	43.9	0.0
Professional, Scientific and Technical Services	26.4	24.6	22.9	22.4	20.9	17.9	4.7
Administrative and Support Services	0.1	0.1	0.1	0.1	0.1	44.2	0.0
Public Administration and Safety	1.1	1.2	1.1	0.9	0.8	12.3	0.1
Education and Training	0.0	0.0	0.0	0.0	0.0	67.4	0.0
Health Care and Social Assistance	0.1	0.1	0.1	0.0	0.1	30.5	0.0
Arts and Recreation Services	0.0	0.0	0.0	0.1	0.1	824.1	0.2
Other Services	1.4	1.6	1.2	0.9	0.9	-9.0	-0.1
Total	**85.0**	**82.4**	**80.4**	**76.0**	**72.5**	**27.3**	**23.2**

Digital activity by division	Division share of digital activity (%) 2012–13	Division share of digital activity (%) 2013–14	Division share of digital activity (%) 2014–15	Division share of digital activity (%) 2015–16	Division share of digital activity (%) 2016–17	2012–13 to 2016–17 growth rate %	2012–13 to 2016–17 contribution to growth %
E-commerce	3.3	3.5	3.8	4.6	4.4	99.6	3.2
Construction in telecommunications infrastructure	11.8	14.1	15.7	19.4	23.1	193.1	22.7
Total	100.0	100.0	100.0	100.0	100.0	49.1	49.1
Digital activity as a share of GVA	5.4	5.5	5.9	6.6	7.2	-	-

Source: ABS cat. 5215, 5217, 5204; BCAR estimates.

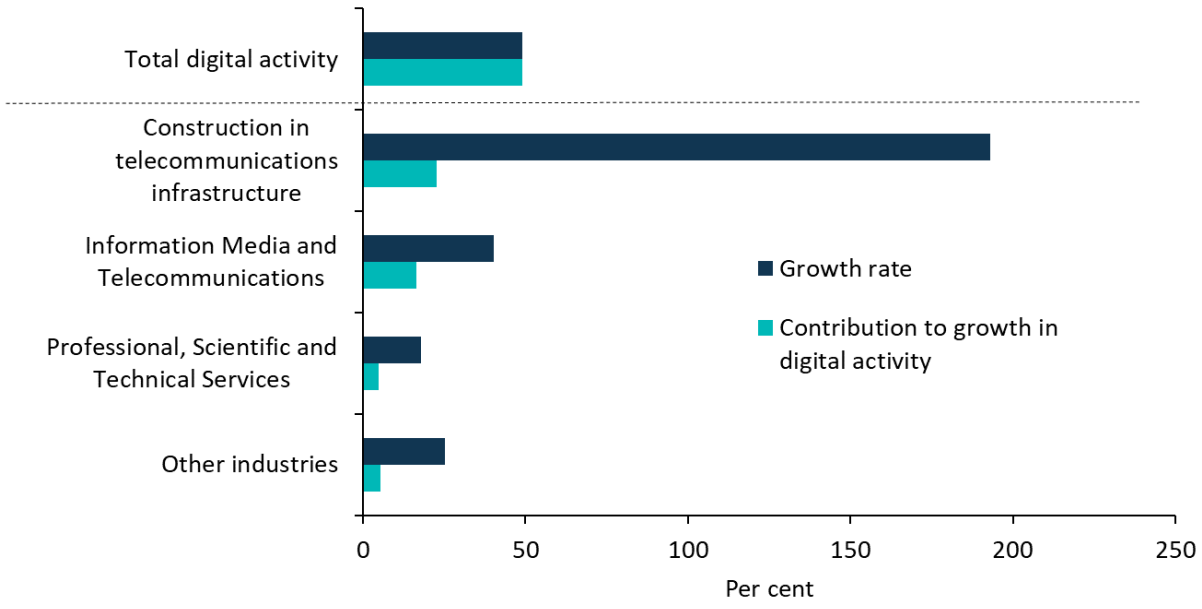
Construction in telecommunications infrastructure was the largest contributor, adding 22.7 percentage points to this growth (Figure 45). Digital activity in construction grew by 193.1 per cent over the period, and almost doubled as a share of digital activity, growing from 11.8 per cent to 23.1 per cent over the period.

IMT was the second largest contributor, adding 16.4 percentage points to the growth. Digital activity in this industry increased by 40.3 per cent from 2012–13 to 2016–17. However, as a share of digital activity, it declined by 2.4 percentage points, from 40.6 per cent in 2012–13 to 38.2 per cent in 2016–17.

PSTS was the third largest contributor to growth, adding 4.7 percentage points over the period. Digital activity in PSTS increased by 17.9 per cent from 2012–13 to 2016–17. However, as a share of digital activity, it declined 5.5 percentage points, from 26.4 per cent in 2012–13 to 20.9 per cent in 2016–17.

In all divisions excluding construction in telecommunications, IMT and PSTS, the contribution to this growth in digital activity was 5.3 percentage points.

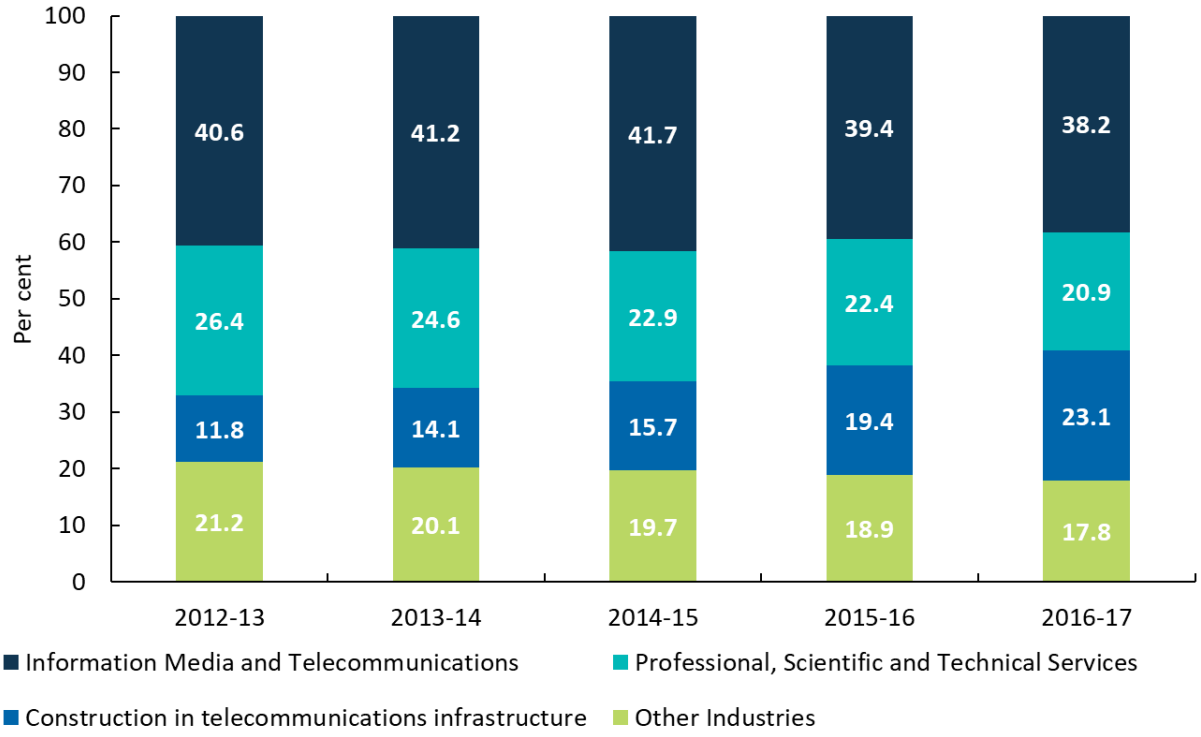
Figure 45. Digital activity GVA growth rate of key divisions, 2012–13 to 2016–17, volume measures



Source: ABS cat. 5215, 5217, 5204; BCAR estimates.

