



MINISTRY OF ECONOMY
DEPARTMENT OF STATISTICS MALAYSIA

Min-Max Scaling: New Statistical Approach to Measure Malaysian Well-Being Index

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“Looking Beyond GDP: Towards Social Well-being and Environmental Sustainability”

25TH-26TH SEPTEMBER 2023



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OUTLINES

Introduction

**Methodology of
Min-Max Scaling**

Results of Study

Z-Score
Min-Max

**Discussion and
Conclusion**

Insight



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INTRODUCTION

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OBJECTIVE OF STUDY

1

This research aims to examine the use of a new methodology, namely Min-Max Scaling in the calculation of Malaysian Well-Being Index

2

To compare the results using z-score and min-max scaling techniques

INTRODUCTION

1

Well-being is a positive state experienced by individuals and societies. Similar to health, it is a resource for daily life and is determined by social, economic and environmental conditions. Well-being encompasses quality of life and the ability of people and societies to contribute to the world with a sense of meaning and purpose. (World Health Organization, WHO)

2

Many countries began to discover alternative mechanisms for measuring the well-being of the nation's population. There are common approaches to measure well-being in terms of framework, reporting and progress of nation's population. Measuring well-being involves assigning numerical values to these dimensions and combining them into an overall index value. There are different methods available to standardize and scale the numerical values assigned to the dimensions of well-being.

3

Min-Max Scaling is a simple and easy-to-understand normalization technique. It involves scaling the data to a fixed range, typically between 0 and 1. This makes it easy to implement and interpret, even for those who are new to machine learning and data science. This can help machine learning algorithms converge faster and more accurately (Bhandari, 2020).

Organizational using Min-Max Scaling technique

Indices	Organizational
Human Development Index (HDI)	United Nations Development Programme (UNDP)
Better Life Index (BLI)	Organisation for Economic Co-operation and Development (OECD)
World Happiness Report (WHR)	Sustainable Development Solutions Network powered by Gallup World Poll Data
Sustainable Society Index (SSI)	United Nations Global Compact (UNGC)
Malaysia Happiness Index (MHI)	Department of Statistics Malaysia (DOSM)
Indeks Kesejahteraan Keluarga (IKK)	Lembaga Penduduk dan Pembangunan Keluarga Negara (LPPKN)
Indeks Kesejahteraan Psikologi Malaysia (IKPM)	Jabatan Perkhidmatan Awam (JPA)



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METHODOLOGY OF MIN-MAX SCALING

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MIN-MAX SCALING TECHNIQUE

STEP 1

Normalization score for each indicator data

- Calculation of normalization scores for each indicator
- Calculation of min-max scaling index for each indicator

STEP 2

Calculation index for each component

- Calculation of the annual index for each for each component by average the normalization score for the indicators involved

STEP 3

Composite index calculation

- Calculation of the annual composite index by average the components indices

Min-Max Scaling

Minimum/ Maximum value in data sets

- Min-Max Scaling is a procedure used to standardized the range of a variable so that they all take values between zero and one (0, 1) (Osberg, 2009). The key reason why it may be necessary to scale variables is that an increase is always good for well-being and a decrease is always bad.
- This serves for two purpose which are it standardizes variables in such a way that an increase is always good for well-being and a decrease is always bad.
- It prevents well-being from being dominated by a few underlying variables that take on very large range of values.

Calculation index for each component

$$I_j = \frac{x - x_{min}}{x_{max} - x_{min}}$$

Source: Human Development Index (UNDP),
Better Life Index (OECD)

Min-Max Scaling

Calculation index for each component

- If a variable increase it corresponds to an increase in overall well-being, the value is scaled according to the formula:

$$I_j = \frac{x - x_{min}}{x_{max} - x_{min}}$$

- If a variable increase it corresponds to a decrease in overall well-being, the value is scaled according to the formula:

$$I_j = \frac{x_{max} - x}{x_{max} - x_{min}}$$

- In both cases, the range of values is 0-1, and 0 corresponds to the lowest level of well-being, and 1 corresponds to the highest.
- Composite index assigns equal weight to indicators and components. Each dimension is normalized through linear scaling and aggregation relies on equal weighting (Osberg & Sharpe, 2010).

