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Decision-making in African universities demands rigorous data: Evidence from graduation rates at Eduardo Mondlane University in Mozambique

Nelson Casimiro Zavale[a,b,*], Luísa A. Santos[c], Lourenço Manuel[d], Maria da Conceição L. Dias[b], Maida A. Khan[e], Emílio Tostão[d], Ana M. Mondjana[f]

[a] University of Basel-Centre for African Studies, Petergraben 11, CH-0451, Room No. 214, Basel, Switzerland
[b] Eduardo Mondlane University-Faculty of Education and Quality Assurance Office, Av. Julius Nyerere, Campus Universitário, 3453 P.O. Box 257, Maputo-Mozambique
[c] Eduardo Mondlane University-Director of Quality Assurance Office, Av. Julius Nyerere, Campus Universitário, 3453 P.O. Box 257, Maputo-Mozambique
[d] Eduardo Mondlane University-Faculty of Agronomy and Forestry Engineering, Av. Julius Nyerere, Campus Universitário, 3453 P.O. Box 257, Maputo-Mozambique
[e] Eduardo Mondlane University-Director of Pedagogical Directorate, Av. Julius Nyerere, Campus Universitário, 3453 P.O. Box 257, Maputo-Mozambique
[f] Eduardo Mondlane University-Vice-Chancellor for Academic Affairs, Av. Julius Nyerere, Campus Universitário, 3453 P.O. Box 257, Maputo-Mozambique

A R T I C L E I N F O

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A B S T R A C T

Graduation rate is often used as indicator of efficiency and accountability of higher education institutions. However, its official and academic use entails pitfalls, particularly in Sub-Saharan Africa (SSA). Based on evidence from Eduardo Mondlane University in Mozambique, this paper contributes to the academic and policy debate on graduation rates in SSA, by using logistic regression analysis to measure and explain this indicator. The paper's findings are twofold: (i) graduation rates at UEM (and eventually in SSA) may be different from what their misleading measurement and usage may portray; (ii) graduation rates are particularly affected by the academic aspects of students and the institution. The paper claims that rigor is needed to produce data (e.g. graduation rates) on African universities to strategically inform decision-making.

1. Introduction

The number of enrolled students who persist until graduation and the time-to-degree are commonly used as indicators of institutional efficiency and accountability (Horn and Lee, 2016; Theune, 2015). Economic, political and academic concerns back the need to oversee the time students take to graduate. Costs of graduating beyond the timeframe imply more tuition fees to pay (for families), more public money wasted (for states) and ineffective mechanisms of holding higher education institution (HEIs) accountable for their activities (Gillmore and Hoffman, 1997). Furthermore, the longer students take to graduate, the less is their probability to graduate, because academic engagement fades away with time and the eagerness to take alternative life decisions – or *competing risks* (Murray (2014)-increases. The relevance of graduation rates has led some governments to include this indicator in their rating systems of linking HE funding to performance (e.g., US government, see Pike and Graunke, 2015; Archibald and Feldman, 2008).

While graduation rate is among the commonly used indicators of institutional performance, its measurement is not easy, consensual and uniform. Its meaning and reliability are dependent on how it is measured. At international level, the *OECD Education at a Glance*, one of the commonly used data on graduation rates,[1]

* Corresponding author at: University of Basel-Centre for African Studies, Petergraben 11, CH-0451, Room No. 214, Basel, Switzerland; Eduardo Mondlane University-Faculty of Education and Quality Assurance Office, Av. Julius Nyerere, Campus Universitário, 3453, P.O. Box 257, Maputo-Mozambique.

E-mail addresses: nelson.casimiro.zavale@gmail.com, nezava@yahoo.com.br, nelson.zavale@unibas.ch (N.C. Zavale), luisasantos47@gmail.com (L.A. Santos), zlouremanuel@gmail.com (L. Manuel), saodias@live.com (M. da Conceição L. Dias), khan.maida@gmail.com (M.A. Khan), emilio.tostao@gmail.com (E. Tostão), anamondjana@gmail.com (A.M. Mondjana).

[1] http://www.oecd.org/edu/education-at-a-glance-19991487.htm.

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estimates the average graduation rates of several OECD countries, particularly from Western Europe, North America and Oceania, to be between 60 and 70%, (OECD data, quoted in Hovdhaugen et al., 2015, p. 14). Caution is nevertheless needed when interpreting these rates, because differences in calculation methods imply differences in meaning and reliability. As Hovdhaugen et al. (2015) refer, the calculation methods differ across OECD countries. Some countries use cross-sectional method to calculate graduation rates, i.e. they divide the number of graduates by the number of new entrants in a particular year. Other countries use true-cohort method, i.e. they track student cohorts over time. The first method does not consider the time-to-degree, whereas the second does. Depending on the method used, the rate of 60%, for example, may have different meanings. If the true-cohort method is used, it means that 60% of students graduate within the legal study duration, or legal duration plus one, two or three years, depending on the timeframe considered. If the cross-sectional method is used, it may mean that a particular HE system, institution or programme graduates 60% of its enrolled students, regardless of the time these students take to degree.

