
Estimating Productivity and Identifying the Frontier

Malaysia Productivity Nexus



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Background

Analysis of productivity at **industry** and **sectoral-level** is often **too broad** to be a practical basis for policy and strategy formulations.

It is therefore essential to understand how **firm-level (enterprise) productivity** patterns **evolve** by taking into account the **heterogeneity** between firms.

Benchmarking and **identification** of **frontier firms** would provide better insights in devising effective policies to boost productivity at the sectoral level.

Micro-level performance

Comparing firms' productivity within the same industry provides several benefits. Firms in different sectors can have different levels and growth rates of productivity for reasons unrelated to firm performance.

Variation in labour and capital intensity

Different pace of technological change

Degree of product differentiation and competition

Objectives

- 1 Preliminary evaluation of **firm level** efficiency and productivity based on the nine 'Productivity Nexus'
- 2 Identification of **frontier firms** and **non-frontier** firms at the sectoral level
- 3 Analysis of productivity growth and organizational slack (**x-inefficiency**)
- 4 Recommendation on **benchmarking framework** for enterprise level productivity assessment

Concept and context

Productivity reflects how efficiently a combination of inputs is used to produce output.

Higher productivity doesn't necessarily mean higher profitability. Nor do higher profits necessarily mean higher productivity.

Multi-Factor Productivity (MFP)

MFP reflects how efficiently a **combination** of **inputs** is used to produce output.

The term **MFP** is also known as Total Factor Productivity (TFP).

It is often thought of as a proxy for **broad technological advances** that increase the output from a composite of inputs.

Source: Conway, 2016

These advances can include **new technology** associated with new types of **equipment**, improvements in management and production processes, increased **scale** and improved worker **skills**.

Frontier Firms

Definitional variants and approaches

OECD defines frontier firms as those in the **top 10% of the productivity distribution** – either globally (global frontier) or among domestic firms (domestic frontier).

Multi-Factor-Productivity (MFP) measure is based on Solow residual model using **ORBIS** database covering firms under two-digit-industry classification*.

* International Standard Industrial Classification (ISIC)

COUNTRY LEVEL STUDIES

1

Distribution and ranking

Top 10 or top 100 ranked firms in each industries as a basis for measuring productivity frontier

2

Localize databases and sectoral classifications

New Zealand: Longitudinal Business Database (NZ Statistics)
Netherlands: Business Registry Dataset, Non-Financial Datasets, Polisbus Dataset (Central Bureau of Statistics)

3

Variations in specification and methodology used

Index number, parametric and non-parametric approach
Output and input definition
Variable weightage

Methodology

A three-step approach

Phase One

Quantitative Analysis of Firm-level Microdata

Identification of frontier and non-frontier firm for **benchmarking** purposes

Allows for various **decompositions** of productivity level and growth

Identify the nature of misallocation (**slack**) at the firm-level

Phase Two

Qualitative and inquiry evidence based case studies

Exploration of the **underlying causes** of growth, innovation and productivity change

Phase Three

Workshops and Engagements

Policy recommendations through Enterprise Productivity Programme

The underlying productivity drivers



Source: New Zealand Productivity Commission (April, 2020)

Frontier Analysis

Firm-level productivity performance

| Data Development Analysis (DEA) construct a frontier as the ratio of the weighted sum of outputs to a weighted sum of inputs to enable comparisons on efficiency and productivity performance.

| DEA uses a ratio of total factor productivity to measure performance by attributing a virtual optimal weight to each production entity's input and output.

| The optimal weights are arrived at by means of a Linear Programming (LP) model.

| The efficient frontier is a function that indicates the maximum attainable level of output corresponding to a given composite inputs.

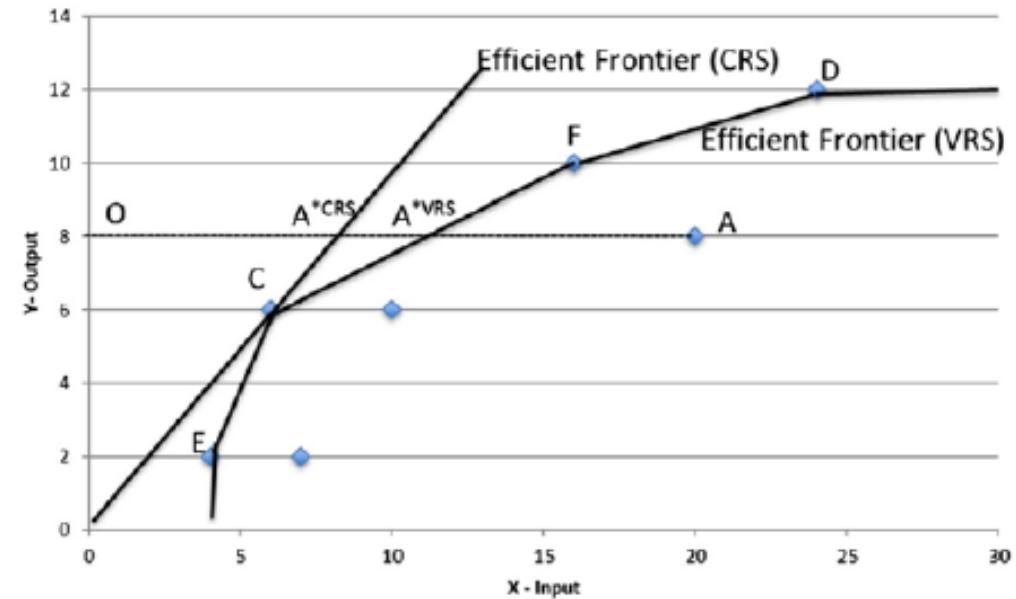


Figure 1: Hypothetical illustration of an efficient frontier

Frontier Analysis

Firm-level productivity performance

Efficiency score

Frontier methods represent performance by an efficiency **score**, calculated as the firm's **distance** to the best practice industry frontier.

Comparative analysis

The general use of DEA is to determine, **compare** and **evaluate** efficiency of multiple production entities **against the best** observed performance.

Slack adjustment & Peers

A firm that is **not on the frontier** is rated to be **inefficient** and has the **potential to improve** its performance by realigning its resources according to its **benchmark** peers.

Frontier Analysis

General specifications and parameters

OECD MultiProd Project

Micro-aggregated data study on productivity patterns across countries and over time

M
F
P

OUTPUT

Gross output
Revenue

Value Added
Revenues - cost of sales

INPUT

Capital and Investment
Total investment across all asset classes

Labour
Employment in headcounts and Labour costs

*The choice of simpler input measures has been driven by the aim of collecting comparable statistics across firms while achieving the broadest possible coverage.

M
F
P

OUTPUT

Value Added
Revenues - cost of sales

INPUT

Capital and Investment
Total investment across all asset classes

Labour
Employment in headcounts and Labour costs

Total assets

Inventories, development property, plant equipment, investment properties, intangible assets, receivables and etc.

Total equity

Shareholder equities and non-controlling interest

Labour input

Proxyed by staff costs (excluding executive director remunerations)

Data

Source and compilation

The study relies on **annual financial reports** of **public listed (main market)** companies under **Bursa Malaysia**. Specific sectors under the Productivity Nexus are the key domain for measuring firms' productivity over the period of 2017 to 2019.



Prime market for listing of established companies

Regulatory benchmark

Compliance with relevant rules and guidelines prescribed by Securities Commission and Bursa Malaysia

Market benchmark

Non-prescriptive dimension which is purely market driven



Identifiable core business

- Majority ownership and management control of an identifiable core business which is the principal source of operating revenue or after-tax profit



Good management

- Effectively managed by capable people with the requisite experience and qualification
- Management continuity well in place



Healthy financial position

- Positive cash flow from operating activities
- Adequate working capital (for at least 12 months after listing)



Risk management

- Internal control and risk management systems are in place in view of the company's business and growth plans



Business prospects

- Involvement in growth industry
- Established brand or market visibility
- Inroads made against competitors
- Core business that is well positioned to reap returns



Commitment to compliance

- Sufficient systems, procedures, policies, controls and resources in place to ensure continuous compliance with the relevant rules and regulations



Responsible directors

- Directors are fully aware of and understand their fiduciary obligations



Good corporate governance

- Strong corporate governance policies and practices
- Founders, promoters, directors and management team have a good track record in corporate governance



No conflicts of interest

- Satisfactory resolution of any conflicts of interest situations



Does not undermine public interests

- Determination that the acting of an applicant does not undermine public interests