*Source: Human Development Index (UNDP),
Better Life Index (OECD)*

METHODOLOGY

Cut point of Well-Being Scoring

Score Cut points	Category of Well-Being
0.00 – 0.20	Lowest
0.21 – 0.40	Low
0.41 – 0.60	Moderate
0.61 – 0.80	High
0.81 – 1.00	Highest



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RESULT OF STUDY

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RESULT

Method	Z-score (2000=100)			Min-Max Score		
Sub-composite/ Component	2020	2021	Percentage Change	2020	2021	Percentage Change
Malaysian Well-Being Index	117.7	119.2	1.3	0.60	0.62	3.3
Economic Sub-composite	126.0	127.2	1.0	0.69	0.71	2.9
Transportation	127.2	125.8	-1.1	0.68	0.66	-2.9
Communications	129.4	131.1	1.3	0.83	0.88	6.0
Education	132.2	133.8	1.2	0.69	0.70	1.4
Income and Distribution	117.8	120.6	2.4	0.51	0.56	9.8
Working Life	123.4	124.7	1.1	0.73	0.76	4.1
Sosial Sub-composite	113.1	114.7	1.4	0.56	0.58	3.6
Housing	119.6	120.8	1.0	0.56	0.58	3.6
Entertainment and Recreation	109.8	104.5	-4.8	0.36	0.23	-36.1
Public Safety	134.1	138.7	3.4	0.87	0.95	9.2
Social Participation	132.8	130.9	-1.4	0.89	0.84	-5.6
Governance	117.7	125.7	6.8	0.56	0.71	26.8
Culture	90.2	96.0	6.4	0.16	0.22	37.5
Health	110.4	108.4	-1.8	0.66	0.66	0.0
Environment	105.6	108.5	2.7	0.45	0.46	2.2
Family	97.7	98.9	1.2	0.51	0.53	3.9

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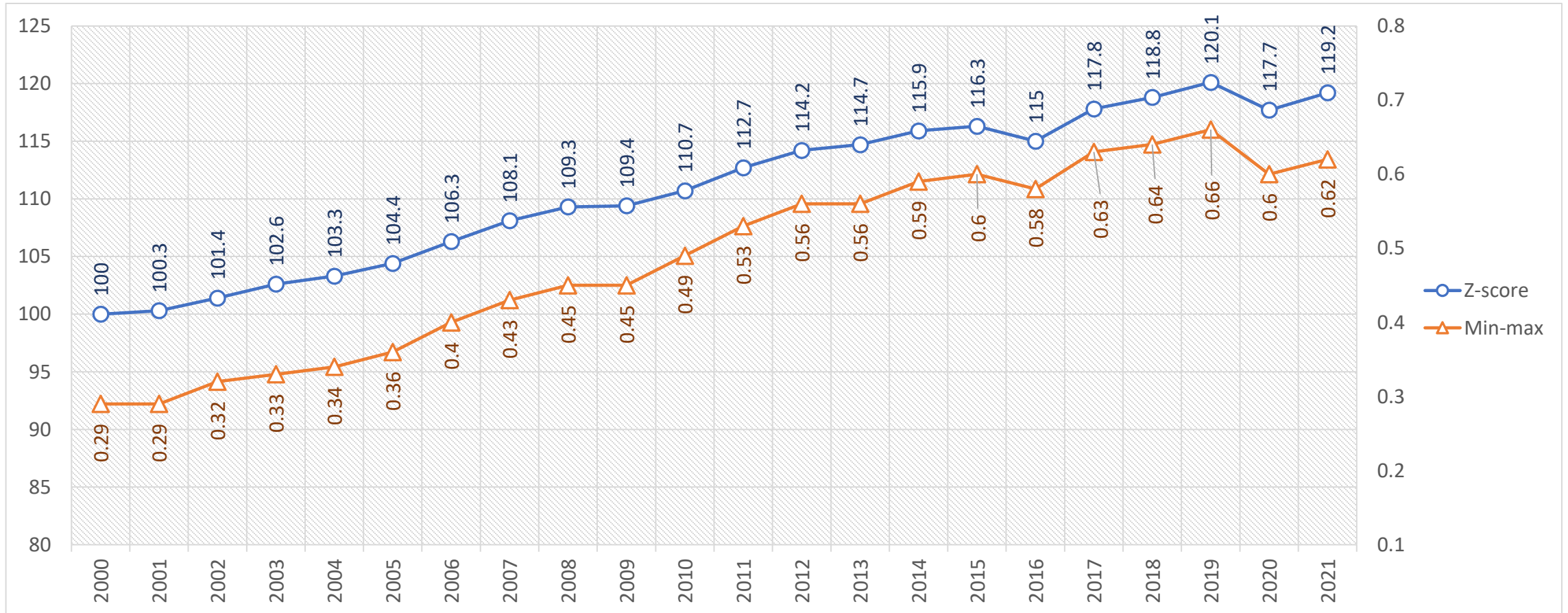