These differences suggest that the reliability of graduation rates is constrained by the rigor in calculation methods and by the timely availability of data on university entrants and graduates. Difficulties in obtaining data lead some countries to measure graduation rates, through the simpler method of dividing graduates by admissions. The time-to-degree tends to be avoided, at least in official data, because tracking students over time is more challenging. The *OECD Education at a Glance*'s data suggests that some developed countries face this challenge as well, despite having relatively more developed information systems.

Perhaps nowhere the challenge of rigorously measuring graduation rates is more pronounced than in Sub-Saharan Africa (SSA). Accompanying the world trend of HE expansion (Zeleza, 2016), HE in SSA has expanded rapidly, from less than 0.2 million in the 1970s, to over 4.5 million in 2008. However, this expansion was not accompanied by the production of consistent and updated data on dropout and graduation rates (Mohamedhai, 2014, p. 64–70). The few available data are less reliable, since they are hardly based on rigorous quantitative measurement. Quantitative data, when and where available, often consist of ratio between graduates and enrolments in a given year. For example, Bunting and Cloete (2012) have used this ratio to compare graduation rates from 8 flagship African universities: in 2007, this ratio was estimated at 28% at the University of Mauritius, 27% at universities of Cape Town and Makerere, 23% at University of Dar Es Salam, 22% at the University of Botswana, 20% at the University of Ghana and 9% at Eduardo Mondlane University (UEM), in Mozambique. Cognisant of eventual problems in interpreting these percentages, Bunting and Cloete (2012) anticipated an explanation: "*a ratio of 25% for graduates to enrolments indicates that at least 75% out of every 100 students entering the university will eventually graduate*" (p.25). While these percentages may be used as an indication of institutional performance, their reliability is reduced by not using rigorous quantitative procedures, in which the time-to-degree is considered. For example, in their estimation of 9% as the graduation rate at UEM in 2007, Bunting and Cloete (2012) did not consider the time taken by these 9% of students to graduate. Without this information, the reliability of this rate is compromised and its interpretation demands caution. This situation backs the need to adopt more rigorous procedures to measure graduation rates in SSA.

South Africa seems to be the only country in SSA where graduation rates are studied more systematically and rigorously. According to the Council on Higher Education (CHE, 2013), about 25% of undergraduate students obtain their diploma on time, 35% in five years and 55% never graduate. The Centre for Higher Education Transformation has estimated the national average graduation rate in South Africa at 40% for 3-year undergraduate degrees, with variations across universities: e.g., 68% of students graduate after 6 years at Stellenbosch and 64% at UCT (CHE, 2013, quoted in Cloete, 2014, p. 1). Factor responsible for diverse types of students' outcomes are also studied in South Africa (Murray, 2014). In other SSA countries, graduation rates are hardly examined through rigorous methods.

As elsewhere in SSA, in Mozambique graduation rates are hardly systematically and rigorously examined. The ratio graduates vs. enrolments per year is the only available data. According to the Ministry of Education, during 2008–2012, the average ratio was either below 2% (MINED, 2012, p. 119) or between 8,8% and 13,3% (MINED, 2014, p. 116). The difference in these official ratios suggests inconsistent calculation procedures. While these ratios indicate that HEIs may be graduating too few students, they do not enable to know the time-to-degree, nor the percentage of students graduating per cohort. Without this data, it is difficult to infer and take smart decisions on HEIs' efficiency concerning graduation. This paper claims that more rigorous methods are needed to measure and explain graduation rates in SSA. The paper backs this claim by applying a quantitative method to measure graduation rates and explain some of its determinants at UEM in Mozambique. Three key questions are addressed: (i) how long do UEM students take to graduate? Are there differences across fields? What factors do contribute to UEM's graduation rates?

2. Conceptualising and measuring graduation rates

2.1. Concept of graduation rate

The challenge of rigorously measuring and explaining graduation rate – and its potential misleading use – demands a prior conceptual clarification. In the specialised literature, graduation or completion rate refers to the proportion of students who graduate, as a percentage of those who should graduate (DeAngelo et al., 2011; Cook and Pullaro, 2010; Pinkus, 2006). This implies that a timeframe is critical when conceptualising graduation rate, namely the period taken by a specific cohort of students from enrolment to graduation. Graduation rate will be high or low according to the percentage of students who graduate within a prescribed duration of programmes. A graduation rate of 50% implies that half of students under consideration complete their programmes in a prescribed period. Given the low probability of graduating within prescribed duration of programmes, an extra period is often added. This extra period can legally be established and thus varying from country to country. In US, for example, graduation rate is officially defined as the proportion of full-time, first-time bachelor's degree seeking students who complete their programme within 100 or 150% of the programme time. In four-year undergraduate programmes, the US official graduation rate considers all students who complete their programmes in six-year timeframe (Horn and Lee, 2015; Gillmore and Hoffman, 1997).