Source: *Going Public - A Practical Guide to Listing on Bursa Malaysia (2020)*

Data

Source and compilation

| Bursa Malaysia Mainboard listing: 977 companies

| Divided into 13 sectoral indices covering 38 + 4 subsectors in line with the internationally recognised standard (i.e. ICB and GICS)

| **Mapping** of Bursa sectoral listings with the 9 Productivity Nexus

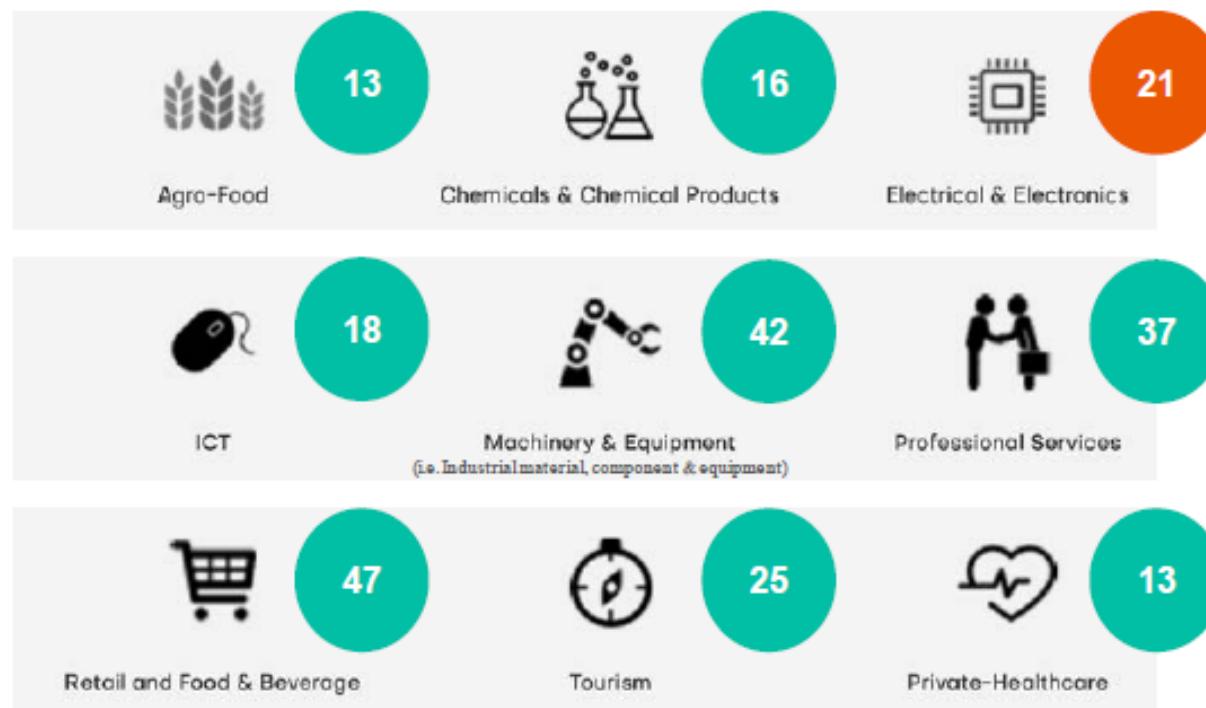
	Sector	Subsector		Sector	Subsector		Sector	Subsector
1.	Construction		6.	Property		10.	Transportation and logistics	Transportation and logistic services Transportation equipment
2.	Consumer products and services	Agricultural product Automotive Food/beverages Household goods Personal goods Retailers Travel, leisure and hospitality	7.	Industrial products and services	Auto parts Building materials Chemicals Diversified industries Industrial engineering Industrial materials, components and equipment Industrial services Metals Packaging materials Wood and wood products	11.	Telecommunications and media	Media Telecommunications equipment Telecommunications service providers
3.	Energy	Energy infrastructure, equipment and services Oil and gas producers Other energy resources	8.	Real estate investment trusts		12..	Utilities	Electricity Gas, water and multi-utilities
4.	Financial services	Banking Insurance Other financials	9.	Technology	Digital services Semiconductors Software Technology equipment	13.	Plantation	
5.	Healthcare	Healthcare equipment and services Healthcare providers Pharmaceuticals						

Notes:
Industry Classification Benchmark (ICB)
Global Industry Classification Standards (GICS)

Table 1: Bursa Malaysia sector and subsector classifications

Data

Source and compilation



- | Variation in **definitional classification** of sectoral level used.
- | **Overlapping subsectors** under different sector classifications.
- | **Unavailability** of employees headcounts microdata at firm level or number of persons engaged.
- | **Newly listed** on Bursa Malaysia mainboard or being delisted

Figure 2: Malaysia Productivity Nexus

Data

Source and compilation



Figure 3: Bursa Malaysia Main Market Indices



Findings

Preliminary

Firm-level efficiency score

Firms' level efficiency scores for Electrical & Electronics Nexus over the period of 2017-2019



Frontier and non-frontier firms

Identification of efficient frontier firms for benchmarking and listing of non-frontier firms

Relative efficiency ranking

Ranking of frontier and non-frontier firms for Productivity Nexus



Peers and relative targets

Peers for the non-frontier firms and potential improvement targets



Productivity trend

Sources of productivity growth and its decomposition





Findings

Electrical & Electronics Nexus

Electrical & Electronics Nexus 2017



7

out of 21 firms were on
the efficient frontier

Electrical & Electronics Nexus 2018



5

out of 21 firms were on
the efficient frontier

Electrical & Electronics Nexus 2019



7

out of 21 firms were on
the efficient frontier

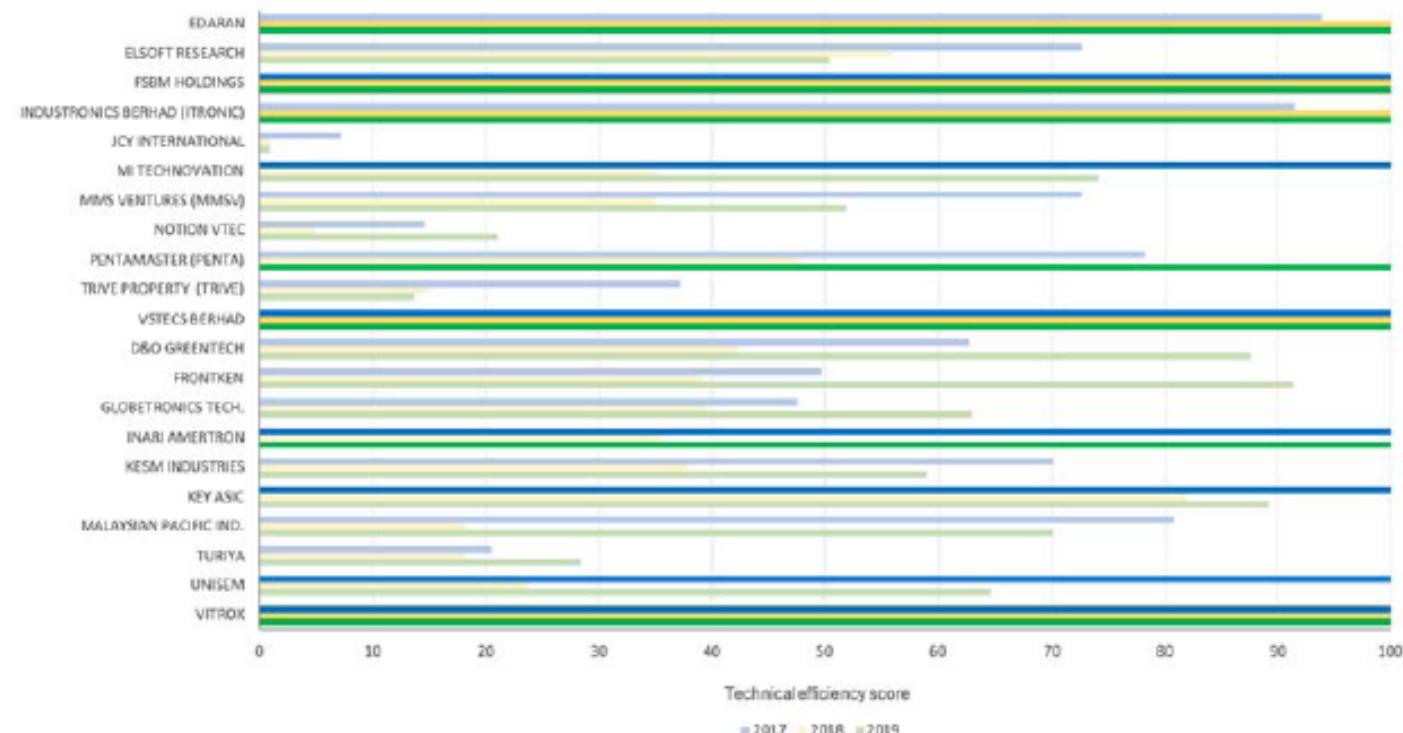


Figure 4: Electrical and Electronics Nexus technical efficiency and frontier firms

Findings

Electrical & Electronics Nexus

Over the period of 2017-2019, **3 firms** had consistently recorded as the efficiency frontier for the **Electrical & Electronics Nexus**.

