THE SINGAPORE STUDY ON INTELLECTUAL PROPERTY RIGHTS (IPR)-INTENSIVE INDUSTRIES AND ECONOMIC PERFORMANCE

IPOS
INTELLECTUAL PROPERTY
OFFICE OF SINGAPORE

CONTENTS

EXECUTIVE SUMMARY

Intellectual property rights (IPR) are key intangible assets for individuals and enterprises. According to a study by the World Intellectual Property Organisation (WIPO) and Luiss Business School (LBS) on intangible assets (IAs), investments in IAs such as brands, design, and software have grown over three times faster than investments in tangible assets between 2008 and 2024 (WIPO and LBS, 2025). In addition, global corporate intangible value has increased by more than 10-fold between 1996 and 2024 to US$80 trillion. This highlights the increasing importance of IAs as drivers of innovation and economic growth in a globalised knowledge economy.

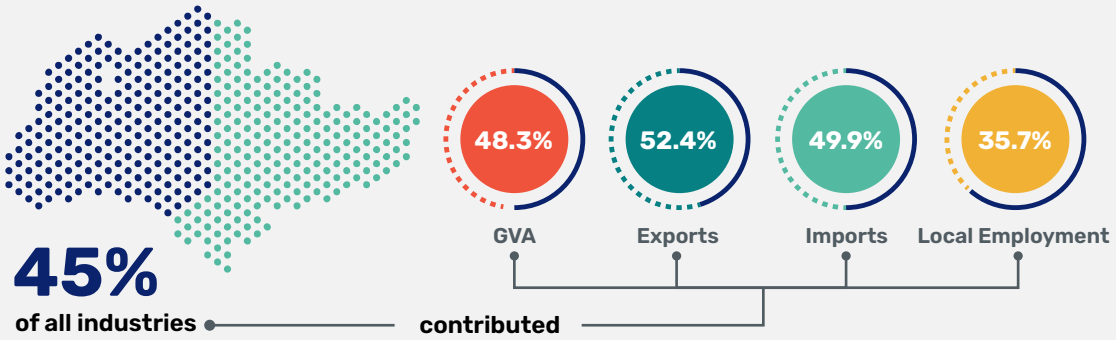
Singapore has recognised IPR as a fundamental driver of innovation and economic competitiveness. In response to global trends and growing importance of IPR in economic development, Singapore has launched the Singapore IP Strategy 2030 (SIPS 2030) in 2021, which aims to provide a conducive environment for entrepreneurs and businesses in the protection and commercialisation of intellectual property (IP) for competitive advantage and sustainable growth. Through SIPS 2030, Singapore continues to invest in comprehensive IP infrastructure, regulatory frameworks, and policy mechanisms to equip local enterprises and innovators with the tools and knowledge to manage their IA/IP effectively. This reflects Singapore's focus as a knowledge-based economy, where robust IP management serves as a critical enabler for value creation and global competitiveness.

To assess the role of IPR on driving Singapore's economic performance, this study identified the IPR-intensive industries in Singapore and measured their economic contribution through (a) gross value added (GVA), (b) merchandise trade, (c) local employment, and (d) wage premium.

Key Findings

This study found that IPR-intensive industries in Singapore contributed significantly to the economy. Between 2013 and 2017, around 45 per cent of all industries in Singapore were found to be intensive in at least one type of IPR (i.e., patents, trademarks and registered designs). These industries contributed 48.3 per cent of GVA in Singapore, 52.4 per cent of exports, 49.9 per cent of imports, and 35.7 per cent of local employment. This study also observed a wage premium of 12.3 per cent for employees in IPR-intensive industries.

IPR-intensive industries between 2013 and 2017



1 INTRODUCTION

Globally, Intangible Assets (IAs), such as technology, software, data, designs, and brands have become key drivers of modern economic growth. Since 1995, real investment in intangibles has expanded by more than 140 per cent to US$7.6 trillion in 2024, while tangible investment has grown by about 30 per cent. This gap has widened since 2008, with investment into intangible capital growing by more than three times faster than investment in physical capital (WIPO and LBS, 2025). This shift is also reflected in global gross domestic product (GDP) composition, with intangible investment rising from around 10 per cent of GDP in 1995 to nearly 14 per cent in 2024, overtaking tangible investment in 2009 (WIPO and LBS, 2025).

In Singapore, innovation and intangible assets also play an increasingly vital role in driving economic growth. Specifically, the growth in gross fixed capital formation of intangible assets (9.7 per cent per annum) has significantly exceeded that of physical assets (1.6 per cent per annum) between 2009 and 2021 (Toh, B. and Ting, J., 2022). By 2021, IAs represented 7.9 per cent of Singapore's GDP and 38.6 per cent of gross fixed capital formation.

The focus on intangibles has translated into international competitiveness. Between 2011 and 2024, Singapore enterprises have increasingly commercialised their intellectual property globally, with total charges for IP use in service exports growing from S$3.3 billion to S$26.3 billion. In addition, Singapore's innovation capabilities were further recognised in the Global Innovation Index (GII) 2025, which highlights the nation's strengths in human capital, research, and business sophistication.

At the firm level, the economic benefits of IPR were demonstrated. An IPOS study found that Singapore-listed enterprises with strong brands and patent portfolios experienced higher revenue and profits (Chan, M, 2023). In addition, IPR ownership was associated with a 21.7 per cent increase in profit per employee per annum and a 20.8 per cent increase in profit per invested capital per annum (Lim, W.P. and Tan, J, 2023).

Given that IPR constitute key intangible assets, these trends underscore their critical role in supporting Singapore's knowledge-based economy. Therefore, this study seeks to identify IPR-intensive industries in Singapore, and quantify their contributions to Singapore's economic growth and competitiveness. Specifically, this study measures the total economic contribution of IPR-intensive industries in terms of (a) GVA, (b) merchandise trade, (c) local employment, and (d) wage premium. Through this analysis, this study aims to provide policymakers and enterprises with evidence-based insights into the significance of IPR in sustaining innovation, productivity, and long-term economic development.

The total economic contributions (averaged between 2018 and 2022) for each IPR-intensive industry are provided in **Table 1**.

