

# Chapter 1

## Introduction

### 1.1 Background

As the issue of sustainability becomes the topic of the 21st century, it is becoming more and more important to balance growth with the limited nature of our planet. Current development models mostly focus on economic growth that is often centered on escalating consumption. Yet the planetary boundaries are often left out when it comes to advancements in economic growth and living standards. A new perspective is required to not only fulfill the expected growth to support development of human life, but also keep into account the consumption that is involved.

The Doughnut economy concept is an existing and relatively new concept that visualizes where our position must be to continue growth without risking falling under the minimum standard of life or going over the ecological ceilings. The Doughnut Economy framework has been applied in various contexts such as tourism management and urban development (Hartman & Heslinga, 2022; Hjelmsoeg et al., 2023). Multiple studies have also explored the quantification of the Doughnut economy model. The take-away of the Doughnut Economy model is the undeniable connection between factors that contribute to social or living qualities and the environment. This concept may be used to assess any potential issue that may arise due to imbalance between these two dimensions prior to deciding what needs to be done when facing these issues, it is of the utmost importance that we assess where we are in terms of social performance and ecological damage. Rahma & Fauzi (2024) is one of the very few that explored the concrete application of the Doughnut Economy model. They found that the use of the Social Performance Index (SPI) and Ecological Damage Index (EDI) could give an idea where 34 provinces in Indonesia are located within the Doughnut model. Such research provides valuable insights for policy-makers and helps identify which areas require special attention and improvement

for them to stay in the 'sweet spot' in the Doughnut model. Benchmarking research such as this also allows comparative analysis across different regions (Luukkanen et al., 2021). The interest of this study is in the weighting of variables conducted in the paper by Rahma & Fauzi (2024), where expert opinions were used to rank the variables that make up the SPI and EDI that shows the proximity of provinces in Indonesia with the foundational values of social performance and the ceiling values of ecological damage indicators. Properly assigning weights to variables is one of the most essential parts in any decision-making process. Not assigning weights to variables or assuming the equal importance of variables may hinder the process of achieving a representative result. The issue that comes with subjective weighting schemes is that it may not necessarily reflect reality in a neutral way.

One common way to objectively calculate and assign weights to variables is the Principal Component Analysis (PCA). PCA is a multivariate technique that reduces the dimensionality of data while preserving as much variance as possible. PCA extracts important information by representing them as a set of new orthogonal variables called principal components (PC). PCA has also been validated as an effective data-driven method for criteria weight assignment (Dugger et al., 2022). Aside from PCA, the Entropy method is one of the more popular variable weighting methods. The Entropy method is based on uncertainty of the data set when assigning weights to variables. This paper aims to utilize PCA and the Entropy method to approach the weighting process more objectively to analyze the SPI and EDI of 34 provinces in Indonesia.

## **1.2 Objective**

The objective of this study is:

- 1.2.1 To calculate the weights of variables involved in the EDI and SPI using entropy and PCA method.
- 1.2.2 Determine the best means of data-driven weighting between the two methods.

- 1.2.3 Assess the changes in EDI and SPI calculation of provinces using the best means of data-driven variable weighting.

### **1.3 Hypothesis**

The hypotheses of this study are:

- 1.3.1 The weights of variable change due to calculation using PCA and Entropy.
- 1.3.2 Results of SPI and EDI of all provinces changes after PCA and Entropy weighting.
- 1.3.3 EDI and SPI calculation using the new weighting method will change the ecological damage and social performance standing of some provinces.