- FSBM
- VSTECS
- VITROX

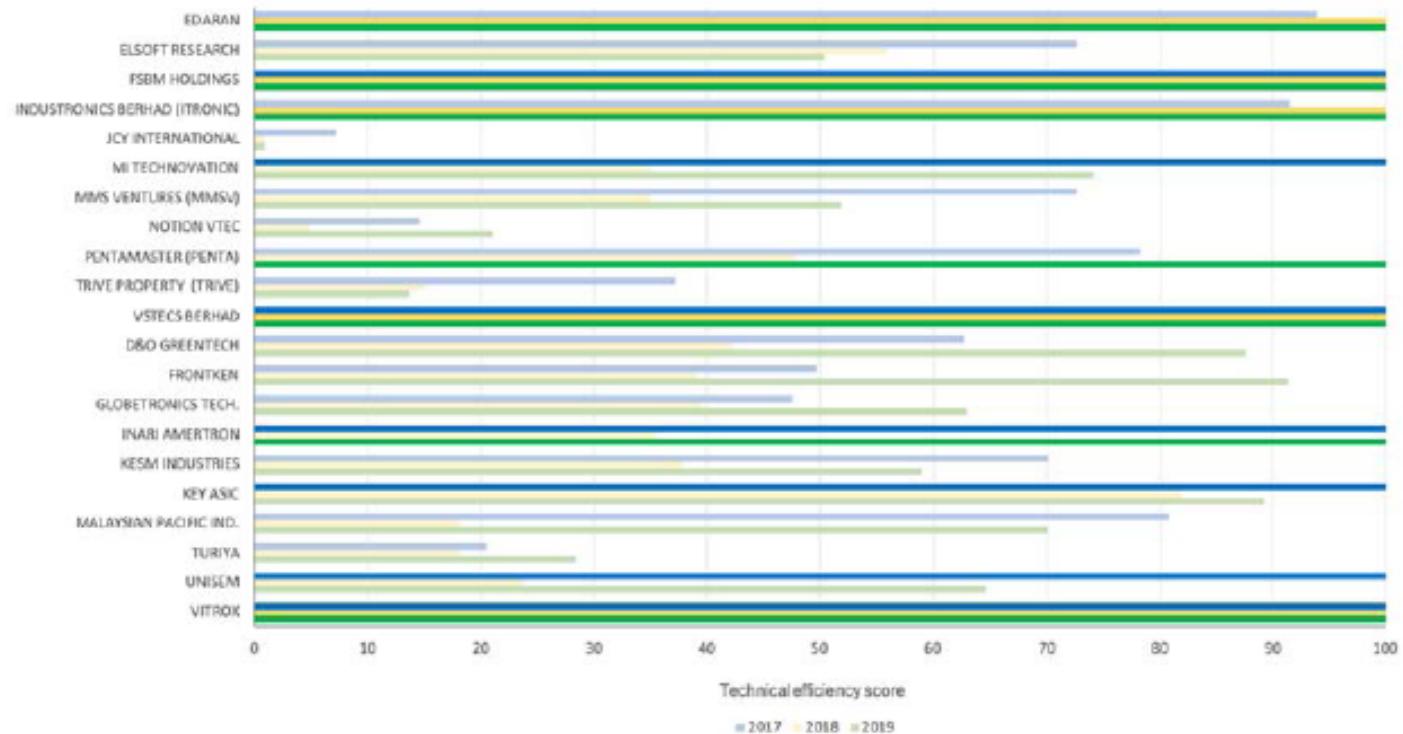


Figure 4: Electrical and Electronics Nexus technical efficiency and frontier firms

Findings

Electrical & Electronics Nexus

| Over the period of 2017-2019, **FSBM** and **VSTECS** had consistently ranked 1st and 2nd in technical efficiency performance relative to other firms on the frontier for **Electrical & Electronics Nexus**.

| **Edaran Berhad** joined the bandwagon of the top rank in recent years while **Mi Technovation** which had consistently on the frontier, improved the rank to 3rd in year 2019.



Figure 5: Electrical & Electronics Nexus frontier firms ranking

Findings

Electrical & Electronics Nexus

| The existence of persistent **technical inefficiencies** over time offers an opportunity for the non-frontier firms to reduce inputs usage to achieve the same level of outputs.

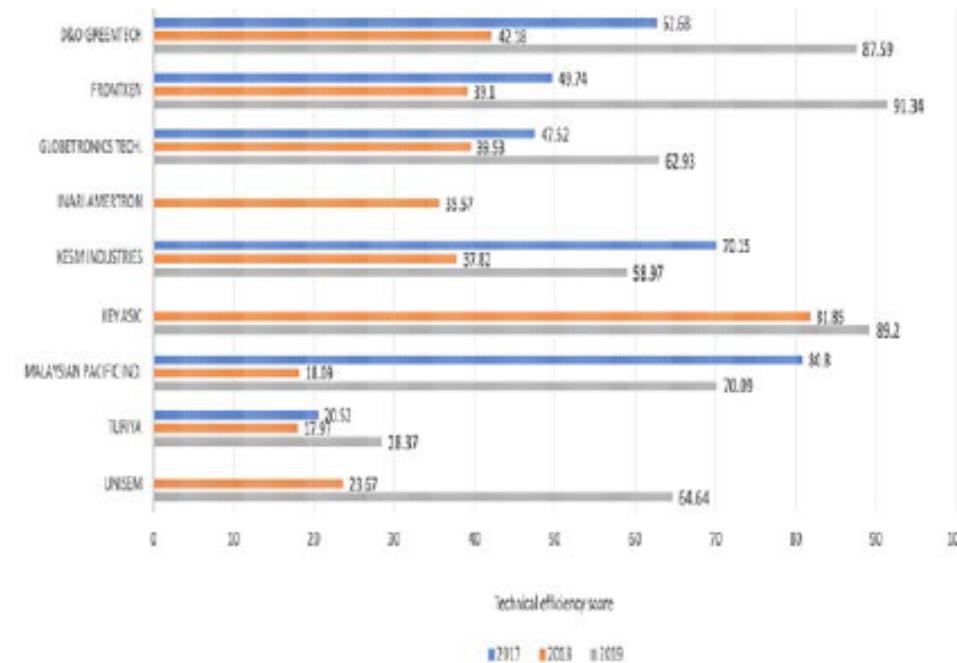
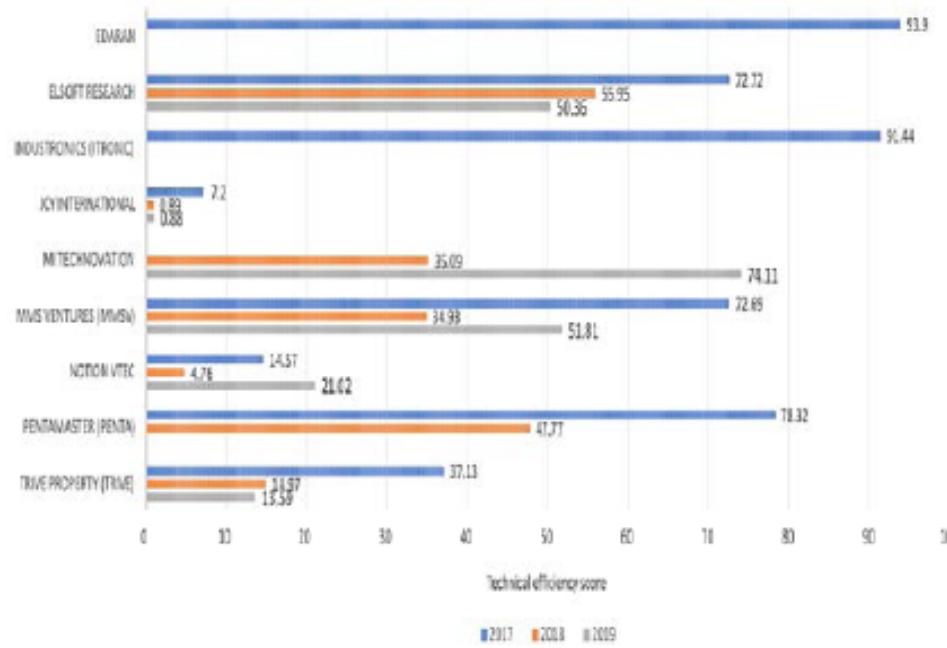