Table 1: Total Economic Contributions by IPR-intensive Industries (Averaged Between 2018 and 2022)[1]

IPR-intensive industries	GVA (%)	Exports (%)	Imports (%)	Employment (%)	Wage premium (%)
Patent	32.8	42.6	38.5	11.8	28.7
Trade mark	16.7	11.4	10.7	23.7	5.9
Design	4.3	4.6	6.0	8.0	1.2
All	48.3	52.4	49.9	35.7	12.3

[1]*The figures for all IPR-intensive industries do not represent the simple summation of each individual IPR-intensive industry, as some industries are intensive in more than one type of IPR. Due to data limitations, this study covered 229 industries.*

2 METHODOLOGY OF THE STUDY

2.1 Methodology and Definitions

This study aims to identify IPR-intensive industries in Singapore and assess their total economic contributions between 2018 and 2022. Similar to studies conducted by the United States Patent and Trademark Office (USPTO), European Union Intellectual Property Office (EUIPO), European Patent Office (EPO), and United Kingdom Intellectual Property Office (UKIPO), this study defined IPR-intensive industries as those with a higher-than-average count of granted IPR per 1,000 local employees[2] in Singapore.

For this study, IPR are defined as patents, trade marks, and design applications granted to Singapore-registered enterprises[3] between 2013 and 2017. Each granted IPR is matched to its corresponding industry classification using the Unique Entity Number (UEN) and applicant name. Industries were classified using the Singapore Standard Industrial Classification (SSIC) 2020. Most industries were analysed at the 4-digit SSIC level, with some exceptions due to data limitations. In total, this study covers 229 industries[4].

For each of the 229 industries, the intensity value for each type of IPR was calculated by normalising the count of each IPR type by 1,000 local employees[5]. Industries with IPR intensity value higher than average are considered IPR-intensive industries.

Following the identification of IPR-intensive industries, this study examines their average economic contributions, focusing on gross value added, merchandise trade, local employment, and wage premium. Similar to studies conducted by other IP offices, different time periods were used for collecting granted IPR applications and assessing the economic contributions of IPR-intensive industries to account for the time lag between research and development (R&D) and innovation outcomes (i.e., economic indicators from 2018 to 2022 were used to evaluate the performance of IPR-intensive industries identified during the 2013 to 2017 period).

[2]*Local employees refer to Singapore Citizens and Permanent Residents who are Central Provident Fund (CPF) members. This excludes self-employed citizens/residents.*

[3]*This study only considered the IPR granted to Singapore-registered enterprises in ACRA database between 2013 and 2017.*

[4]*Selected industries, such as Public administration and defence activities, Activities of households as employers of domestic personnel and Activities of extra-territorial organisations and bodies industries, were excluded from this study due to data limitations.*

[5]*The count of IPR were divided by the industry's average local employment in the same time period (i.e., 2013 - 2017).*

2.2 Data Sources

The following data sources were used for this study:

i. Granted IPR data. Patents, trade marks and designs registered by Singapore-registered enterprises from 2013 to 2017 were compiled from the IPOS Registry. Trade marks filed in multiple classes were counted separately for each class[6].

ii. Entity information. Entity data was retrieved from the Accounting and Corporate Regulatory Authority (ACRA) database. This data included business names, UEN[7], and SSIC codes, which identify the primary business activities[8].

iii. Local employment. Local employment figures by industry from 2018 to 2022 were retrieved from Singapore Government administrative data.

iv. Local wages. Monthly wage data for local employees by industry from 2018 to 2022 were retrieved from Singapore Government administrative data.

v. Gross value added (GVA). GVA data by industry from 2018 to 2022 were retrieved from: (i) Department of Statistics (DOS) for services and utilities sectors, (ii) Economic Development Board (EDB) for manufacturing sectors, and (iii) Building and Construction Authority (BCA) for construction sectors.

vi. Merchandise trade. Import and export values of goods by industry from 2018 to 2022 were retrieved from the Ministry of Trade and Industry (MTI) / Enterprise Singapore (ESG).

[6]*For example, this study considered a trade mark filed in 2 classes as 2 trade marks.*

[7]*The Unique Entity Number (UEN) is a standard identification number issued by the Singapore government to registered business entities / organisations.*

[8]*The Singapore Standard Industrial Classification (SSIC) is the national standard for classifying economic activities undertaken by economic units in Singapore. It adopts the basic framework and principles of the International Standard Industrial Classification of All Economic Activities (ISIC). For more information on SSIC, refer to Department of Statistics (DOS) Singapore here https://www.singstat.gov.sg/standards/standards-and-classifications/ssic.*

3 FINDINGS OF THE STUDY

3.1 Identification of IPR-intensive Industries

The IPR intensity value was calculated by normalising the count of granted IPR from 2013 to 2017 by 1,000 local employees in each industry. Industries with an above-average IPR intensity value across all 229 industries are defined as IPR-intensive.

This study identified **103 IPR-intensive industries** (**Table 2**), which represents 45 per cent of the total industries considered in this study (refer to **Appendix 6.3** for the full list of IPR-intensive industries).

Four industries were identified as IPR-intensive across all types of IPR between 2013 and 2017, namely, (i) scientific research and development, (ii) industrial design activities, (iii) manufacture of jewellery, bijouterie and related articles, and (iv) manufacture of domestic appliances industries (**Table 3**).

Table 2: Number of IPR-intensive Industries in Singapore (2013 - 2017)

	Patent	Trade Mark	Design	Any one type
IPR-intensive	31	72	21	103
Non IPR-intensive	198	157	208	126

Table 3: IPR Intensity Values for Industries Intensive in All Types of IPR (2013 - 2017)

	IPR Intensity Value for		
Industry	Patent	Trade Mark	Design
Industrial design activities	5.8	45.0	27.0
Manufacture of jewellery, bijouterie and related articles	3.0	47.7	5.1
Manufacture of domestic appliances	84.1	124.3	9.1
Scientific research and development	13.1	31.7	4.7

3.1.1 Patent-intensive Industries

Across the 229 industries covered in this study, the overall average patent intensity value was **2.33.** There were **31 industries** with above-average patent intensity value between 2013 and 2017. **Table 4** presents the top 10 industries ranked by their patent intensity value. From the table, it appears that a majority of the top 10 patent-intensive industries were manufacturing-related industries.

Table 4: Top 10 Patent-intensive Industries (2013 - 2017)

Rank	Industry	Patent Intensity Value (2013 - 2017)
1	Manufacture of glass and glass products	147.6
2	Manufacture of domestic appliances	84.1
3	Market research and public opinion polling	26.0
4	Wholesale of fuels and related products	22.2
5	Manufacture of optical instruments and photographic equipment	17.9
6	Manufacture of measuring, testing, navigating and control equipment; watches and clocks	16.8
7	Scientific research and development	13.1
8	Other personal service activities n.e.c. [9]	12.5
9	Higher education	12.0
10	Manufacture of electronic components and boards	11.0

[9]The term n.e.c. stands for 'not elsewhere classified'. It is used to identify residual activities, which include less prevalent economic activities that do not meet the criteria for separate classification.

3.1.2 Trade Mark-intensive Industries

Across the 229 industries covered in this study, the overall average trade mark intensity value was **27.47.** There were **72 industries** with above-average trade mark intensity value in Singapore between 2013 and 2017.