IMT, construction in telecommunications infrastructure and PSTS comprised 82.2 per cent of digital activity in 2016–17, up from 78.8 per cent in 2012–13 (Figure 46). In all divisions excluding these three main drivers, the share of digital activity decreased by 3.4 percentage points, from 21.2 per cent in 2012–13 to 17.8 per cent in 2016–17.

Figure 46. Digital activity share of GVA by key divisions, 2012–13 to 2016–17, volume measures



Source: ABS cat. 5215, 5217, 5204; BCAR estimates.

Domestic output by division—current prices

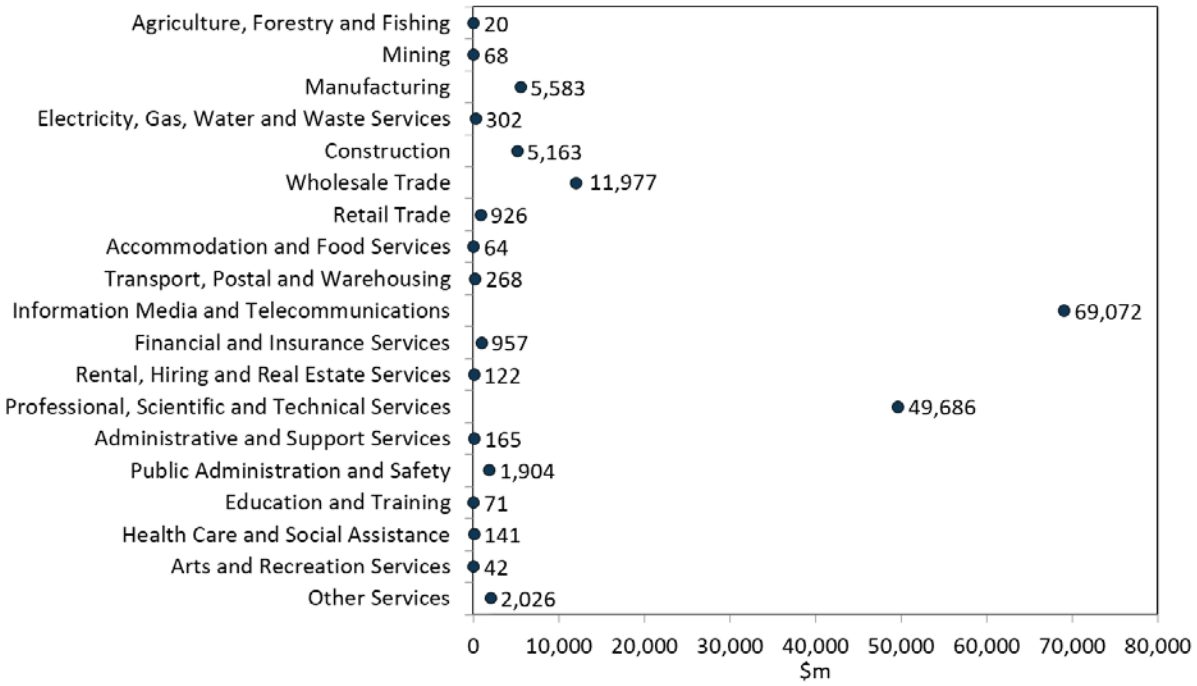
IoT activity—current prices

Domestic output of IoT was $148.6 billion in 2016–17, or 4.5 per cent of total output. IMT was the largest contributor, at $69.1 billion in 2016–17, or 46.5 per cent of IoT output (Figure 47).

The second largest contributor was PSTS, which contributed $49.7 billion in 2016–17, or 33.4 per cent of IoT output.

In contrast, the smallest contributor was Agriculture, forestry and fishing, which contributed only $20 million in 2016–17, or 0.01 per cent of total IoT output. This industry includes the production of grains, vegetables and livestock which are not related to IoT activity. While the potential impact of digitally-enabling technologies might be material, the direct contribution of agriculture itself to IoT activity is small.

Figure 47. IoT output by industry division, 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

IoT output increased by 15.1 per cent, or $19.5 billion from 2012–13 to 2016–17 (Table 32). IMT was the largest contributor to this growth over the period, increasing by $9.3 billion or 15.5 per cent. The growth in IMT was mainly due to telecommunications services and internet publishing and broadcasting.

PSTS was the second largest contributor to IoT output, increasing by $7.0 billion or 16.4 per cent, from 2012–13 to 2016–17. This was primarily driven by an increase in computer system design and related services of $6.6 billion or 15.7 per cent over the period.

IMT and PSTS comprised 79.9 per cent of IoT in 2016–17. In all divisions excluding these two main drivers, IoT output grew by $3.2 billion or 12.0 per cent over the period to $29.8 billion in 2016–17.

Table 32. IoT products output by industry division, from 2012–13 to 2016–17

IoT activity by division	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
Agriculture, Forestry and Fishing	19	15	17	18	20	1	5.3
Mining	62	66	80	72	68	6	9.7
Manufacturing	4,603	4,185	4,615	5,438	5,583	981	21.3
Electricity, Gas, Water and Waste Services	147	186	260	233	302	155	105.4
Construction	3,890	4,407	4,454	4,844	5,163	1,273	32.7
Wholesale Trade	11,921	11,036	11,507	11,204	11,977	56	0.5
Retail Trade	848	776	769	947	926	78	9.1

IoT activity by division	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
Accommodation and Food Services	43	45	37	52	64	21	48.8
Transport, Postal and Warehousing	280	235	269	315	268	-12	-4.3
Information Media and Telecommunications	59,816	61,915	65,276	66,102	69,072	9,256	15.5
Financial and Insurance Services	608	585	738	790	957	349	57.4
Rental, Hiring and Real Estate Services	83	67	76	75	122	39	47.0
Professional, Scientific and Technical Services	42,678	41,571	42,686	47,194	49,686	7,007	16.4
Administrative and Support Services	111	109	136	141	165	54	48.6
Public Administration and Safety	1,589	1,818	1,975	1,951	1,904	315	19.8
Education and Training	40	52	49	62	71	31	77.5
Health Care and Social Assistance	107	125	118	107	141	34	31.8
Arts and Recreation Services	30	24	32	45	42	12	40.0
Other Services	2,220	2,712	2,245	1,912	2,026	-194	-8.7
Total	**129,095**	**129,929**	**135,339**	**141,502**	**148,557**	**19,461**	**15.1**

Source: ABS cat. 5215, 5217; BCAR estimates.