Figure 6: Electrical & Electronics Nexus technical inefficiency of the non-frontier firms

Findings

Electrical & Electronics Nexus

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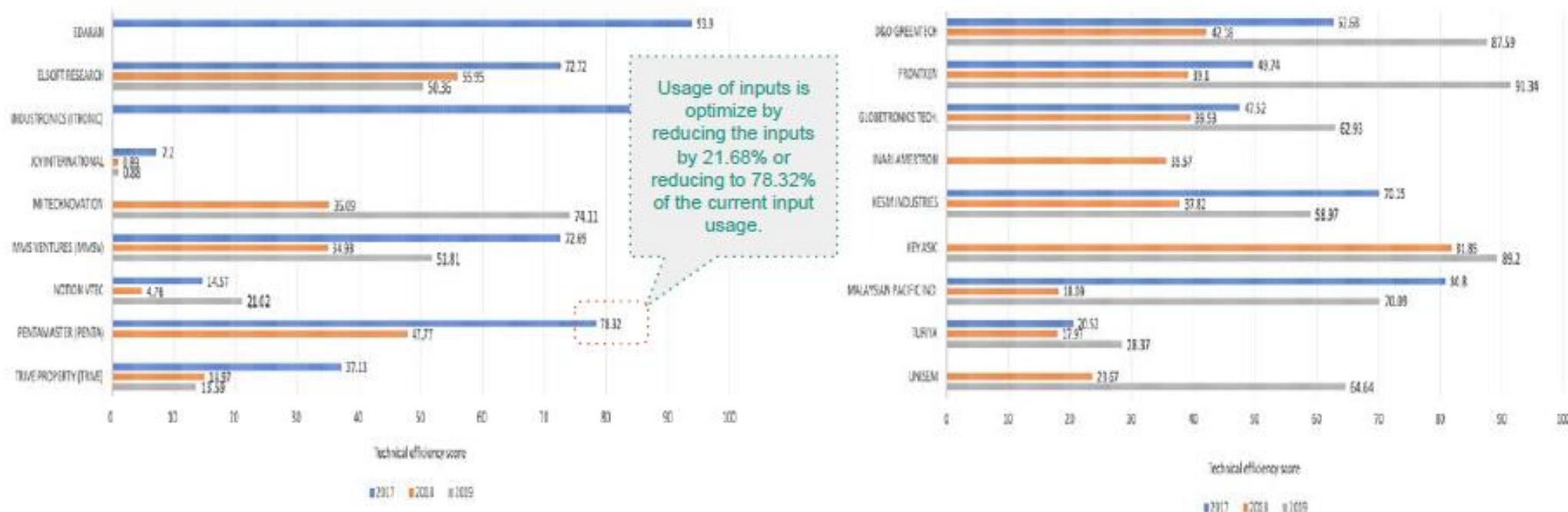


Figure 6: Electrical & Electronics Nexus technical inefficiency of the non-frontier firms

Findings

Electrical & Electronics Nexus

| The overall technical efficiency score for the non-frontier firms averaged at **57.10, 33.13, and 54.64** for the year 2017, 2018 and 2019, respectively.

| On average, non-frontier firms were using **more than doubled** the required amount of inputs to produce the given output level.

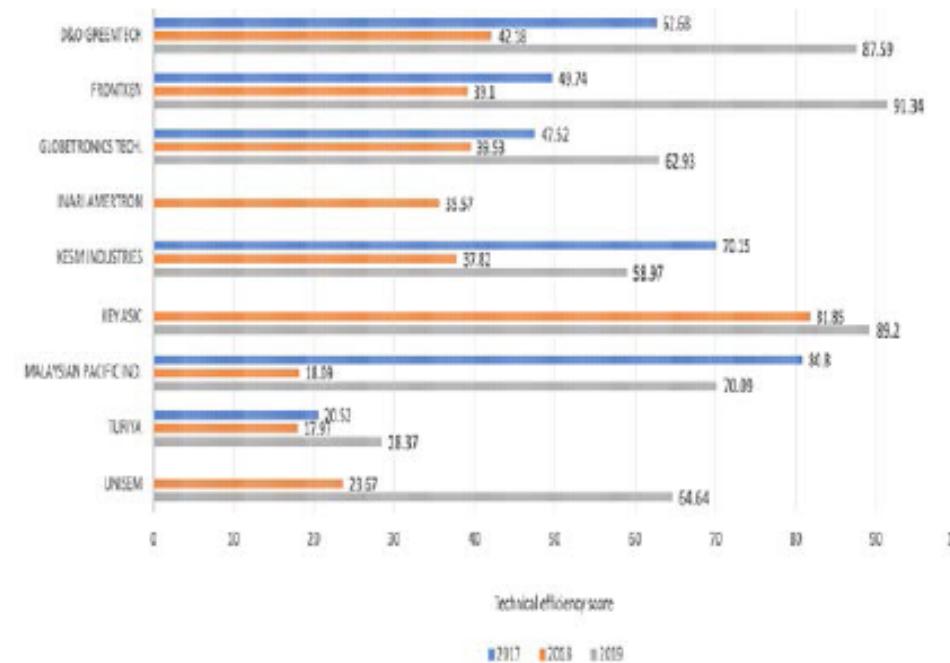
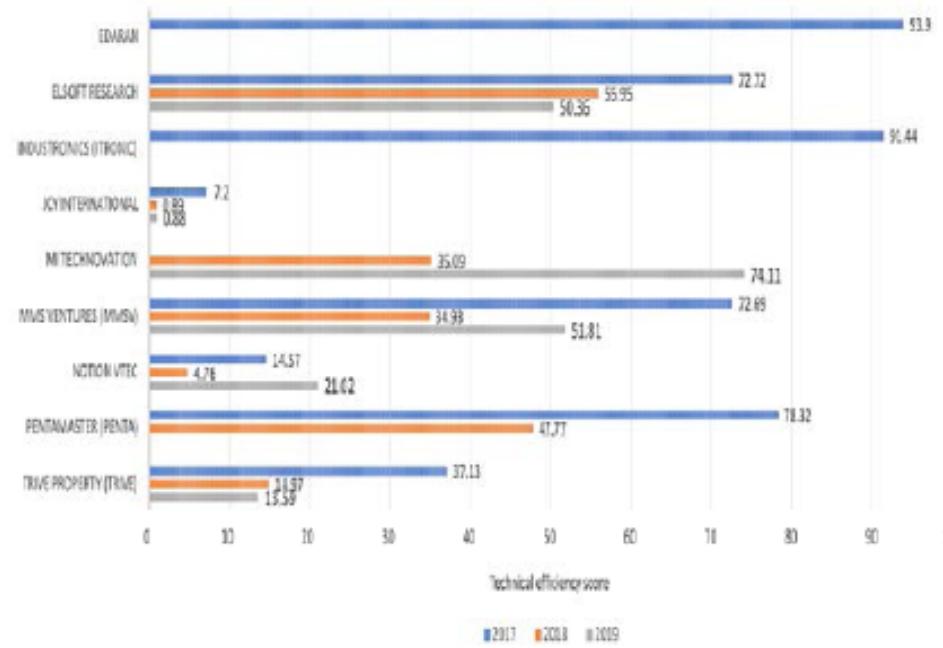


Figure 6: Electrical & Electronics Nexus technical inefficiency of the non-frontier firms

Findings

Tourism Nexus

| On average, non-frontier firms were using **more than doubled** the required amount of inputs to produce the given output level.

Non-optimal usage of inputs

Waste of resources



Source: *Productivity Matters - Benchmarking your company to up your game* (2016)

Findings

Electrical & Electronics Nexus

| Relative importance of peers as a benchmark and role model for non-frontier firms are based on the calculated lambda values.

| Greater value of lambda indicates a better benchmark and role model frontier peers relative to others based on operating scale.