Table 5 presents the top 10 trade mark-intensive industries ranked by their trade mark intensity value. The top 10 trade mark-intensive industries were largely in manufacturing, as well as agriculture and fishing industries. In addition, this study found that the top trade mark-intensive industry (i.e., reproduction of recorded media industry) had a trade mark intensity value at least three times higher than the remaining industries.

Table 5: Top 10 Trade Mark-intensive Industries (2013 - 2017)

Rank	Industry	Trade Mark Intensity Value (2013 - 2017)
1	Reproduction of recorded media	676.2
2	Growing of food crops (non-hydroponics)	214.6
3	Activities of business, employers and professional membership organisations	149.4
4	Livestock production (except poultry and animal specialties)	140.8
5	Professional, scientific and technical activities n.e.c.	130.8
6	Manufacture of domestic appliances	124.3
7	Manufacture of footwear	111.9
8	Growing of food crops (hydroponics)	105.2
9	Libraries, archives, museums and other cultural activities	92.3
10	Wholesale of sporting and other recreational goods	87.2

3.1.3 Design-intensive Industries

Across the 229 industries covered in this study, the overall average design intensity value was **2.74**. There were **21 industries** with higher than overall average design intensity value in Singapore between 2013 and 2017.

The top 10 design-intensive industries, ranked by their design intensity value, were concentrated in manufacturing and wholesale and retail trade industries (**Table 6**). Notably, the top design-intensive industry (i.e., retail sale of personal effects in specialised stores) had a design intensity value of at least two times higher than the remaining industries. This was mainly contributed by local jewellery brands such as Aspial-Lee Hwa Jewellery and SK Jewellery.

Table 6: Top 10 Design-intensive Industries (2013 - 2017)

Rank	Industry	Design Intensity Value (2013 - 2017)
1	Retail sale of personal effects in specialised stores	278.7
2	Manufacture of basic precious and non-ferrous metals	99.2
3	Manufacture of electric lighting equipment	30.7
4	Industrial design activities	27.0
5	Manufacture of motor vehicles, trailers and semi-trailers / Manufacture of motor vehicle bodies (coachwork), trailers and semi-trailers	23.2
6	Manufacture of furniture	14.0
7	Wholesale of handicrafts and fancy goods	11.7
8	Manufacture of domestic appliances	9.1
9	Wholesale of sporting and other recreational goods	7.9
10	Wholesale of other household goods	6.1

3.2 Economic Contributions of IPR-intensive Industries

This section examines the **average economic contributions** of IPR-intensive industries in Singapore between 2018 and 2022.

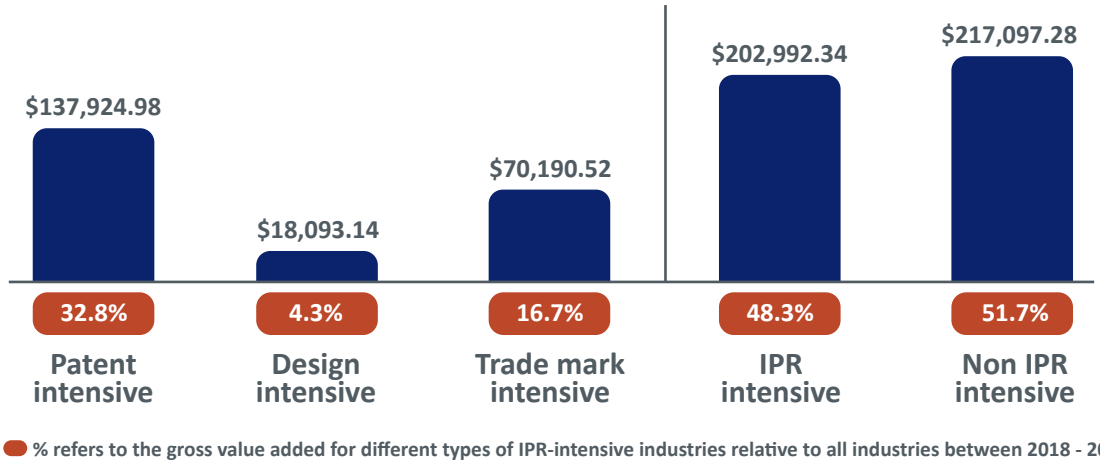
Similar to studies conducted by other IP offices, we evaluated the economic contributions across four key indicators: namely, gross value added, merchandise trade, local employment, and wage premium.

Overall, the analyses showed that IPR-intensive industries in Singapore contributed nearly 50 per cent to both gross value added and imports, and over 50 per cent of exports. Additionally, these industries accounted for almost 40 per cent of Singapore's local employment, with employees in IPR-intensive industries earning a wage premium as compared to those in non IPR-intensive industries.

3.2.1 Contributions of IPR-intensive Industries to Gross Value Added[10]

Figure 1 shows the total gross value added (GVA) contributed by IPR-intensive industries from 2018 to 2022 on average. This study found that these industries collectively generated S$203 billion or 48.3 per cent of average GVA in Singapore during this period. The largest proportion of GVA was contributed by the patent-intensive industries (32.8 per cent), followed by the trade mark-intensive industries (16.7 per cent), and design-intensive industries (4.3 per cent).

Figure 1: Total Contribution of IPR-intensive Industries to Gross Value Added in Millions (2018 - 2022 Average)



[10]*Due to data limitations, the analysis of GVA contributions covers 186 industries, of which 89 were IPR-intensive.*

Table 7 presents the total contribution of top 10 IPR-intensive industry contributors to Singapore's GVA, ranked by their share of GVA between 2018 and 2022. Notably, close to one third of the share of GVA was contributed by the top 10 IPR-intensive industries, which were mostly residing in the manufacturing and wholesale trade industries.