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Comparison MyWI 2000-2021 using z-score and Min-max Scaling





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CONCLUSION AND DISCUSSION

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CONCLUSION AND DISCUSSION


TECHNIQUE

An alternative approach to Z-score normalization is Min-Max Scaling




The value of the overall index score for Malaysian Well-being Index (MyWI) in 2021 was 0.62. Malaysian Well-being was at moderately level.

SCORE



FURTHER ANALYSIS

Needs to be conducted further analysis to look into components that truly gave impact to Malaysian well-being. It is needed to reviewing back the components to avoid multicollinearity and noise to the data.



Overall, these alternative measures can provide a more comprehensive picture of country's progress and help policymakers make more informed decisions about how to improve rakyat's well-being and quality of life.

Policy Makers



When will it be implemented?

Currently, DOSM provides MyWI using both methods for internal use. Compilation using the Min-Max method is still at the stage of discussion and approval by top management and the main stakeholders (Ministry of Economy).



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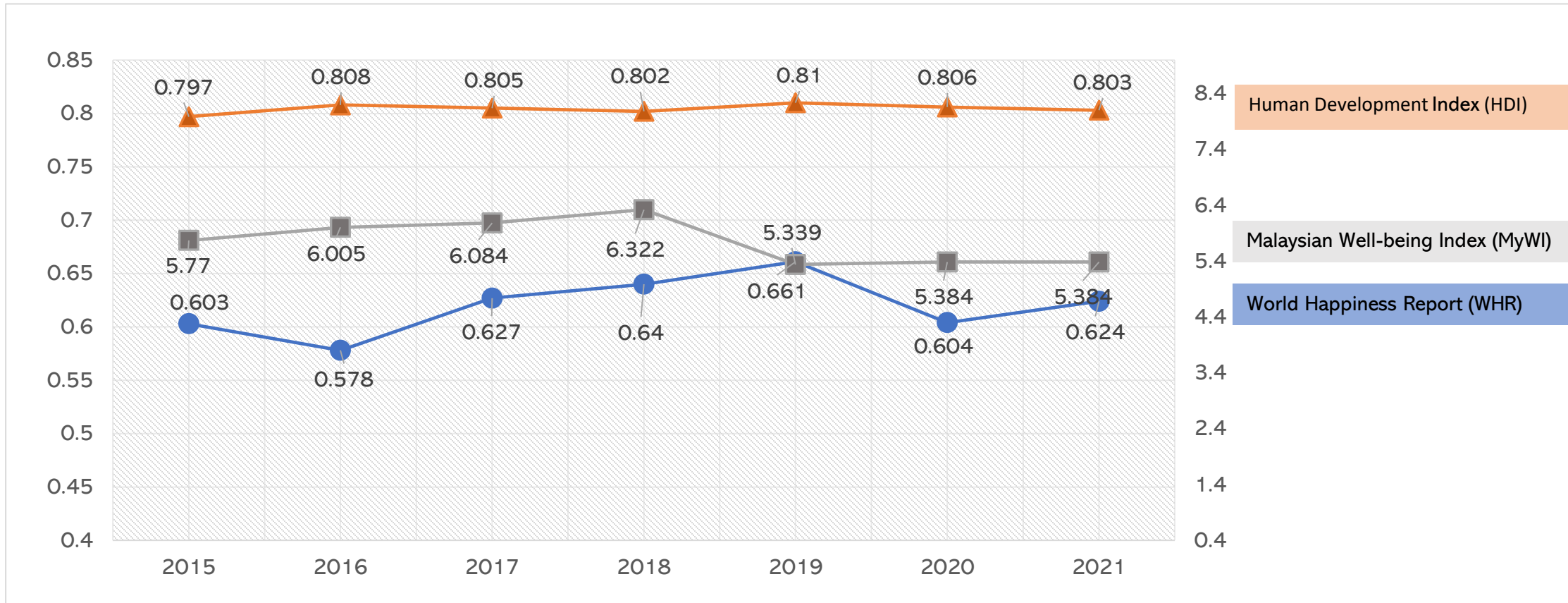
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Malaysia's score for various Wellbeing Index using Min-Max Scaling



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