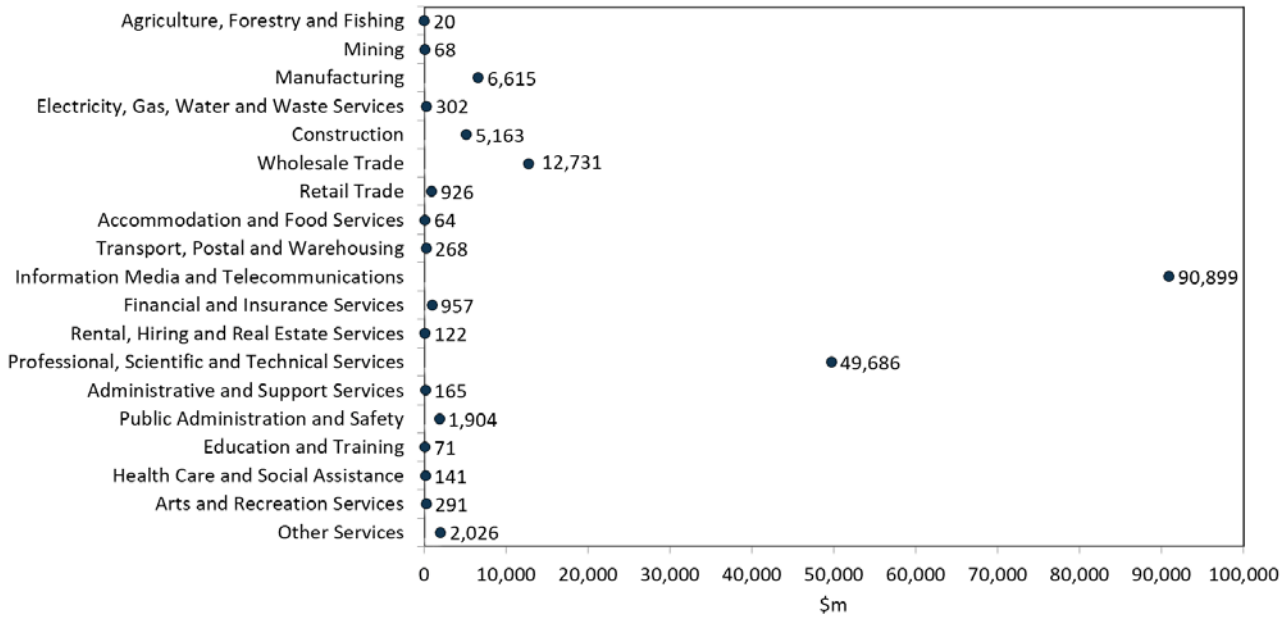
ICT activity—current prices

ICT domestic output was $172.4 billion in 2016–17. IMT was the largest contributor at $90.9 billion in 2016–17, or 52.7 per cent of ICT output (Figure 48).

The second largest contributor was PSTS, which contributed $49.7 billion in 2016–17, or 28.8 per cent of ICT output.

The smallest contributor was Agriculture, forestry and fishing, which contributed $20 million in 2016–17, or 0.01 per cent of the total ICT output.

Figure 48. ICT output by industry division, 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

ICT output increased by 15.2 per cent, or $22.8 billion from 2012–13 to 2016–17 (Table 33). IMT was the largest contributor to this growth, increasing by $12.2 billion or 15.5 per cent over the period. PSTS was the second largest contributor to ICT output, increasing by $7.0 billion or 16.4 per cent from 2012–13 to 2016–17.

IMT and PSTS comprised 81.5 per cent of ICT in 2016–17. In all divisions excluding these two main drivers, ICT output grew by $3.6 billion or 12.6 per cent over the period to $31.8 billion in 2016–17.

Table 33. ICT products output by industry division, from 2012–13 to 2016–17

ICT activity by division	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
Agriculture, Forestry and Fishing	19	15	17	18	20	1	5.3
Mining	62	66	80	72	68	6	9.7
Manufacturing	5,732	4,957	5,632	6,446	6,615	883	15.4
Electricity, Gas, Water and Waste Services	147	186	260	233	302	155	105.4
Construction	3,890	4,407	4,454	4,844	5,163	1,273	32.7
Wholesale Trade	12,458	11,591	12,046	11,913	12,731	273	2.2
Retail Trade	848	776	769	947	926	78	9.1
Accommodation and Food Services	43	45	37	52	64	21	48.8
Transport, Postal and Warehousing	280	235	269	315	268	-12	-4.3

ICT activity by division	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
Information Media and Telecommunications	78,670	81,992	85,919	87,984	90,899	12,229	15.5
Financial and Insurance Services	608	585	738	790	957	349	57.4
Rental, Hiring and Real Estate Services	83	67	76	75	122	39	47.0
Professional, Scientific and Technical Services	42,678	41,571	42,686	47,194	49,686	7,007	16.4
Administrative and Support Services	111	109	136	141	165	54	48.6
Public Administration and Safety	1,589	1,818	1,975	1,951	1,904	315	19.8
Education and Training	40	52	49	62	71	31	77.5
Health Care and Social Assistance	107	125	118	107	141	34	31.8
Arts and Recreation Services	30	24	32	239	291	261	870.0
Other Services	2,220	2,712	2,245	1,912	2,026	-194	-8.7
Total	**149,616**	**151,333**	**157,538**	**165,295**	**172,419**	**22,803**	**15.2**

Source: ABS cat. 5215, 5217; BCAR estimates.

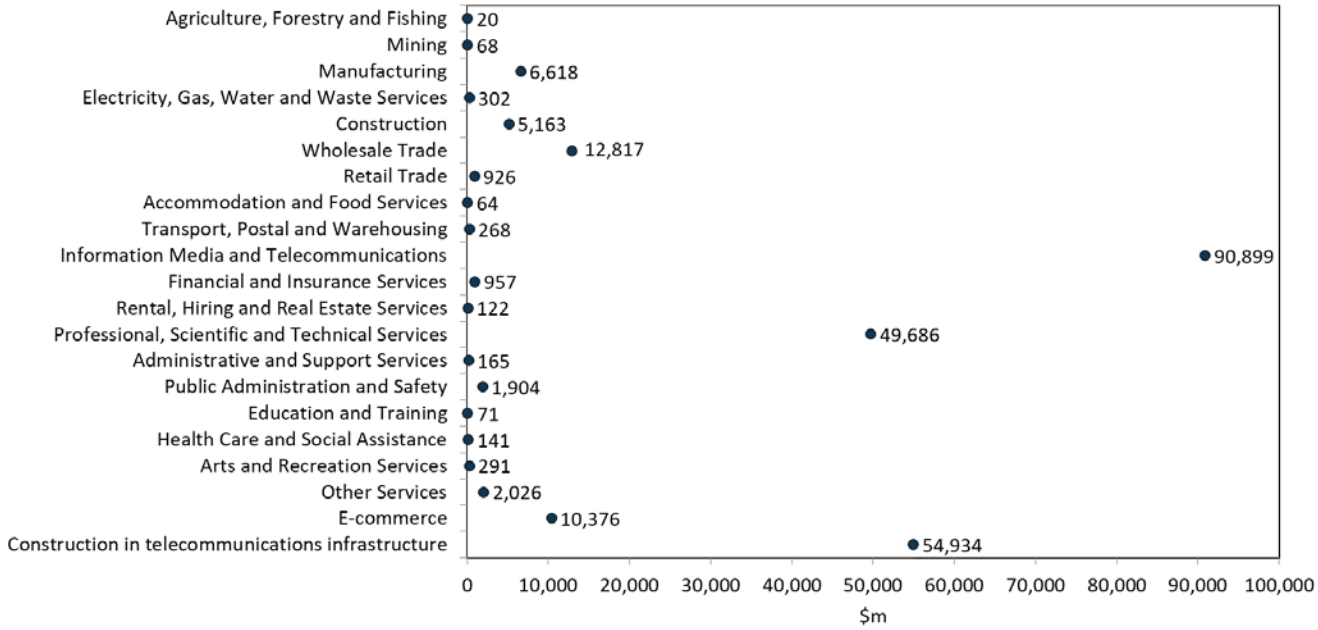
Digital activity—current prices

Digital activity output was valued at $237.8 billion in 2016–17, or 7.2 per cent of domestic output. IMT was the largest contributor at $90.9 billion in 2016–17, or 38.2 per cent of output from digital activity (Figure 49).