Table 7: Top 10 IPR-intensive Industry Contributors by Percentage Share of Gross Value Added

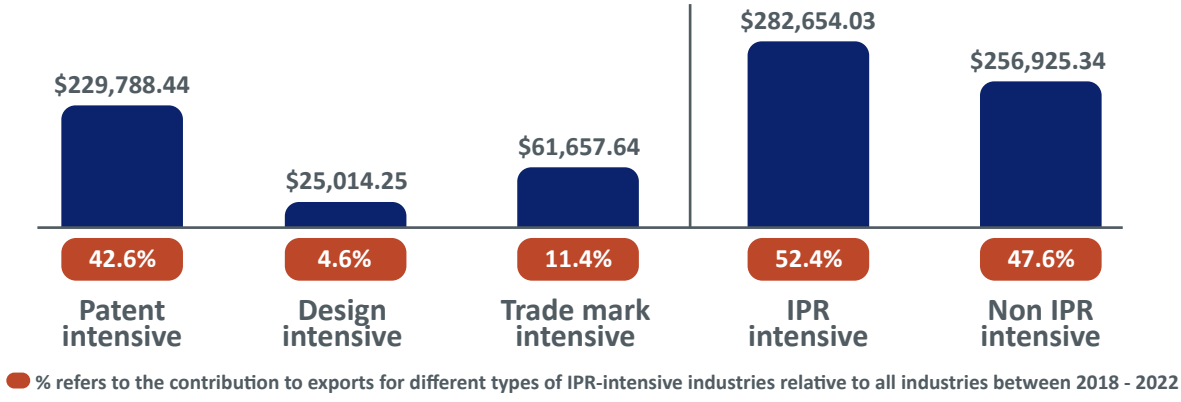
Rank	Industry	Share of Total GVA (2018 - 2022 Average)
1	Manufacture of electronic components and boards	9.6%
2	Wholesale of fuels and related products	6.2%
3	Renting and leasing of other machinery, equipment and tangible goods / leasing of non-financial intangible assets	2.6%
4	Activities of head offices; centralised administrative offices and business representative offices	2.3%
5	Manufacture of pharmaceuticals and biological products	2.1%
6	Manufacture of special purpose machinery	2.0%
7	Data analytics, processing, hosting and related activities; internet search engines	1.5%
8	Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms	1.5%
9	Manufacture of other chemical products / manufacture of man-made fibres	1.4%
10	Wholesale of chemicals and chemical products	1.2%
	Total Contribution by the Top 10 IPR-intensive Industry Contributions to GVA[11]	30.5%
	Total Contribution of All IPR-intensive Industries to GVA	48.3%

3.2.2 Contributions of IPR-intensive Industries to Trade[12]

Merchandise Exports [13]

Figure 2 provides the total contribution of exports by IPR-intensive industries between 2018 and 2022. On average, these industries contributed S$283 billion or 52.4 per cent of exports from Singapore between 2018 and 2022. Specifically, patent-intensive industries contributed most significantly (42.6 per cent), followed by trade mark-intensive industries (11.4 per cent) and design-intensive industries (4.6 per cent).

Figure 2: Total Contribution of IPR-intensive Industries to Exports in Millions (2018 - 2022 Average)



[11] *Figures in the table are rounded to 1 decimal place and may not add up to total due to rounding.*

[12] *Due to data limitations, the analysis of trade contributions covers 221 industries, of which 103 were IPR-intensive.*

[13] *This study considered both domestic exports and re-exports in its analysis.*

Table 8 shows the export contribution of the top 10 IPR-intensive industries, ranked by their share of exports between 2018 and 2022. The table highlights that the top 10 IPR-intensive industries contributed over 40 per cent of exports between 2018 and 2022, and they were made up of manufacturing and wholesale trade related industries.

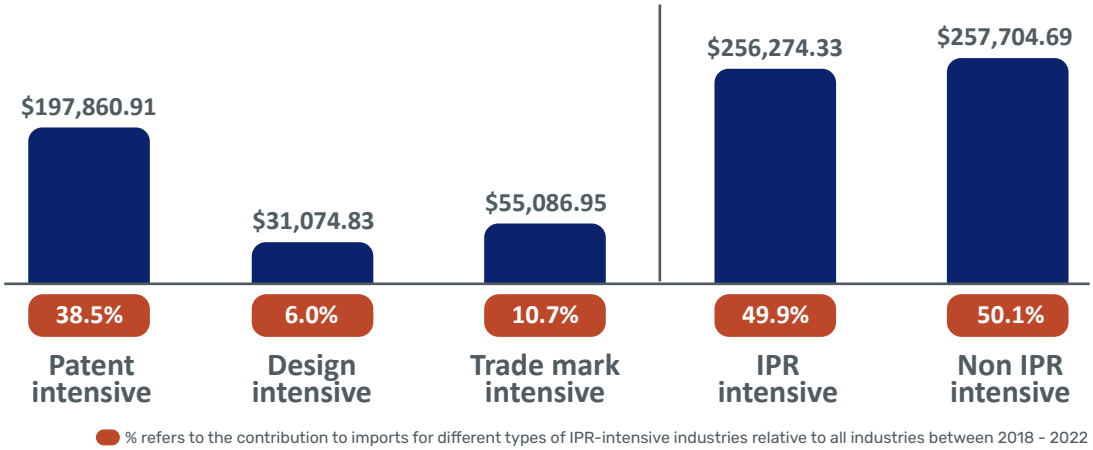
Table 8: Top 10 IPR-intensive Industry Contributors by Percentage Share of Exports

Rank	Industry	Share of Total Exports (2018 - 2022 Average)
1	Manufacture of electronic components and boards	12.5%
2	Wholesale of fuels and related products	8.2%
3	Manufacture of special purpose machinery	4.5%
4	Manufacture of pharmaceuticals and biological products	3.3%
5	Wholesale of chemicals and chemical products	2.9%
6	Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms	2.8%
7	Manufacture of medical and dental instruments and supplies	2.1%
8	Manufacture of other chemical products / manufacture of man-made fibres	2.1%
9	Wholesale of personal effects	2.0%
10	Non-specialised wholesale trade	2.0%
	Total Contribution of the Top 10 IPR-intensive Industry Contributors to Exports[14]	42.2%
	Total Contribution of All IPR-intensive Industries to Exports	52.4%

Merchandise Imports

Figure 3 shows the total contribution of imports by IPR-intensive industries between 2018 and 2022. This study found that these industries contributed an average of $256 billion (49.9 per cent) of imports into Singapore between 2018 and 2022. Furthermore, patent-intensive industries contributed most significantly to imports into Singapore (38.5 per cent), followed by trade mark-intensive (10.7 per cent) and design-intensive industries (6.0 per cent).

Figure 3: Total Contribution of IPR-intensive Industries to Imports in Millions (2018 - 2022 Average)



[14] *Figures in the table are rounded to 1 decimal place and may not add up to total due to rounding.*

Table 9 provides the import contribution of the top 10 IPR-intensive industries, ranked by their share of imports between 2018 and 2022. IPR-intensive industries collectively accounted for 49.9% of total imports, with the top 10 contributing 39.4%. Similar to exports, the wholesale of fuels and related products and manufacture of electronic components and boards industries continue to be top contributors to imports into Singapore.

