Big Data Analytics Artefact for Outcome-Based Funding Prediction in South African Public Universities

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ABSTRACT

This study designed a big data analytics artefact for the prediction of outcome-based funding (OBF) in South African public universities. Universities in South Africa (SA) are subsidized based on their performance known as OBF that is measured depending on the outputs from teaching, research, and engagements. OBF metrics are well documented; however, public universities fail to achieve the targets for higher scores. These failures are attributed to poor decision-making resulting from limited analysis of the voluminous data generated. This study used design science methodology to develop a big data analytics artefact for prediction of OBF outcomes. The artefact was evaluated for prediction using machine learning training and tested with data collected from South African universities. Findings indicated that for better prediction using big data analytics, system characteristics, size, structure, top management support, market, infrastructure, and government regulations factors play a significant role.

KEYWORDS

Big Data Analytics, Data Processing, Decision Making in Public Universities, Machine Learning, Outcome-Based Funding, Teaching Development Grant

INTRODUCTION

Universities, globally, receive their financial income from various sources to successfully run their operations (Hearn et al., 2016). In South Africa, universities raise their finances through government funding, student tuition fees, and private income (USAF, 2016). According to the Department of Higher Education and Training DHET (2015), government funding includes the subsidies the ministry provides to the universities. Tuition fees are the costs that the students pay to the university; while private funding consists of funds the universities raise through research contracts, donations, investments, and the renting out of facilities. The DHET (2015) indicates that government funding accounts for 40% of total income, while tuition fees and private subsidies each account for 30%,

respectively. The government funding is further categorized into earmarked and block grants. The earmarked grant is the subsidy that the government provides to the universities to improve student success, whereas the block grant amount is determined by the performance of the institution. The block grant is linked to the university performance and is also referred to as outcome-based funding (OBF) (Temoso & Myeki, 2023).

This funding covers approximately 70% of the government funding, which implies that failing to raise sufficient OBF is a challenge that may lead universities to experience financial shortfalls (Dlamini, 2016).

The South African landscape highlights that funding is linked to national policy goals and the performance of the universities. OBF is referred to as block grant, which is a funding that is incentivized through academic activities and is categorised into four, namely: teaching input grant, teaching output grant, research output, as well as the institution factor grant, which relates to a large enrolment of full-time disadvantaged students (De Klerk et al., 2017). The principle behind OBF is that of encouraging and motivating universities to improve the student success rate and research output (Temoso & Myeki, 2023). In the South African perspective, OBF focuses on four priority areas, namely, teaching input, which is linked to enrolments the university makes each year; teaching output, which is linked to the graduation of undergraduates and masters' structured research qualifications; research output, which is linked to publications and doctoral qualifications; as well as the institutional factor, which is linked to full-time enrolments of disadvantaged students, such as black and coloured South African citizens. Hafzan et al. (2019) observe that several measures have been proposed to enable universities to improve their OBF. These include improving on the universities' curricula to make such attractive to learners and the industry, provision of better pedagogical approaches, retention of good experienced academic staff, as well as proper analysis of the generated data by the university. Such actions could draw better insights, thus enabling real-time decision-making (Moyo & McKenna, 2021).

Hawthrone and Grzybowksi (2019) note that South Africa (SA) has one of the highest economic inequalities worldwide with a Gini coefficient of 0.63 in 2015. These economic inequalities are mainly attributed to the apartheid-era that introduced racial discrimination policies, which left many communities financially and socially excluded. Due to its historical nature and the increasing globalization, the country has been suffering insufficient human resources, especially in the academic domain. In the South African perspective, the demand for highly skilled academic employees in institutions of higher education and training has remained high, and this trend is likely to continue (Hoque & Tshutsha, 2022). As a result many universities fail to attract and/or retain highly qualified academic staff, which causes them to fall short of attaining the required scores for OBF (Segooa et al., 2019).

Attainment of a good OBF score is mainly dependent on good performance of an academic institution, which accrues from various factors among them is the attraction and retainment of highly experienced and skilled academic staff (Galli, 2020). Because of the poor economic stand of many citizens whose children seek a higher education, the South African government decided to significantly increase its contribution to higher education (Dlamini, 2016). The increment of the government's financial contribution, on the positive side, led to the establishment of more universities in the country. Whereas, on the negative side, it created more internal competition for skilled academic staff (De Klerk et al., 2017). Successful academic institutions depend on having the right number of skilled and capable academic staff who should be well motivated in order to contribute to the institution. However, in order to motivate these staff, factors including satisfactory salary, job design, internal communication, as well as better and real-time decision-making need to be put into consideration (Galli, 2020; Hoque & Tshutsha, 2022). It is imperative that academic institutions attract, motivate, and retain knowledgeable academic staff in order to remain abreast with OBF requirements (Arman, 2023). Thus, in addition to their obvious desirability, such institutions must also have effective

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