The second largest contributor was construction in telecommunications infrastructure, which contributed $54.9 billion in 2016–17, or 23.1 per cent of digital activity output.

The smallest contributor was Agriculture, forestry and fishing, which contributed $20 million in 2016–17, or 0.01 per cent of the total digital activity output.

Figure 49. Digital activity output by industry division, 2016–17



Source: ABS cat. 5215, 5217; BCAR estimates.

Output from digital activity increased by 38.2 per cent, or $65.8 billion from 2012–13 to 2016–17 (Table 34). Construction in telecommunications infrastructure was the largest contributor to this growth over the period, increasing by $38.0 billion or 223.6 per cent over the period. IMT was the second largest contributor to digital activity output, increasing by $12.2 billion or 15.5 per cent over the period.

IMT, construction in telecommunications infrastructure and PSTS combined comprised 82.2 per cent of ICT in 2016–17. Excluding these three main drivers, output in digital activity from the remaining industry divisions grew by $8.6 billion or 25.5 per cent over the period to $42.3 billion in 2016–17.

Table 34. Digital activity output by industry division, from 2012–13 to 2016–17

ICT activity by division	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
Agriculture, Forestry and Fishing	19	15	17	18	20	1	5.3
Mining	62	66	80	72	68	6	9.7
Manufacturing	5,735	4,960	5,632	6,449	6,618	883	15.4
Electricity, Gas, Water and Waste Services	147	186	260	233	302	155	105.4
Construction	3,890	4,407	4,454	4,844	5,163	1,273	32.7
Wholesale Trade	12,491	11,625	12,080	11,997	12,817	326	2.6
Retail Trade	848	776	769	947	926	78	9.1
Accommodation and Food Services	43	45	37	52	64	21	48.8
Transport, Postal and Warehousing	280	235	269	315	268	-12	-4.3

ICT activity by division	2012–13 $m	2013–14 $m	2014–15 $m	2015–16 $m	2016–17 $m	Change from 2012–13 to 2016–17 $m	Change from 2012–13 to 2016–17 %
Information Media and Telecommunications	78,670	81,992	85,919	87,984	90,899	12,229	15.5
Financial and Insurance Services	608	585	738	790	957	349	57.4
Rental, Hiring and Real Estate Services	83	67	76	75	122	39	47.0
Professional, Scientific and Technical Services	42,678	41,571	42,686	47,194	49,686	7,007	16.4
Administrative and Support Services	111	109	136	141	165	54	48.6
Public Administration and Safety	1,589	1,818	1,975	1,951	1,904	315	19.8
Education and Training	40	52	49	62	71	31	77.5
Health Care and Social Assistance	107	125	118	107	141	34	31.8
Arts and Recreation Services	30	24	32	239	291	261	870.0
Other Services	2,220	2,712	2,245	1,912	2,026	-194	-8.7
Total	149,652	151,370	157,572	165,383	172,508	22,856	15.3
E-Commerce							
Construction in telecommunications infrastructure	5,400	6,115	7,151	10,007	10,376	4,977	92.2
Total	**16,975**	**21,551**	**27,537**	**39,516**	**54,934**	**37,959**	**223.6**
Share of total GVA (%)	**172,026**	**179,036**	**192,260**	**214,906**	**237,818**	**65,791**	**38.2**

Source: ABS cat. 5215, 5217; BCAR estimates.

Appendix D. Methodology

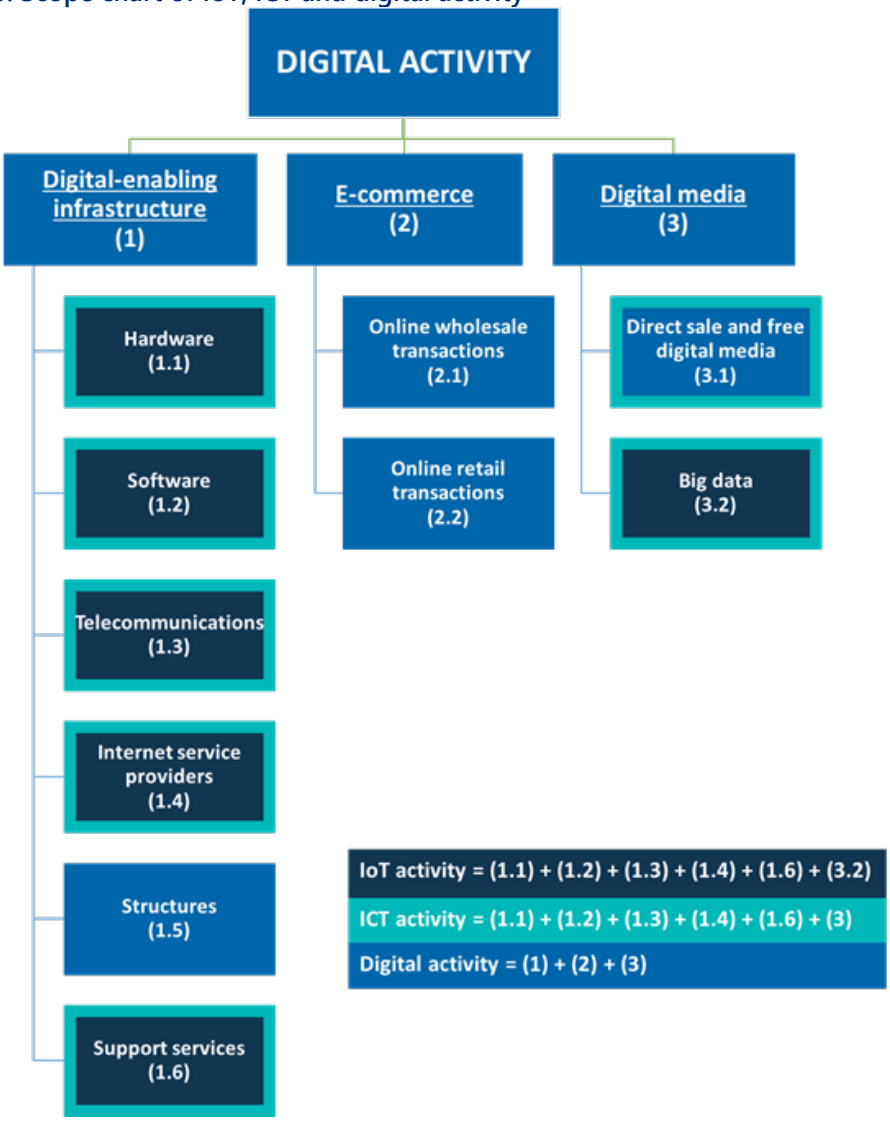
Definition and scope

Estimates of the economic values of IoT, ICT and digital activity are determined by how they are defined and identified within the national accounts framework.

The BCAR has broadly adopted the structure of digital activity used by the US Bureau of Economic Analysis (BEA) which is split into three categories of digital economy goods and services: digital-enabling infrastructure, e-commerce and digital media (Figure 50).