Table 9: Top 10 IPR-intensive Industry Contributors by Percentage Share of Imports

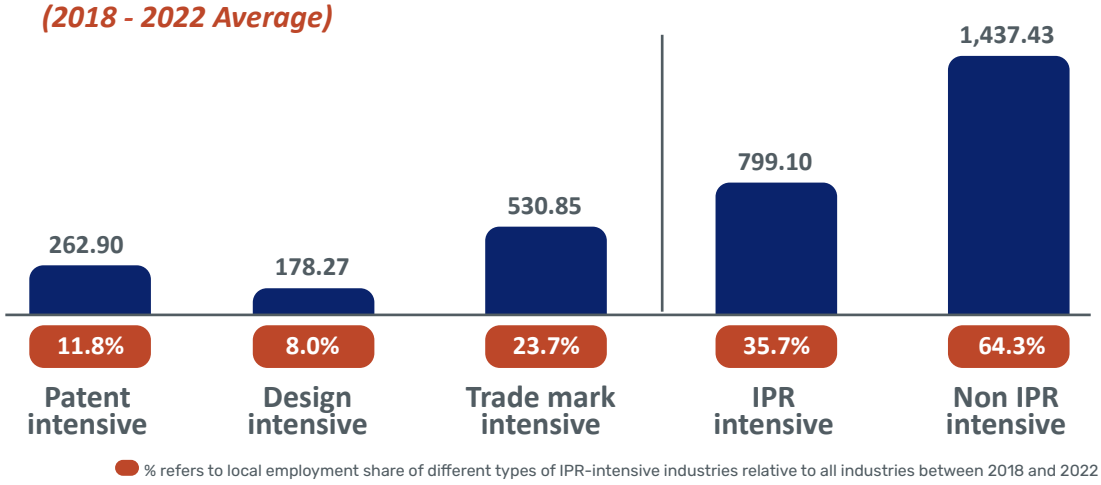
Rank	Industry	Share of Total Imports (2018 - 2022 Average)
1	Wholesale of fuels and related products	10.9%
2	Manufacture of electronic components and boards	9.3%
3	Activities of head offices; centralised administrative offices and business representative offices	6.8%
4	Manufacture of special purpose machinery	2.4%
5	Wholesale of chemicals and chemical products	2.2%
6	Wholesale of food, beverages and tobacco	1.9%
7	Wholesale of personal effects	1.8%
8	Non-specialised wholesale trade	1.8%
9	Manufacture of other chemical products / manufacture of man-made fibres	1.2%
10	Manufacture of pharmaceuticals and biological products	1.2%
	Total Contribution of the Top 10 IPR-intensive Industry Contributors to Imports[15]	39.4%
	Total Contribution of All IPR-intensive Industries to Imports	49.9%

[15] *Figures in the table are rounded to 1 decimal place and may not add up to total due to rounding.*

3.2.3 Contributions of IPR-intensive Industries to Employment

As illustrated in **Figure 4**, IPR-intensive industries contributed 35.7 per cent of average local employment between 2018 and 2022. The trade mark-intensive industries contributed most significantly (23.7 per cent) to local employment, followed by patent-intensive (11.8 per cent) and design-intensive (8.0 per cent) industries in Singapore.

Figure 4: Total Contribution of IPR-intensive Industries to Local Employment in Thousands (2018 - 2022 Average)



Compared to other economic contributions, the top 10 IPR-intensive industries contributing to local employment exhibit a broader range of industries including management consultancy and holding companies (**Table 10**).

Table 10: Top 10 IPR-intensive Industry Contributors by Percentage Share of Local Employment

Rank	Industry	Share of Total Local Employment (2018 - 2022 Average)
1	Non-specialised wholesale trade	3.7%
2	Management consultancy activities	3.6%
3	Activities of holding companies	2.2%
4	Computer programming activities	1.5%
5	Manufacture of electronic components and boards	1.3%
6	Manufacture of other food products	1.3%
7	Higher education	1.2%
8	Activities of head offices; centralised administrative offices and business representative offices	1.0%
9	Other education	1.0%
10	Business support service activities n.e.c.	1.0%
	Total Contribution of the Top 10 IPR-intensive Industry Contributors to Local Employment[16]	17.8%
	Total Contribution of All IPR-intensive Industries to Local Employment	35.7%

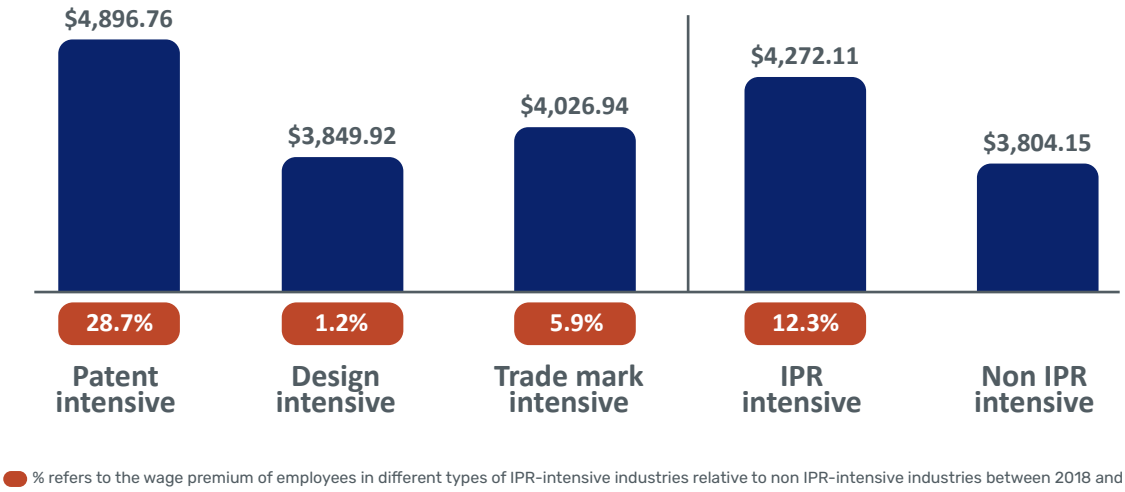
[16]*Figures in the table are rounded to 1 decimal place and may not add up to total due to rounding.*

3.2.4 Contributions of IPR-intensive Industries to Wages[17]

As shown in **Figure 5**, local employees in the IPR-intensive industries earned an average monthly wage[18] of $4,272.11, which represents a 12.3 per cent premium as compared to employees in non IPR-intensive industries.

Within the IPR-intensive industries, employees in patent-intensive industries enjoyed the highest wage premium, at 28.7%, while those in trademark-intensive industries saw a 5.9% premium. However, employees in design-intensive industries earned wages similar to those in non-IPR-intensive industries, with a wage premium of just 1.2%.