	Non-frontier firms	 FSBM	 VSTECS	 ViTrex [®]
1.	Elsoft Research	(0.80)	(0.04)	(0.07)
2.	JCY International	(1.00)	(0.00)	(0.00)
3.	MI Technovation	(0.00)	(0.27)	(0.34)
4.	MMS Ventures	(0.64)	(0.00)	(0.04)
5.	Notion VTEC	(0.00)	(0.02)	(0.09)
6.	Trive Property	(0.99)	(0.00)	(0.00)
7.	D&O Greentech	(0.00)	(0.00)	(0.00)
8.	FRONTKEN	(0.00)	(0.00)	(0.04)
9.	Globetronics	(0.00)	(0.00)	(0.16)

	Non-frontier firms	 FSBM	 VSTECS	 ViTrex [®]
10.	KESM Industries	(0.00)	(0.00)	(0.08)
11.	Key Asic	(0.78)	(0.01)	(0.03)
12.	Malaysia Pacific Industries	(0.00)	(0.00)	(0.00)
13.	Turiya	(0.92)	(0.06)	(0.02)
14.	UNISEM	(0.00)	(0.00)	(0.00)

Notes:

Figures in parentheses are Lambda values

Table 2: Electrical and Electronics Nexus non-frontier firms' peers (2019)

Findings

Tourism Nexus

Malmquist productivity index indicates total factor productivity change (TFP) from one period to another.

Any movement of productivity over time can be decomposed into two parts:

- 1 **Movement of the frontier** due to changes in technological capabilities of the firm (technical change)
- 2 **Movement of the firm towards (or far from) the frontier** (technical efficiency)

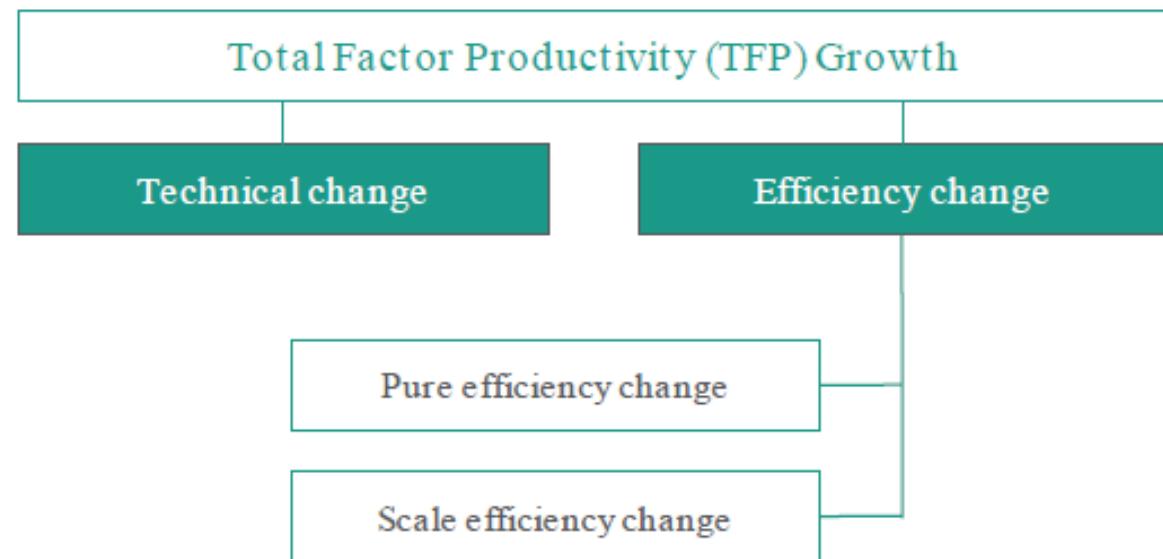


Figure 7: Decomposition of TFP growth

Findings

Electrical & Electronics Nexus

The overall Electrical & Electronics Nexus saw a **slower** TFP growth over the period of 2017-2019.

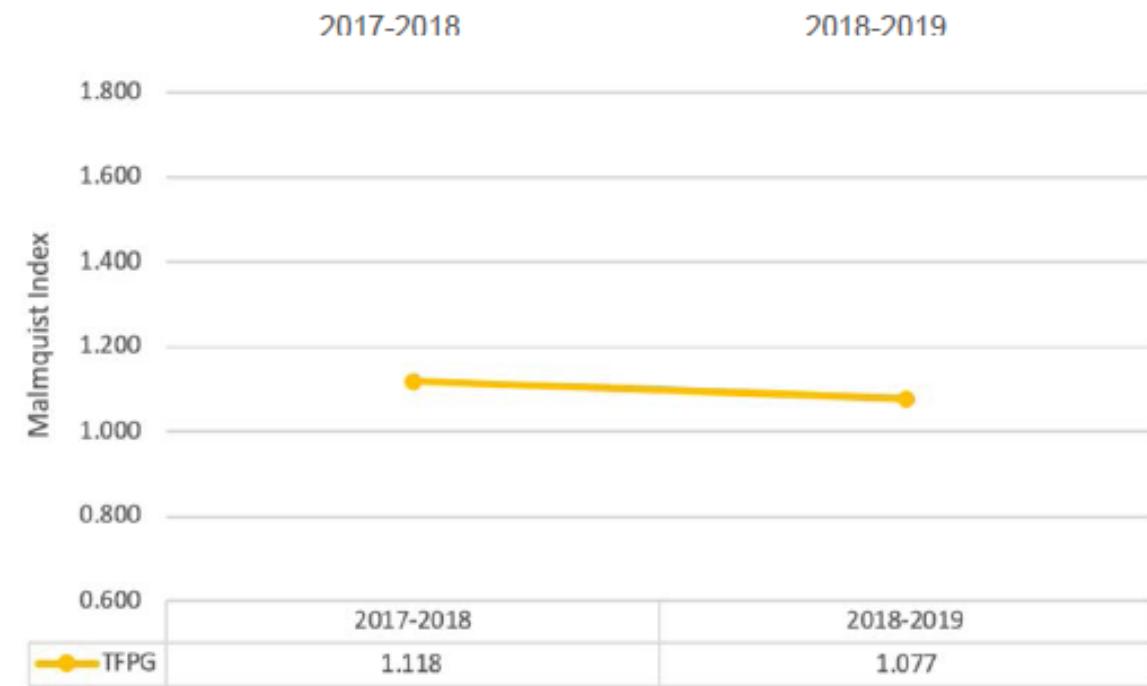
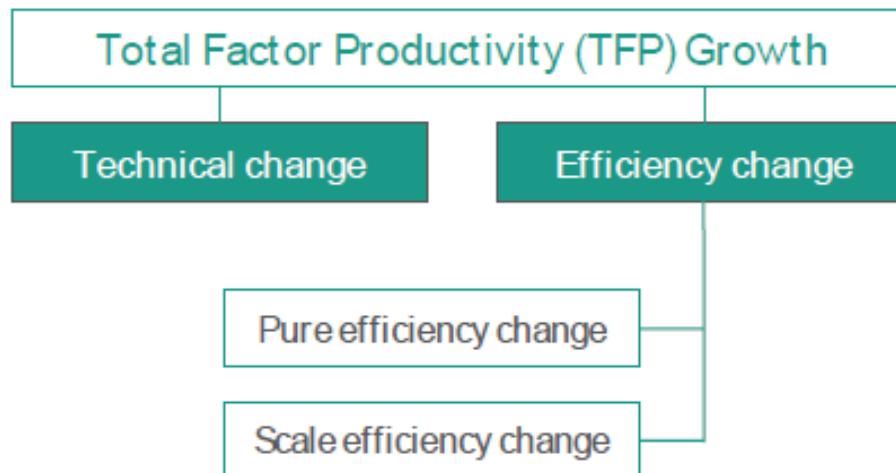


Figure 8: Tourism Nexus productivity trend

Findings

Electrical & Electronics Nexus

- | The slower growth in TFP was mainly contributed by the decline in **pure efficiency** and the slower growth in the **scale** effects.
- | The **positive TFP growth** recorded for the **Electrical & Electronics Nexus** in the recent year was mainly contributed by the significant improvement in the **technological change**.