IoT activity and ICT activity are made up of components within these three categories. ICT activity includes the digital-enabling infrastructure (excluding structures) and digital media categories, while IoT activity consists of the digital-enabling infrastructure components of hardware, software, telecommunications, ISPs, support services, as well as the big data component from the digital media category. IoT activity is a subset of ICT activity, which itself is a subset of digital activity.

Figure 50. Scope chart of IoT, ICT and digital activity



Source: BCAR analysis based on the structure used by the US Bureau of Economic Analysis.

The methodology used in this paper adapts the framework developed by the BEA to apply it to Australia's national accounts framework (Table 35).

Table 35. Scope and definition of IoT, ICT, and digital activity

No.	Category/ Component[xviii]	Definition
1.	**Digital-enabling infrastructure**	**Digital-enabling infrastructure consists of the basic goods and services that support the existence and use of digital activity such as computer networks.**
1.1	Hardware	Goods that constitute a computer system, such as monitors, hard drives, semiconductors, wireless communications products, and audio and visual equipment.[30]
1.2	Software	Programs and other operating information used by devices such as personal computers and commercial servers, and services facilitating these programs.
1.3	Telecommunications	Goods and services that enable the digital transmission of information by cable, telegraph, telephone, broadcasting, or satellite.[30]
1.4	Internet Service Providers (ISPs)	Internet connectivity, access and search services such as Google.
1.5	Structures	Construction of telecommunications infrastructure, such as buildings where digital activity goods are created, and digital activity and support services are supplied.[30]
1.6	Support services	Services performed to support digital infrastructure such as data processing and storage, computer system design, digital consultation, and computer repair services.
2.	**E-commerce**	**E-commerce includes both online wholesale and retail transactions.**
3.	**Digital media[xix]**	**Digital media is content that people create, access, store, or view on digital devices.[31]**

Source: BCAR analysis based on the structure used by the US Bureau of Economic Analysis.

The values of IoT, ICT and digital activity are derived using the supply-use framework of the national accounts, based on the ABS's publication Australian National Accounts: Supply Use Tables (cat. 5217.0).[28] The BCAR has further split the Supply-Use Product Group (SUPG) into Input-Output Product Classifications (IOPCs) to obtain more granular product detail.

The definitions of IoT, ICT and digital activity are categorised by product classifications presented in the input-output tables. IoT, ICT and digital activity consists of 20, 39 and 42 products, respectively (Table 36). All products listed as in scope for the IoT definition are also found in both the ICT and digital activity definitions. The definition for digital activity is based on the BEA working paper: Defining and Measuring the Digital Economy. A detailed breakdown of the product classifications is shown in Appendix E.

[xviii] Bolded text represents the categories of digital activity while non-bolded text represents the components of these categories.

Table 36. List of IoT, ICT and digital activity by component, number of IOPCs

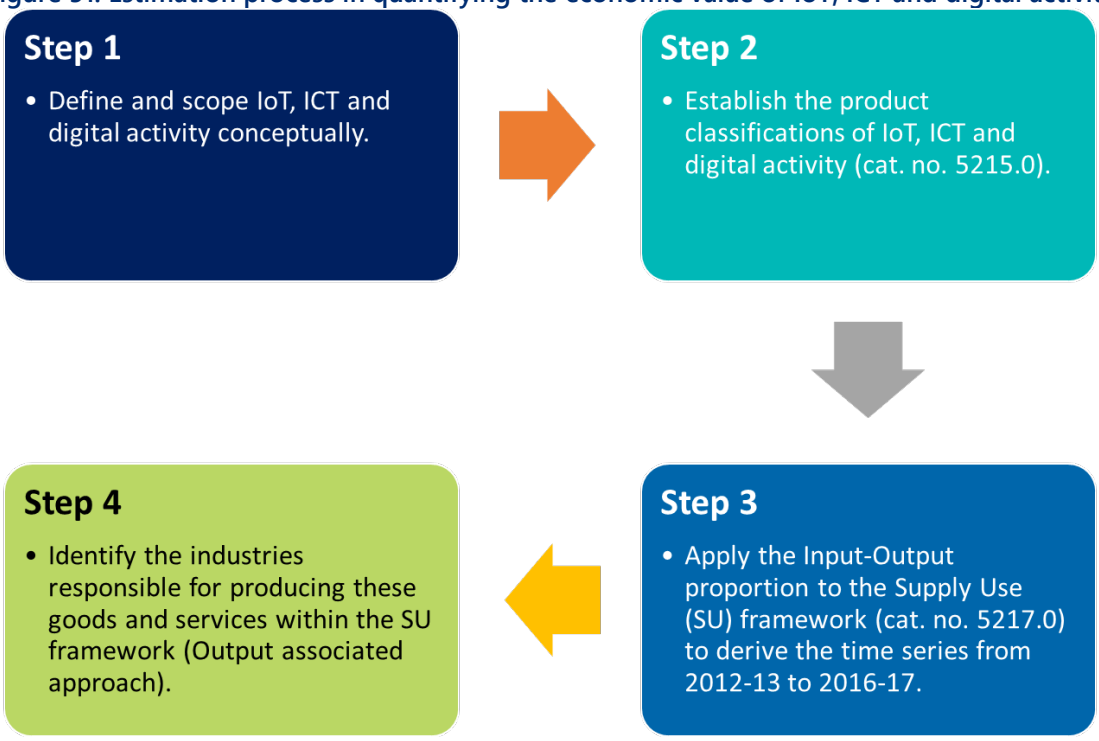
Activity by components	IoT activity	ICT activity	Digital activity
Hardware	6	11	12
Software	1	2	2
Telecommunications	7	10	10
Internet service providers	1	1	1
Support services	5	5	5
Digital Media	0[xix]	10	10
E-commerce[xx]	0	0	1
Structures[xxi]	0	0	1
Total IOPCs	**20**	**39**	**42**

Source: BCAR analysis.

Approach applied in this paper

Four steps were taken by the BCAR to quantify estimates of the economic value of IoT, ICT and digital activity (Figure 51). This approach is broadly consistent with the BEA approach but has been adapted to apply it to the Australian context and classifications. The BCAR analysis uses subsets of the BEA framework of the digital economy to construct definitions of IoT and ICT activity.

Figure 51. Estimation process in quantifying the economic value of IoT, ICT and digital activity



Source: BCAR analysis.

[xix] Products such as data processing and web hosting services, information storage and retrieval services have been identified as both big data and support services. Splits of the data were unavailable. The paper wholly allocated these products under support services.
[xx] The input-output product classifications are not designed to isolate any product relating to e-commerce.
[xxi] The input-output product classifications are not designed to isolate any product relating to structures.

There are five assumptions applied to estimate the economic value of IoT, ICT and digital activity.

1. If a product has been considered partially in scope but is primarily related to digitally-enabling infrastructure, it has been included in the measure.
2. To capture the value of e-commerce for digital activity, the ratio of retail and wholesale online transactions to the share of retail and wholesale trade was applied to the 2012–13 financial year. These figures were derived from the ABS's Retail and Wholesale Industries, Australia, 2012–13 (RISWIS) (cat. no. 8622.0).[29] To create a time series the Business Use of Information Technology (cat. no. 8129.0) was applied after 2012–13.[30]
3. The value of structures was imputed by estimating telecommunication's share of total engineering construction. These figures were derived by using the ABS's Engineering Construction Activity, Australia (cat. no. 8762.0).
4. The BCAR approach deviated from the BEA approach to also include structures in digital activity. The construction industry division in the national accounts includes activity relating to the development of telecommunications infrastructure, which in this paper is considered digitally enabling.
5. Gross value added was quantified by the industry output of activities relating to IoT, ICT and digital activity which comprised the same ratio to total industry output. Intermediate use was assumed to have the same ratio as output. Volume measures were derived by using the Australian System of National Accounts (cat. no. 5204.0).