Figure 5: Average Monthly Wage of Employees in IPR-intensive Industries (2018 - 2022)



[17] *For wage premium analysis, IPR-intensive industries are defined as those with both higher-than-average IPR intensity values and higher-than-average counts of granted IPR. This additional criterion is introduced to account for methodological differences between wage premium analysis (based on an average per-employee basis) and other economic indicators (based on total sums across industries). This approach helps ensure that industries with limited innovation output do not disproportionately skew wage comparisons.*

[18] *This study considered both total wages and employer CPF contributions in its analysis.*

4 CONCLUSION

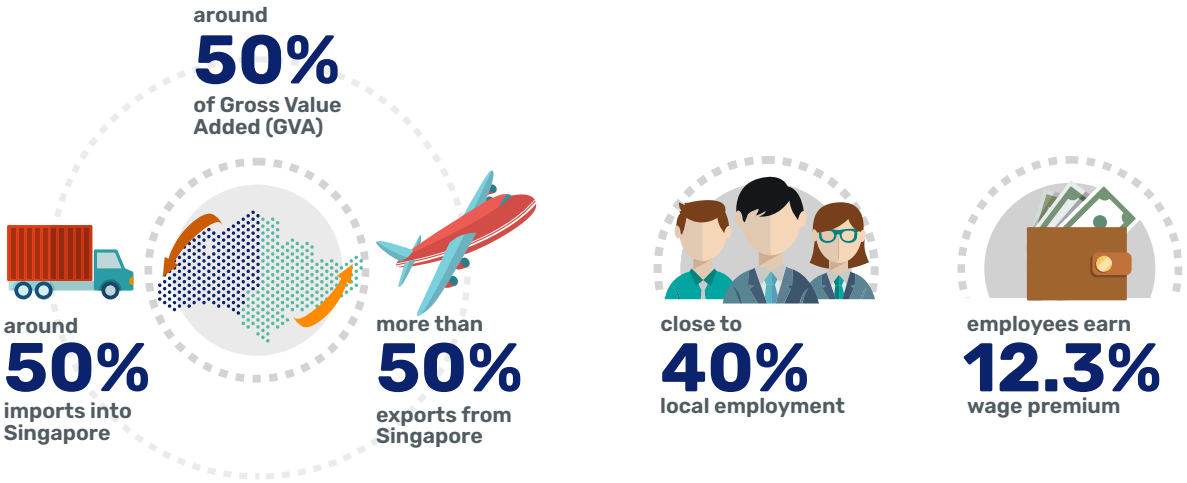
This study identified the IPR-intensive industries in Singapore between 2013 and 2017, as well as their economic contributions between 2018 and 2022. This study found that nearly half of the 229 industries in Singapore were IPR-intensive. Specifically, trade mark-intensive industries were primarily concentrated in manufacturing, as well as agricultural and fishing, while patent-intensive industries were focused in manufacturing. As for design-intensive industries, they were mainly concentrated in manufacturing, along with wholesale and retail trade.

This study further revealed that these IPR-intensive industries contributed close to half of Singapore's gross value added and imports into Singapore, and more than half of exports from Singapore. In terms of local employment, IPR-intensive industries accounted for almost 40 per cent of Singapore's local employment, and employees in these industries earn a 12.3 per cent wage premium as compared to those in non IPR-intensive industries. Among the IPR-intensive industries, patent-intensive industries contributed most to gross value added, merchandise trade, and wage premiums, whilst trade mark-intensive industries contributed most to local employment. The higher local employment contribution of trade mark could be attributed to the widespread use of trade mark across various industries as compared to other types of IPR[19].

While the analysis provides valuable insights into the characteristics of IPR-intensive industries in Singapore, refining the calculation of IPR intensity is recommended to minimise the impact of data from industries with low innovation activities (i.e., few IPR) and small employment size. This would help to better evaluate the IPR-intensity of the industries. Furthermore, future studies could explore the impact of copyright-intensive sectors on Singapore's economy.

Given the substantial contributions of both local and foreign employees to Singapore's economy, future studies could also consider using total employment data, rather than just local employment, to calculate IPR intensity. This approach would provide a more accurate representation of the employment size within the industries. In addition, this study only accounted for IPR applications by local filers. With over 70 per cent of IPR applications received by IPOS originating from foreign filers, future studies could further explore the economic impact of such applications by foreign filers.

IPR-intensive industries between 2013 and 2017



[19]*Based on the employment contributions analysis, there were 72 trade mark-intensive industries in Singapore between 2013 and 2017, at least twice the number of patent-intensive (31 industries) and design-intensive (21 industries) industries.*

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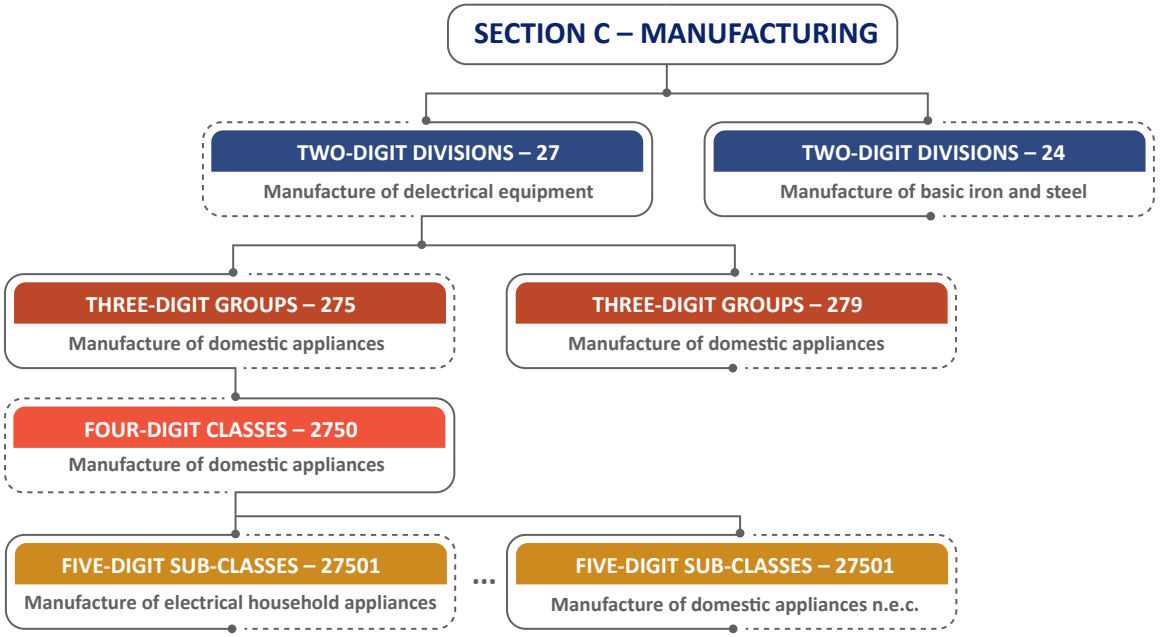
6 APPENDIX

6.1 Singapore Standard Industrial Classification (SSIC) 2020

This study classified industries using SSIC 2020, Singapore's national standard for classifying economic activities. SSIC 2020 has 21 sectors (A–U) divided into multiple levels: 81 divisions (2-digit), 204 groups (3-digit), 382 classes (4-digit), and 1,023 sub-classes (5-digit). **Figure 6** shows an example of this classification for the Manufacturing Sector.