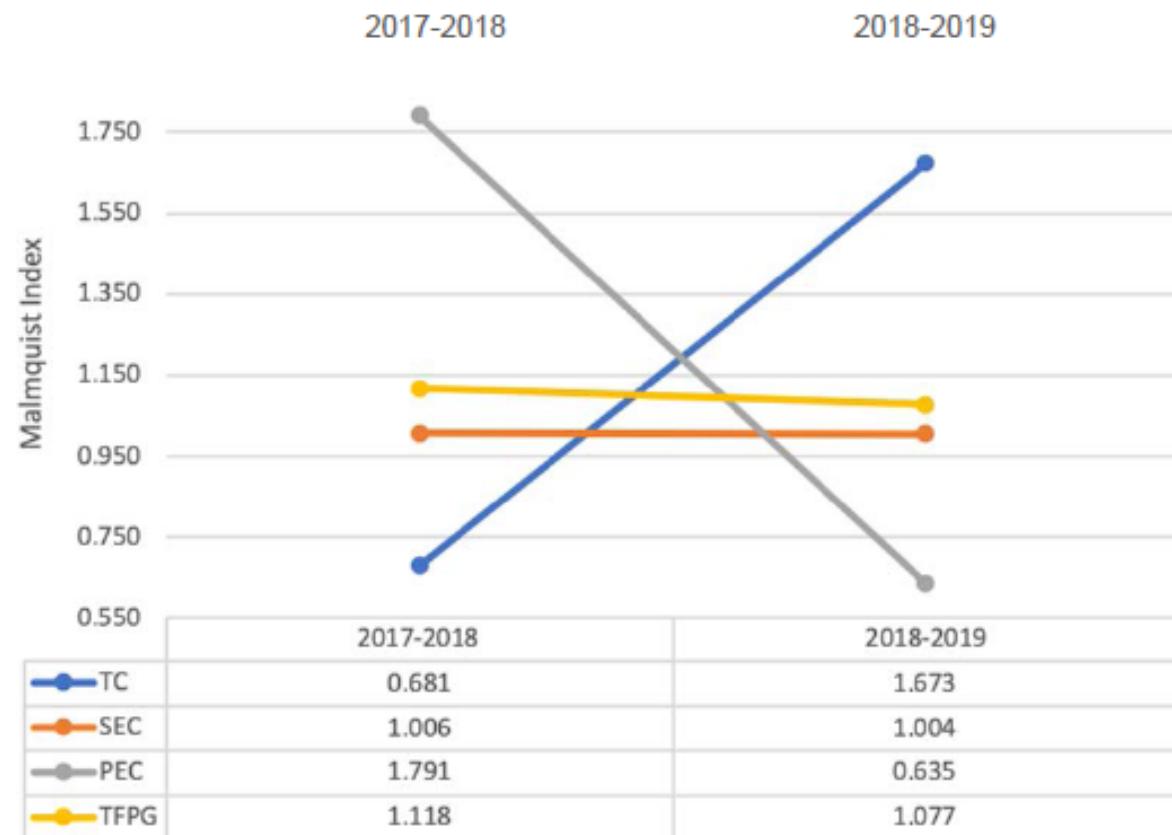


Figure 9: Electrical and Electronics Nexus productivity trend

Findings

Electrical & Electronics Nexus

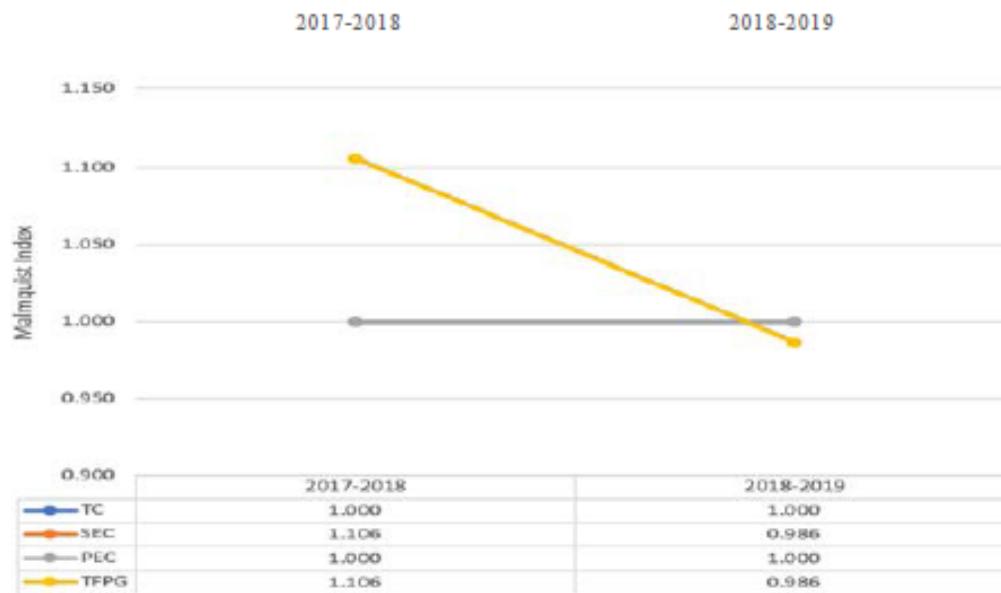


Figure 10 (a): E&E Nexus productivity trend for frontier firms

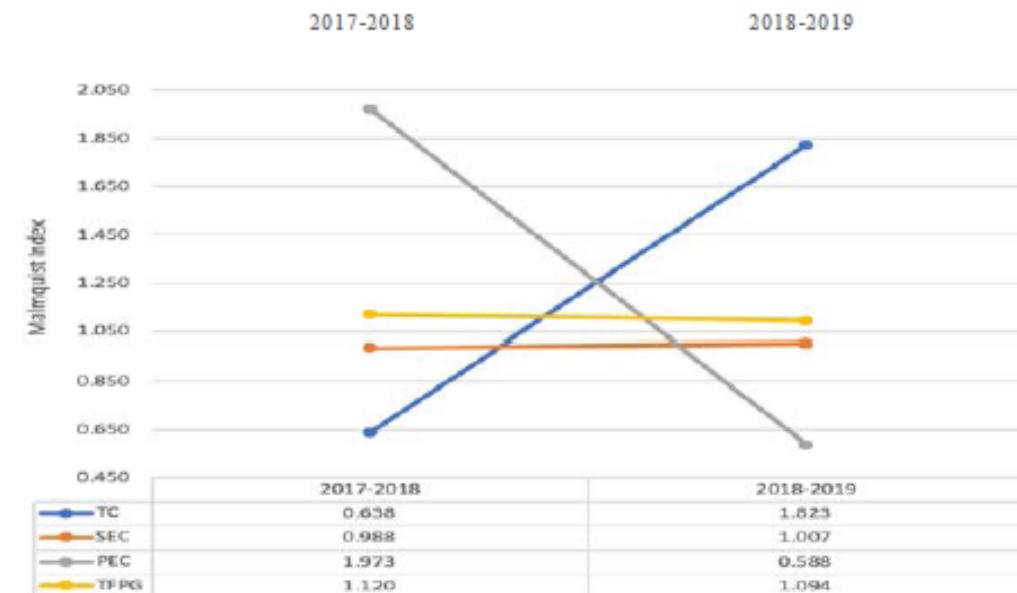


Figure 10 (b): E&E Nexus productivity trend for non-frontier firms

Findings

Electrical & Electronics Nexus

- | On average, the **non-frontier** firms' productivity trends were **catching up** relative to the frontier firms although at a slower rate than year 2017-2018.
- | The **technological change** contributed significantly to the growth of TFP among the **non-frontier** firms despite the declining trend in pure efficiency.
- | The non-frontier firms' average for **pure efficiency trend declined** over the period of 2018-2019 while the frontier firms' average pure efficiency was stagnant.