Measuring structures in the value of digital activity

This paper includes structures (construction in telecommunications infrastructure) to measure the value of digital activity. The US BEA stated that structures should be included in this measure but did not include it due to 'the difficulty in determining the proper allocation of these categories into digital and non-digital components'.[31] The ABS also excluded structures from their measure of digital activity.[32]

The BCAR has included structures by estimating the allocation of digital and non-digital components using the ABS's Engineering Construction Activity (cat. no. 8762.0) publication. To account for structures, digitally-enabling components were identified from the construction division. This division contains three activities: engineering construction activity; building activity; and construction services. All three activities were included in the reporting of digital activity.

The value of structures was derived using telecommunication's share of total engineering construction for every financial year over the period analysed. The three activities contained within the construction division were separated to obtain values consistent with the BEA structure.

In current prices, digital activity was estimated to be $85.0 billion or 5.9 per cent of GVA in 2012–13, growing to $118.9 billion or 7.2 per cent in 2016–17. The value of structures from all three activities combined in the construction division was $27.5 billion or 1.7 per cent of GVA in 2016–17. When this is removed from digital activity, the value reduces to $91.5 billion or 5.6 per cent of GVA in 2016–17 (Table 37). These figures are in line with the BEA's definition of digital activity and are broadly consistent with the ABS's estimates of digital activity at $93.5 billion or 5.7 per cent of GVA in 2016–17.[33]

Table 37. Comparison of digital activity GVA with different measures for structures, 2012–13 and 2016–17, current prices

Digital activity GVA ($m), current prices	2012–13	2016–17
Digital activity	84,986	118,917
As a proportion of GVA (%)	5.9	7.2
Minus construction services	-3,919	-14,098
Digital activity	81,067	104,820
As a proportion of GVA (%)	5.6	6.4
Minus building activity	-2,230	-9,098
Digital activity	78,837	95,722
As a proportion of GVA (%)	5.5	5.8
Minus engineering construction activity	-2,237	-4,273
Digital activity	76,600	91,449
As a proportion of GVA (%)	5.3	5.6

Source: ABS cat. 5215, 5217, 5204, 8762; BCAR estimates.

Appendix E. IOPC list of IoT, ICT and digital activity

Component	IOPC	IOPC Description	IoT activity	ICT activity	Digital activity
Hardware	16200090	Reproduced recorded media products	✗	✓	✓
	24110090	Cameras, image projectors and parts; photographic goods n.e.c (excl. sensitised photographic film, paper, plates and chemicals)	✗	✓	✓
	24190190	Other professional and scientific equipment	✓	✓	✓
	24210030	Laptops, notebooks, personal digital assistants and other portable computers	✓	✓	✓
	24210040	Desktop computers (PCs)	✓	✓	✓
	24210061	Printing and photocopying machinery and parts	✗	✓	✓
	24210070	Other computer hardware, computer peripherals and accessories n.e.c	✓	✓	✓
	24210190	Computer hardware and peripherals (excl. laptops and desktop computers)	✓	✓	✓
	24210200	Vending, monetary, office machinery	✗	✗	✓
	24290010	Television receiving sets (excl. parts)	✗	✓	✓
	24290200	Video games, poker machines and other coin or disc operated games; electronic equipment and parts n.e.c	✗	✓	✓
	24390100	Electrical apparatus to switch, protect or connect circuits (incl. boards and cabinets equipped with such) (excl. inductors)	✓	✓	✓
Software	54200010	Software publishing services (non-customised)	✓	✓	✓
	54200020	Copyright leasing - software (non-customised)	✗	✓	✓
Telecommunications	24190090	Optical fibres, fibre bundles and cables (excl. insulated)	✓	✓	✓
	24220021	Mobile phones and other phones n.e.c (excl. parts)	✓	✓	✓
	24220100	Communication equipment (excl. mobile phones)	✓	✓	✓
	24290190	Other telecommunication and audio visual equipment	✓	✓	✓

Component	IOPC	IOPC Description	IoT activity	ICT activity	Digital activity
	24310090	Cable, wire and strip	✓	✓	✓
	56100010	Radio broadcasting services	X	✓	✓
	56210010	Free-to-air television broadcasting services	X	✓	✓
	56220010	Cable (pay TV) and other subscription broadcasting services	X	✓	✓
	58000010	Telecommunication services (excl. equipment)	✓	✓	✓
	58090010	Other telecommunications services n.e.c	✓	✓	✓
ISPs	59100010	Internet access (incl. ISPs) and internet search services	✓	✓	✓
Support services	59210020	Data processing and web hosting services	✓	✓	✓
	59220010	Information storage and retrieval services	✓	✓	✓
	70000010	Computer systems, hardware and software design and development services	✓	✓	✓
	70000030	Computer support services	✓	✓	✓
	94220010	Electronic and precision equipment repair and maintenance (excl. domestic appliance)	✓	✓	✓
Digital Media	55110010	Motion picture and video production	X	✓	✓
	55120010	Motion picture and video distribution services (incl. discs)	X	✓	✓
	55120020	Copyright leasing - motion pictures and videos	X	✓	✓
	55130010	Motion picture theatre services	X	✓	✓
	55140010	Post-production services and other motion picture and video activities	X	✓	✓
	55210010	Music publishing n.e.c (incl. sheet music)	X	✓	✓
	55210030	Music copyrights - acquiring, registering and selling	X	✓	✓
	55220010	Music and other sound recording studios operation (incl. pre-recorded radio programming services)	X	✓	✓
	57000010	Internet publishing and broadcasting services (incl. radio, television, books, newspapers and magazines)	X	✓	✓

Component	IOPC	IOPC Description	IoT activity	ICT activity	Digital activity
	57000020	Internet publishing - advertising services	✗	✓	✓
E-commerce	N/A	E-commerce includes digitally-ordered, digitally-delivered, or platform-enabled transactions.	✗	✗	✓
Structures	N/A	Construction of buildings where digital activity producers create digital activity goods or supply digital activity services, and buildings that provide support services to digital products	✗	✗	✓

Source: BCAR analysis.
Notes: IOPC=Input-Output Product Classifications; N/A=not applicable; n.e.c.=not elsewhere classified; ✗=out of scope; ✓=in scope.

Appendix F. Understanding the gross value added of IoT activity

This section explains how the economic value of IoT is defined and measured in this paper.

IoT is most commonly understood as the connectivity of physical objects. IoT is regarded as an important emerging technology that allows objects to connect with each other to monitor and manage events seamlessly. However, there is no universally accepted definition for IoT products and international organisations have defined this in different ways (Box 3).