The analysis primarily used 4-digit SSIC codes, consistent with international practices. Where data was unavailable, other classification levels were used. In total, 229 industries were considered for this study.

Figure 6 : Example of SSIC 2020 Classification for Manufacturing (Section C)



6.2 Data Matching of Granted IPR and List of Entities

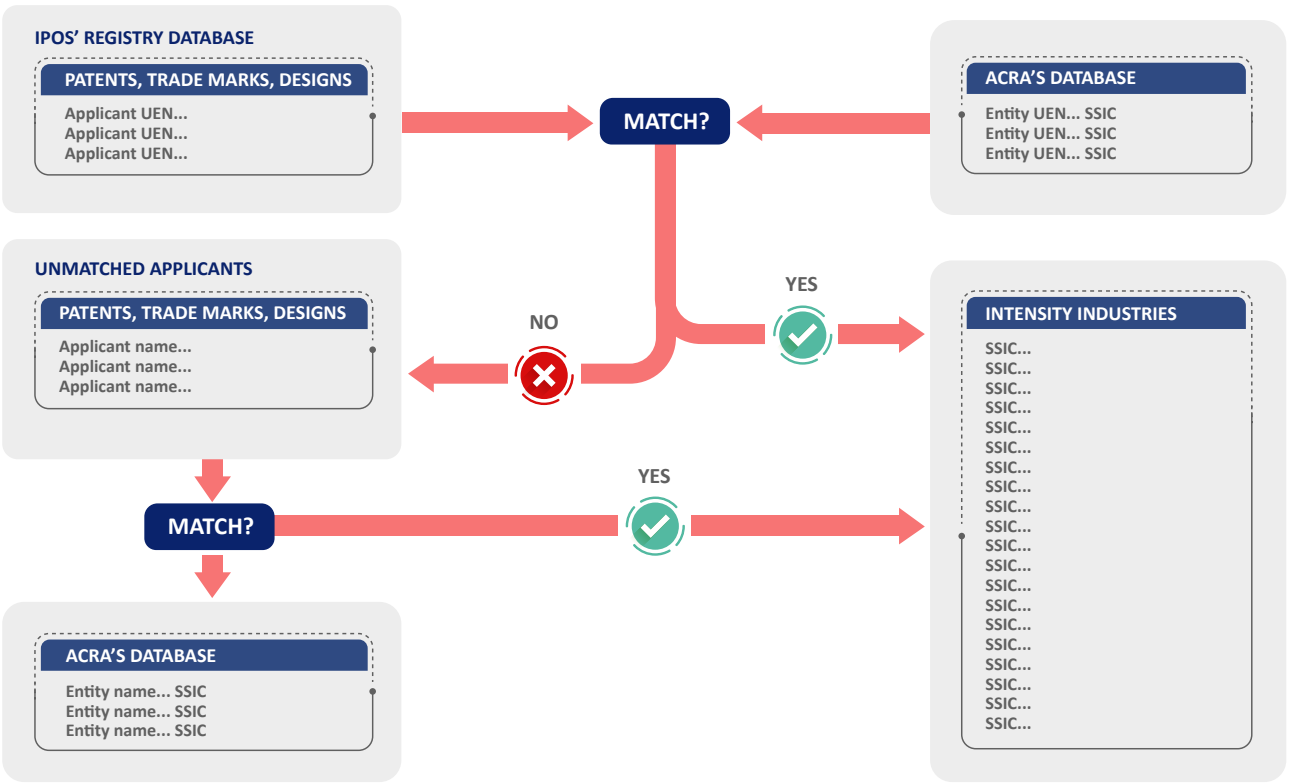
Using the Unique Entity Number (UEN) and applicant name of the granted IPR (i.e., patent, trade mark or registered design) as identifiers, we matched each granted IPR records with the list of entities registered with Accounting and Corporate Regulatory Authority (ACRA) to determine their industry classification. Once the relevant SSIC codes were identified, we aggregated the data to calculate the count of granted IPR per industry.

The data matching process is provided in **Figure 7**. Specifically,

i. Matching by Unique Entity Number (UEN). A UEN matching algorithm was developed to search and match IPR applicants' UEN numbers to the list of UENs for entities registered with ACRA. If there was a match, the SSIC 2020 code for the entity would be identified.

ii. Matching by name. For applicants whose UENs were not identified, an algorithm was developed to standardise applicants' names and match IPR applicants' names to the list of entities registered with ACRA using current and former entity names. If there was a match, the SSIC 2020 code for the entity would be identified[20].

Figure 7 : Flowchart of Data Matching Process for Computation of IPR Counts



[20]*In newer IPR applications, the applicant code is defined by the company's UEN.*

6.3 Table 11: List of IPR-intensive Industries (2013 - 2017)

SSIC	Industry	Intensive in:		
		Trade Mark	Patent	Design
0111	Growing of food crops (non-hydroponic)	Yes	No	No
0112	Growing of food crops (hydroponics)	Yes	No	No
0119	Growing of other crops	No	Yes	No
0141	Livestock production (except poultry and animal specialties)	Yes	No	No
0149	Other animal production	Yes	No	No
0320	Fish farming	Yes	No	No
0900	Service activities incidental to oil and gas extraction (excluding surveying and engineering design and consultancy services supporting mining, oil and gas extraction and offshore exploration activities)	No	Yes	No
102	Processing and preserving of seafood	Yes	No	No
104	Manufacture of vegetable and animal oils and fats	Yes	No	No
106 / 110 / 120	106: Manufacture of grain mill products, starches and starch products 110: Manufacture of beverages 120: Manufacture of tobacco products	Yes	No	No
107	Manufacture of other food products	Yes	No	No
108	Manufacture of prepared animal feeds	Yes	No	No
151	Tanning and dressing of leather; dressing and dyeing	Yes	No	No
152	Manufacture of footwear	Yes	No	No
182	Reproduction of recorded media	Yes	No	No
201	Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms	No	Yes	No
202 / 203	202: Manufacture of other chemical products 203: Manufacture of man-made fibres	Yes	Yes	No
210	Manufacture of pharmaceuticals and biological products	No	Yes	No
222	Manufacture of plastic products	No	No	Yes
231	Manufacture of glass and glass products	No	Yes	No
239	Manufacture of other non-metallic mineral products n.e.c.	Yes	No	No
241 / 243	241: Manufacture of basic iron and steel 243: Casting of metals	No	Yes	No
242	Manufacture of basic precious and non-ferrous metals	No	No	Yes
261	Manufacture of electronic components and boards	No	Yes	No
263	Manufacture of communications equipment	No	Yes	No