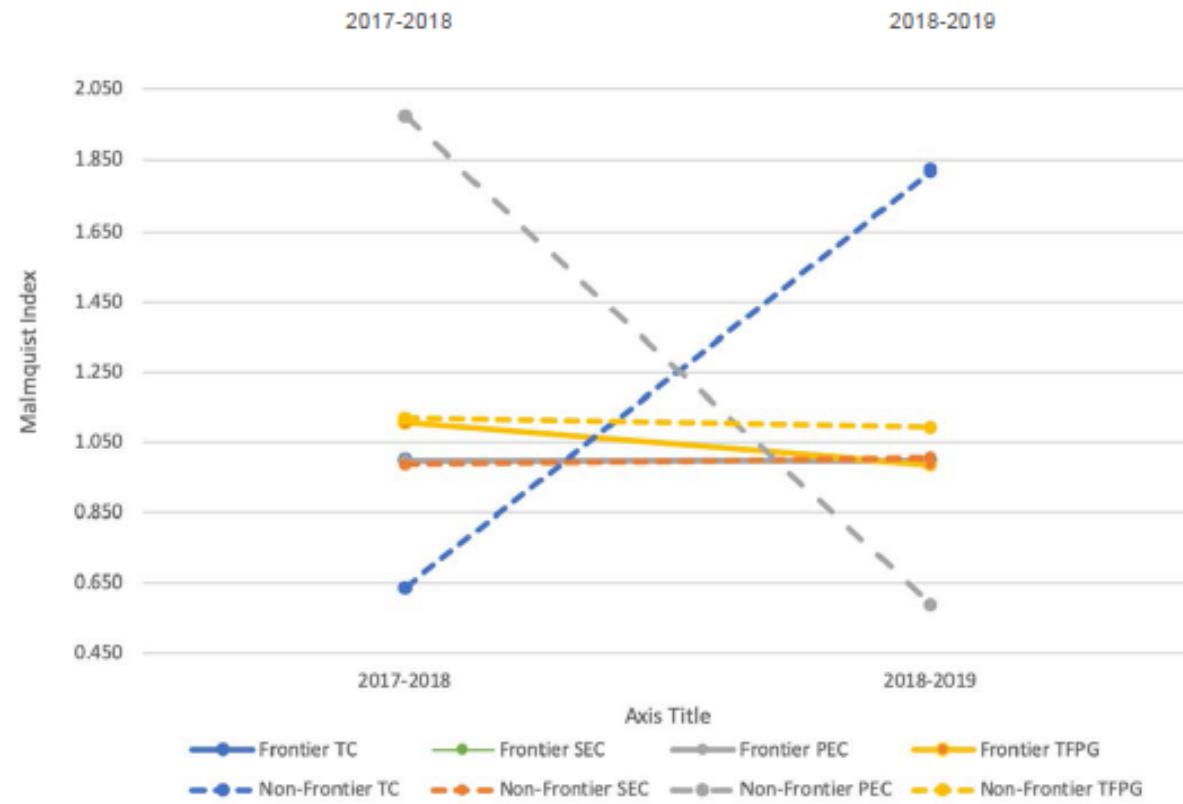


Figure 11: E&E Nexus productivity trend - frontier vs. non-frontier firms

Summary & Conclusion



Tourism

25



Electrical & Electronics

21

Tourism Nexus 2017

8

out of 25 firms were on
the efficient frontier



Tourism Nexus 2018

6

out of 25 firms were on
the efficient frontier



Tourism Nexus 2019

7

out of 25 firms were on
the efficient frontier



Electrical & Electronics Nexus 2017

7

out of 21 firms were on
the efficient frontier



Electrical & Electronics Nexus 2018

5

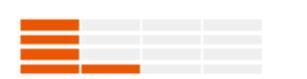
out of 21 firms were on
the efficient frontier



Electrical & Electronics Nexus 2019

7

out of 21 firms were on
the efficient frontier



Summary

& Conclusion

| Consistently on the **frontier** from 2017-2019 and ranked 1st and 2nd in their respective Productivity Nexus

| Highest frequencies for best **role model** frontier peers according to the operating scale.



25

Tourism

- Berjaya Sports Toto Berhad
- Berjaya Land Berhad
- Genting Berhad
- Magnum Berhad
- Pan Malaysia Holdings



21

Electrical & Electronics

- FSBM
- VSTECS
- VITROX



25

Tourism

Summary & Conclusion

| Greater **volatility** in **efficiency** level over time for Electrical and Electronics Nexus relative to the Tourism Nexus

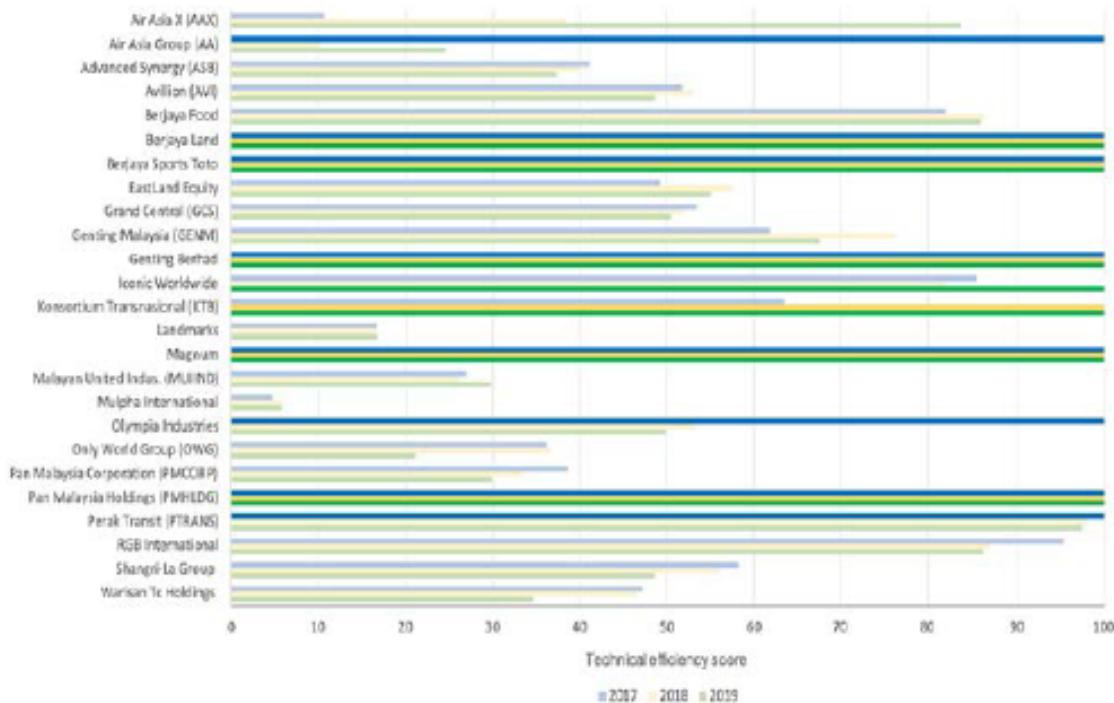


Figure 12 (a): Tourism Nexus technical efficiency and frontier firms

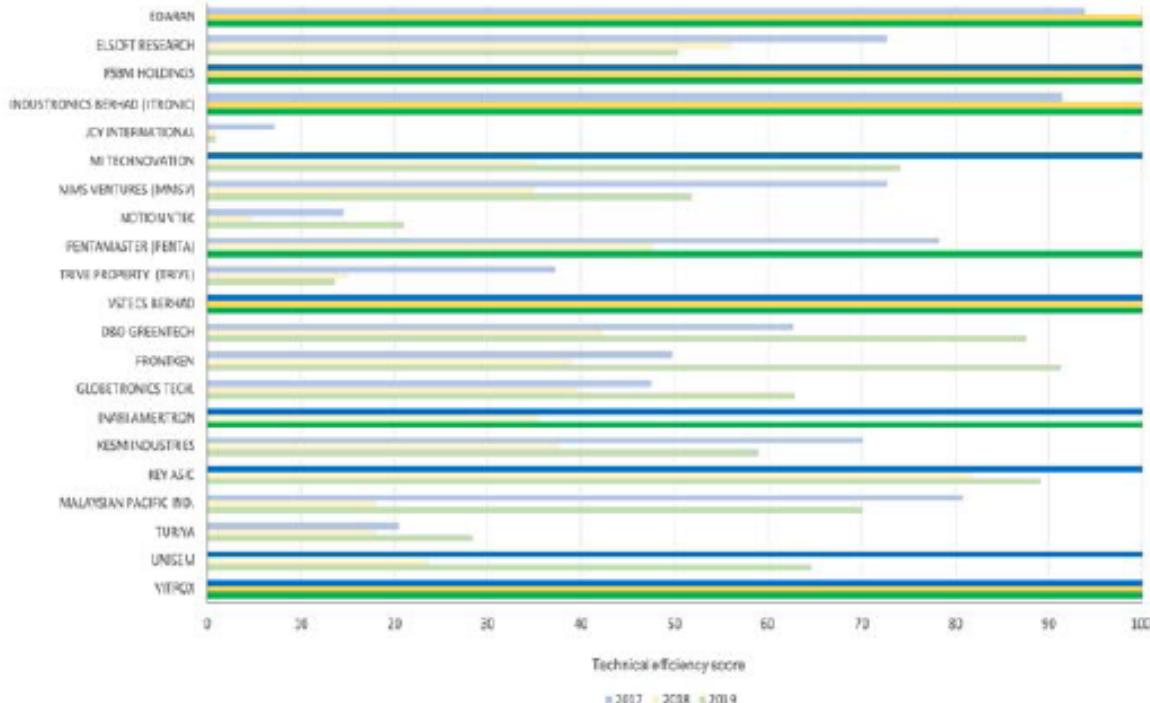


Figure 12 (b): E&E Nexus technical efficiency and frontier firms

Summary & Conclusion



25

Tourism



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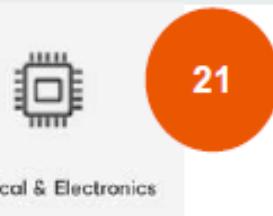
Electrical & Electronics