Box 3: Defining the Internet of Things

- The OECD defines IoT quite broadly by "including all devices and objects whose state can be altered via the Internet, with or without the active involvement of individuals. This includes laptops, routers, servers, tablets, and smartphones, often considered part of the 'traditional Internet'. However, these devices are integral to operating, reading and analysing the state of IoT devices and frequently constitute the 'heart and brains' of the system. As such, it would not be correct to exclude them."[34]
- McKinsey has a narrower definition of IoT as "sensors and actuators connected by networks to computing systems. These systems can monitor or manage the health and actions of connected objects and machines. Connected sensors can also monitor the natural world, people, and animals." Their definition excludes, "systems in which all of the sensors' primary purpose is to receive intentional human input, such as smartphone apps where data input comes primarily through a touchscreen, or other networked computer software where the sensors consist of the standard keyboard or mouse."[35]
- Vodafone defines IoT as connecting "objects, turning them into 'intelligent' assets that can communicate with people, applications and each other. It enables things like cars, buildings and machines to communicate about their status and environment."[36]

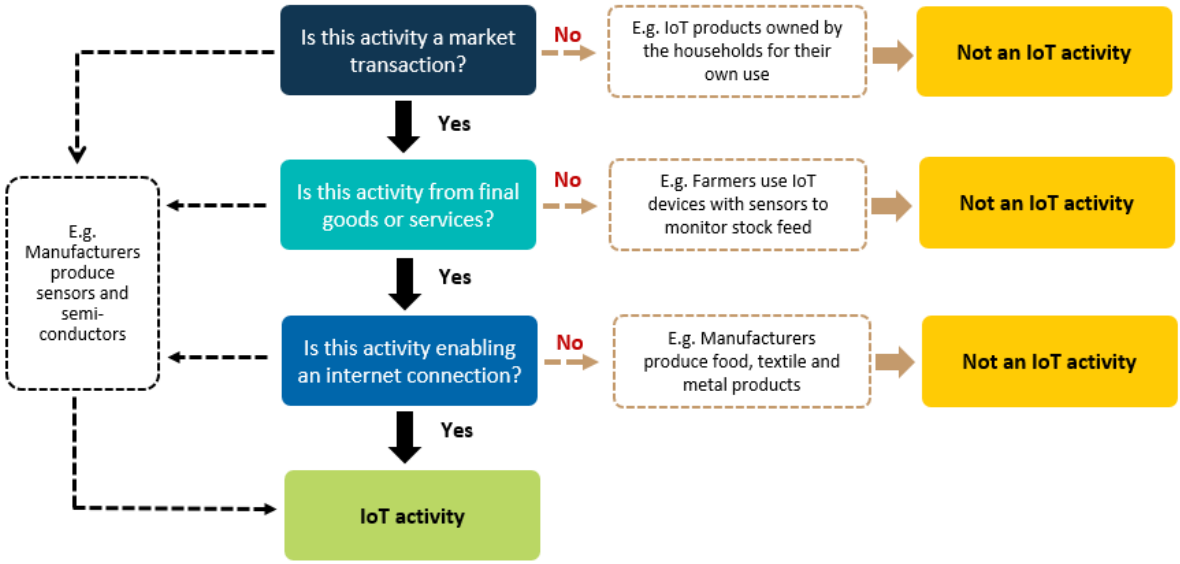
IoT activity

In this paper, the BCAR estimates IoT activity as the direct economic contribution from the production of goods and services that enable an internet connection, such as the production of semi-conductors and sensors. This can be considered an estimate of the direct economic value of the final products that underpin an internet connection. This definition does not necessarily align with how IoT is defined by other organisations.

The BCAR's definition 'based on transactions of goods and services produced that enable and internet connection' is used because there are limitations in the detail by which products are classified in Australia's system of national accounts.

This measure of IoT activity includes market transactions only. By calculating this activity through GVA, this ensures that only its direct contribution to the economy is measured (Figure 52). It does not refer to the indirect economic value of IoT products or the potential productivity impact of IoT on the economy.

Figure 52. Measuring IoT activity



Source: BCAR.

IoT activity depends on the final goods and services produced by industry

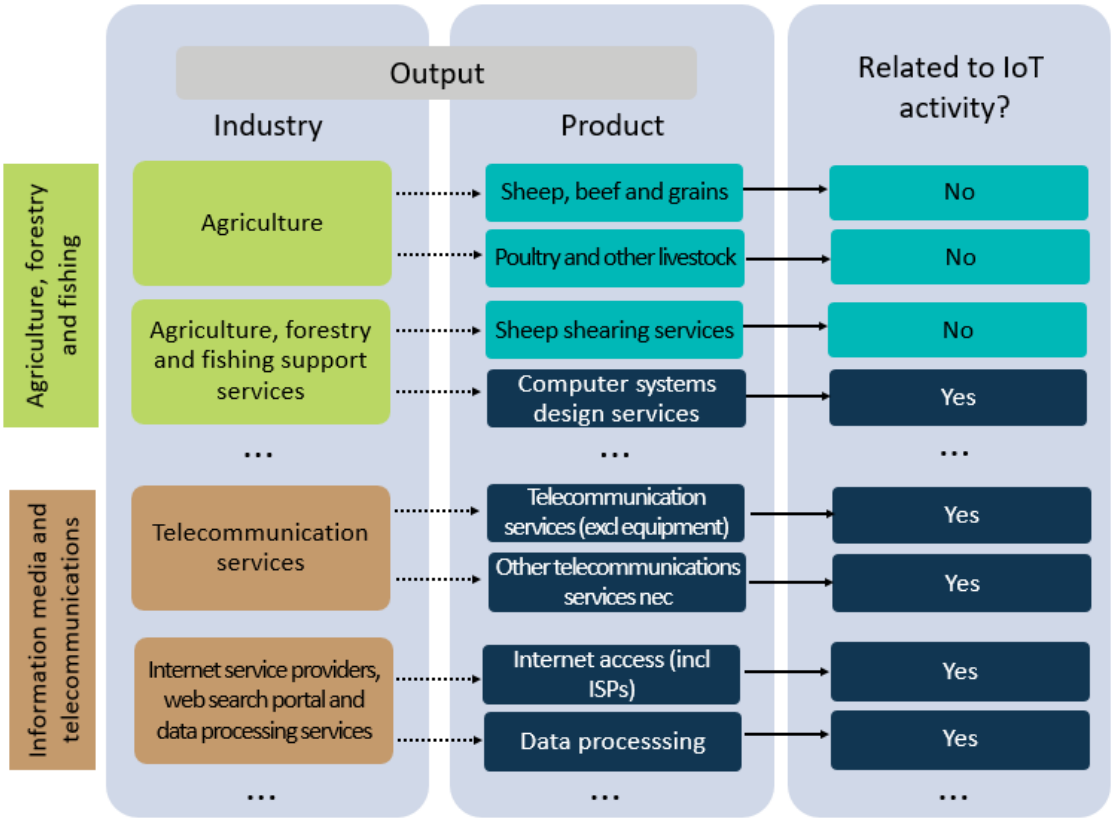
IoT activity is performed mainly in the industry divisions of Information Media and Telecommunications (IMT) and Professional, Scientific and Technical Services (PSTS).

The IMT industry includes telecommunications services, internet publishing and broadcasting, internet service providers, web search portals and data processing services. The main activities engaged by this industry include services to enable the transmission and store of information. These services are directly related to IoT activity causing IMT's contribution to this activity to be quite large.

The PSTS industry also produces many final goods and services that are captured in IoT activity. This industry includes computer system design and related services that perform technological development such as coding, modifying, testing or providing user support for software. All of these services are captured and identified as IoT activity.

While industries across the economy may benefit from using IoT goods and services during production, not all industries make products that relate to IoT activity. For example, the agriculture industry involves raising livestock and growing crops which are not related to IoT activity (Figure 53).