264 / 266 / 268	264: Manufacture of consumer electronics 266: Manufacture of irradiation, electromedical and electrotherapeutic equipment 268: Manufacture of magnetic and optical media	Yes	No	No
265	Manufacture of measuring, testing, navigating and control equipment; watches and clocks	No	Yes	No
267	Manufacture of optical instruments and photographic equipment	No	Yes	No
273	Manufacture of wiring and wiring devices	Yes	No	No
274	Manufacture of electric lighting equipment	Yes	No	Yes
275	Manufacture of domestic appliances	Yes	Yes	Yes
281	Manufacture of general purpose machinery	No	Yes	No
282	Manufacture of special purpose machinery	No	Yes	No
291/292	291: Manufacture of motor vehicles, trailers and semi-trailers 292: Manufacture of motor vehicle bodies (coachwork), trailers and semi-trailers	Yes	No	Yes
302 / 304 / 309	302: Manufacture of railway locomotives and rolling stock 304: Manufacture of military fighting vehicles 309: Manufacture of other transport equipment n.e.c.	No	Yes	No
310	Manufacture of furniture	No	No	Yes
321	Manufacture of jewellery, bijouterie and related articles	Yes	Yes	Yes
322 / 323 / 324 / 329	322: Manufacture of musical instruments 323: Manufacture of sports goods 324: Manufacture of games and toys 329: Other manufacturing n.e.c.	No	No	Yes
325	Manufacture of medical and dental instruments and supplies	No	Yes	No
421 / 422 / 429 / 431	421: Construction of roads and railways 422: Construction of utility projects 429: Construction of other civil engineering projects 431: Demolition and site preparation	No	Yes	No
4621 / 4622	4621: Wholesale of agricultural raw materials and live animals except tropical produce 4622: Wholesale of tropical produce	Yes	Yes	No
4630	Wholesale of food, beverages and tobacco	Yes	No	No
4641	Wholesale of textiles, clothing, footwear and leather goods	Yes	No	Yes
4642	Wholesale of personal effects	Yes	No	No
4643	Wholesale of furniture, home furnishings and other household equipment	No	No	Yes
4644	Wholesale of sporting and other recreational goods	Yes	No	Yes
4645	Wholesale of handicrafts and fancy goods	Yes	No	Yes
4646	Wholesale of medicinal and pharmaceutical products	Yes	No	Yes
4649	Wholesale of other household goods	No	No	Yes
4661	Wholesale of fuels and related products	No	Yes	No

4663	Wholesale of construction materials, hardware, plumbing and heating equipment and supplies	No	No	Yes
4664	Wholesale of chemicals and chemical products	No	Yes	No
4690	Non-specialised wholesale trade	Yes	No	Yes
4721 / 4722 / 4723	4721: Retail sale of food in specialised stores 4722: Retail sale of beverages in specialised stores 4723: Retail sale of tobacco products in specialised stores	Yes	No	No
4741	Retail sale of computers, peripheral equipment, software and telecommunications equipment in specialised stores	Yes	No	No
47510 / 47531 / 47532	47510: Retail sale of textiles 47531: Retail sale of furniture (including mattresses, cushions) 47532: Retail sale of furnishings (e.g. curtains, carpets, pillow cases)	Yes	No	No
47533 / 47534 / 47536 / 47537 / 47539	47533: Retail sale of lighting and lighting accessories 47534: Retail sale of crockery, cutlery and kitchen utensils 47536: Retail sale of musical instruments and scores 47537: Retail sale of security and safety equipment 47539: Retail sale of electrical household appliances, furniture, lighting equipment and other household articles n.e.c.	Yes	No	Yes
4761	Retail sale of books, newspapers and stationery in specialised stores	Yes	No	No
4772	Retail sale of pharmaceutical and medical goods, cosmetics and toilet articles in specialised stores	Yes	No	No
4773	Retail sale of personal effects in specialised stores	Yes	No	Yes
5001	Passenger water transport	Yes	No	No
5811	Book publishing	Yes	No	No
5812	Publishing of directories and mailing lists	Yes	No	No
5813	Publishing of news, journals and periodicals	Yes	No	No
5819	Other publishing activities	Yes	No	No
5820	Software publishing	Yes	No	No
5911 / 60	5911: Movie, video, television and other programme production activities 60: Radio and television broadcasting activities	Yes	No	No
5914	Movie projection activities	Yes	No	No
6101	Telecommunications network operation	Yes	No	No
6109	Other telecommunications activities	No	Yes	No
6201	Computer programming activities	Yes	No	No
6209	Other information technology and computer service activities	Yes	No	No
631	Data analytics, processing, hosting and related activities; internet search engines	Yes	No	No
632 / 639	632: Online marketplaces 639: Other information service activities	Yes	No	No
64190	Other monetary intermediation	Yes	No	No

6420	Activities of holding companies	Yes	No	No
6430	Trusts, funds and similar financial entities	Yes	No	No
6499	Financial service activities, except insurance and pension funding activities n.e.c.	No	Yes	No
6520	Reinsurance	Yes	No	No
6611	Securities and commodities exchange	Yes	No	No
6619	Other activities auxiliary to financial service activities	Yes	No	No
7010	Activities of head offices; centralised administrative offices and business representative offices	No	Yes	No
7020	Management consultancy activities	Yes	No	No
72	Scientific research and development	Yes	Yes	Yes
7310	Advertising	No	No	Yes
7320	Market research and public opinion polling	Yes	Yes	No
7411	Industrial design activities	Yes	Yes	Yes
7490	Professional, scientific and technical activities n.e.c.	Yes	Yes	No
772	Renting and leasing of personal and household goods	Yes	No	No
773 / 774	773: Renting and leasing of other machinery, equipment and tangible goods 774: Leasing of non-financial intangible assets	Yes	No	No
823	Convention, trade show, concert and other event organisers	Yes	No	No
829	Business support service activities n.e.c.	No	Yes	No
8530	Higher education	No	Yes	No
8540	Other education	Yes	No	No
8550	Educational support services	Yes	No	No
8810	Social services without accommodation for the elderly and disabled	Yes	No	No
91	Libraries, archives, museums and other cultural activities	Yes	No	No
931	Sports activities	Yes	No	No
941	Activities of business, employers and professional membership organisations	Yes	No	No
9524	Repair of furniture and home furnishings	Yes	No	No
9529	Repair of other personal and household goods	Yes	No	No
9603	Funeral and related activities	Yes	No	No
9609	Other personal service activities n.e.c.	No	Yes	No