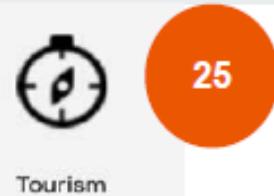
Figure 13 (a): Tourism Nexus frontier firms ranking



Figure 13 (b): Electrical & Electronics Nexus frontier firms ranking



Electrical & Electronics



Tourism

Summary & Conclusion

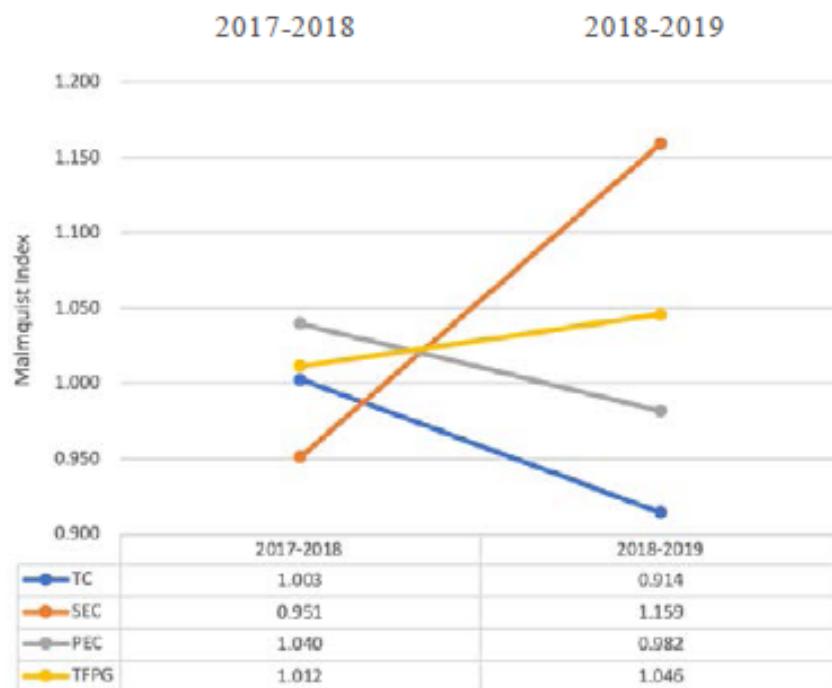


Figure 14 (a): Tourism Nexus productivity trend

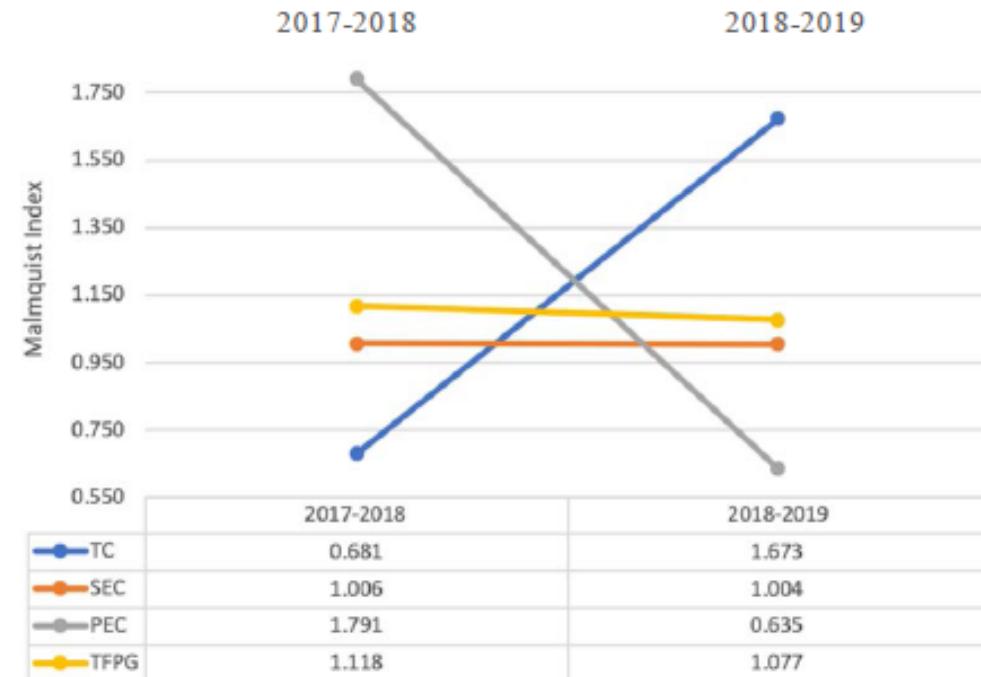


Figure 14 (b): Electrical and Electronics Nexus productivity trend

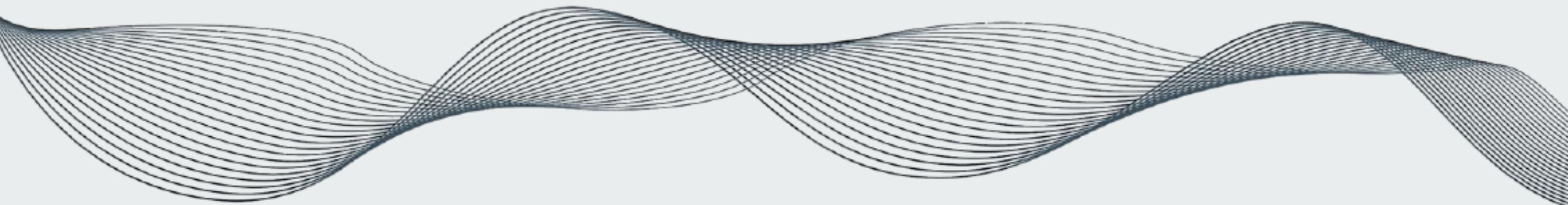


Thank you.

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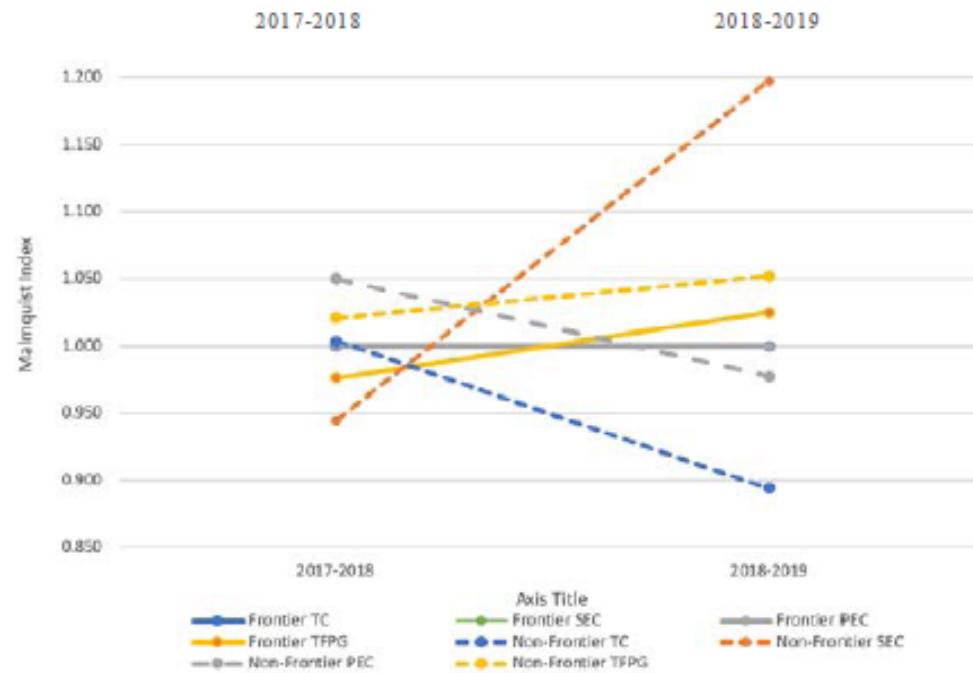


25

Tourism

Summary

& Conclusion



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Electrical & Electronics



Figure 15 (a): Tourism Nexus productivity trend - frontier vs. non-frontier firms

Figure 15 (b): E&E Nexus productivity trend - frontier vs. non-frontier firms

Summary

& Conclusion

Matters of concern

Slower positive trends in TFP growth for the **Electrical and Electronics Nexus**

Deterioration of average pure efficiency trends for the non-frontier firms under **both Nexus**

The average input usage patterns among the non-frontier firms were **more than doubled** the required level for both Nexus