Figure 53. Selected industries with low and high IoT activity in their production



Source: ABS cat. 5215; BCAR estimates.

Another industry that benefits from the use of IoT goods and services is electricity, gas, water and waste services. IoT smart meters can be used to reduce loss of electricity in distribution networks and some sensors can be used to detect water leaks.[37] However, as this industry covers transactions involving the provision of utilities, most goods and services produced by this industry are not related to IoT activity. While the potential impact of IoT-enabling activities to an industry's productivity might be material, its direct contribution in producing IoT goods and services is small.

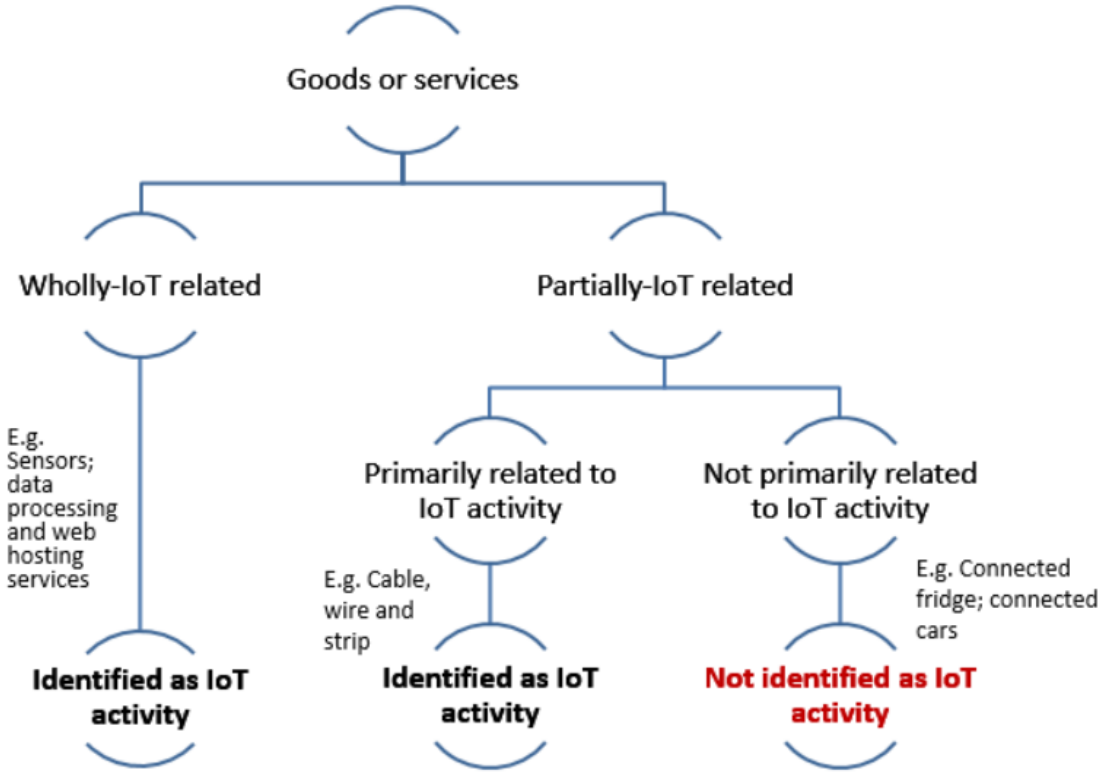
IoT activity is measured through GVA, the production side of the economy, which does not directly reflect household consumption. Households may demand IoT products over the period and use them in their homes. However, household use is not included in this measure of IoT activity. Rather, it is the activity from goods or services that enable an internet connection that is captured in this metric.

Households may also own IoT products with values that could accumulate and depreciate. These products are considered assets to a household, and as such, their values do not reflect transactions of economic activity. These asset values are considered 'stocks' and do not reflect 'flows' in the economy and are not included in the measure of IoT activity.

Enabling an internet connection is the primary purpose of the product

Another example that is not in scope for IoT activity is the household fridge. This device may have some function that enables an internet connection but its primary purpose is to keep food cool. Products with the primary purpose of enabling an internet connection have been included in the measure of IoT activity (Figure 54). Although, if the connected fridge collects data that is resold by the producer to another entity, the data forms part of IoT activity to the extent that it is monetised. This transaction is also contingent on whether the producer is an Australian entity and would therefore be included in the Australian System of National Accounts.

Figure 54. Identifying IoT activity within the national accounts framework



Source: BCAR analysis.

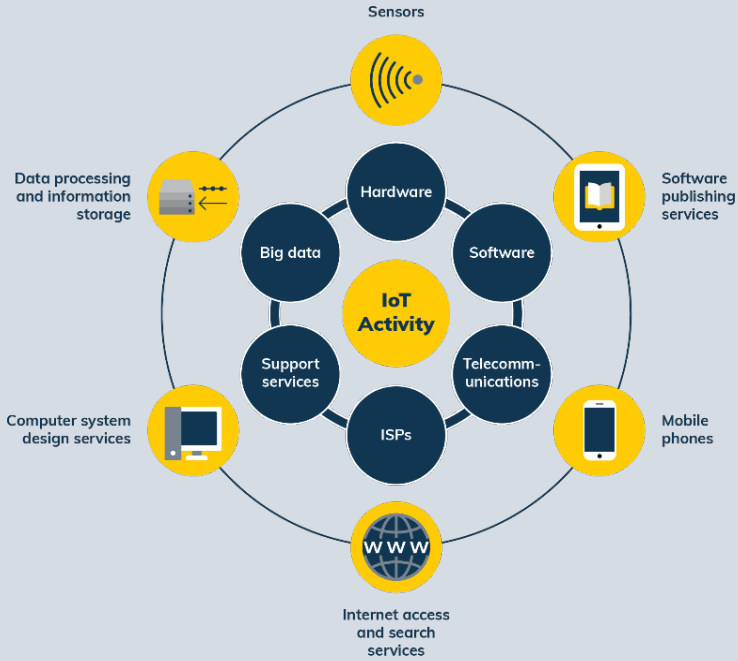
Box 4: How to measure IoT activity within a satellite accounts framework

An IoT satellite accounts framework details the supply and use of IoT-related goods and services and also measures the direct value that IoT activity adds to the economy.

The BCAR has applied the BEA structure and developed a satellite accounts framework for the Australian System of National Accounts. The BEA's structure of digital activity served as a starting point in defining IoT activity. Adoption of this definition has provided a foundation in determining a list of products from the national accounts input-output product classification. This type of satellite accounts for IoT activity is experimental and is the first of its kind.

IoT activity has been scoped as a subset of ICT and digital activity within a satellite accounts framework. This definition has been focused on products that enable an internet connection, which includes goods or services that create this connection between physical objects. The different components of IoT activity is shown in Figure 55.

Figure 55. Components and examples of IoT activity



Source: BCAR analysis.

An example of a product that is not included in this definition is connected cars. The primary function of a car is transportation, and as such the BCAR has not identified it as being part of IoT activity. This product may allow the owner to share internet access and data with other devices both inside and outside the vehicle. However, these interactions do not have a direct monetary value and no economic transaction has taken place.

The definition of IoT activity will evolve with the range of devices and applications produced in the economy. The input-output tables during the period analysed were updated by the ABS to reflect these changes. However the measurement and definition of IoT activity is contingent on the information available within the national accounts framework, such as the current difficulty in measuring online transactions from retail and wholesale trade.

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