Measuring graduation rate and explaining its underlying factors are complex exercises and are matters of controversy within the scientific community. These exercises depend on the existence, availability, consistency, timeliness and comprehensiveness of databases concerning enrolments and completion at programme, institutional, national and cross-national level. The accuracy of graduation rate depends on the possibility of comparing data on students' enrolments with data on students' degree completion, as well as on the possibility of tracking student cohorts from enrolment to graduation. Unfortunately, databases are not always available, consistent, updated, timely and multidimensional, and this makes calculations and explanations often problematic and inaccurate.

2.2. Approaches, methodology and variables to measure and explain graduation rate

While researchers from several countries, particularly from developed countries, have measured and explained graduation rates through rigorous quantitative procedures and have considered the time-to-degree, this kind of literature is quite dynamic in US, particularly articles published in the quantitative-oriented journal *Research in Higher Education*. For this reason, our literature review devotes a larger space to studies carried out in US. However, while studies conducted in US and published in *Research in Higher Education* have been extensively referenced, the review also includes studies targeting other countries and published in other journals, particularly studies providing useful conceptual and methodological insights to frame this study.

Cook and Pullaro (2010) have critically examined the databases and approaches used to measure and explain graduation rates in US. Their analysis deserves to be referenced throughout this literature review because it enables (i) to critically understand the advantages and pitfalls of US databases; (ii) to acquire insights on the different approaches used in US and elsewhere to measure graduation rates and (iii) to obtain insights on different variables used in US and elsewhere to explain graduation rates.

Cook and Pullaro (2010) have examined the main US databases used to calculate graduation rates, namely Integrated Postsecondary Education Data System (IPEDS), National Student Clearinghouse (NSC), Beginning Postsecondary Students (BPS), National Longitudinal Survey (NLS), High School and Beyond (HS&B), National Education Longitudinal Study (NELS), Education Longitudinal Study (ELS) and High School Longitudinal Study (HSLS). They have found out that these databases have advantages and drawbacks (Cook and Pullaro, 2010, p.7-20). The IPEDS's advantages include its mandatory nature to all HEIs receiving federal student funding aid, its annual periodicity, the possibility of using its data to compare different institutions and of disaggregating graduation rates by gender and race. However, IPEDS is criticised for only including first-time, full-time, bachelor's degree seeking students, thus excluding part-time and transfer students, who constitute about 50% of the total American student population. The NSC attempted to remedy the IPEDS's drawbacks, by including the majority of students and collecting updated data enabling to calculate graduation rates in real-time, allowing flexibility in calculation (possibility of calculating graduation rate for different units of analysis, e.g. part-time students, full-time or different sectors of HE, for students taking 8 or more years to graduate). However, NSC database is not public, includes limited demographic data and institutions participate voluntarily. Both IPEDS and NSC are focused on institutional rather than on student graduation rates. Other databases have emerged to follow students pathways to graduation, regardless of institutions attended. BPS, for example, is constructed through a longitudinal follow-up, during seven to eight years, of cohorts of students who enrol in postsecondary education for the first time. Based on sample surveys and interviews, BPS contains a range of valuable data on students, including academic performance and persistence, transition to work, demographic and income characteristics and changes over time, as well as their opinion on HE. The BPS's comprehensiveness in terms of variables allows calculating graduation and persistence rates, and explaining influencing factors. But the main drawbacks of longitudinal surveys include many years' delays until getting results, time-consumption, high costs, and potential uselessness of results for policy-making because of their old age. Other databases are concerned with high schools: NLS, HS&B, NELS, ELS, and HSLS.

Besides the inexistence of absolute accurate databases, Cook and Pullaro (2010)'s analysis on the US case raise three insights about measuring and explaining graduation rates. *Firstly*, that *two approaches* may be followed: snapshot and longitudinal studies. As Pinkus (2006, p.10) explains, "snapshot" studies calculate graduation rates through assessing students' enrolment and completion data at a fixed point of time. Snapshot approach does not follow-up individual students over time (Bailey et al., 2006; Scott et al., 2006; Rodgers, 2013). Scott et al. (2006), for example, examined the determinants of graduation rates in American private and public colleges for students who firstly enrolled in 1991 and graduated in 1997. To do so, Scott et al. (2006) considered a fixed time (the year of graduation, i.e., 1997) and used regression analysis to test different variables that may have been responsible for students who firstly enrolled in 1991 to graduate in 1997. Rodgers (2013) is another example of a snapshot study. Rodgers used regression analysis to test the effect of ethnicity on non-completion rates of minority ethnic students enrolled in British HE system. Based on a sample of one student cohort who attended a post-1992 "lower status" UK university and was expected to graduate in 2004/2005, Rodgers (2013)'s focused not on changes of graduation rates over time, but on how ethnicity impacted the likelihood to graduate amongst different ethnic students in 2004/2005.

Longitudinal studies, on contrary, measure and explain graduation rates over time. Some longitudinal studies are retrospective. Based on available official statistics and regression analysis, retrospective studies track students' careers or institutional backwards, from year (s) of graduation back to year (s) of enrolment (Hinrichs, 2014; Schmidt et al., 2010; Melguizo, 2008; Consuelo and Nora, 2007; Titus, 2006; Taniguchi and Kaufman, 2005; Robinson, 2004; Desjardins et al., 2002). For example, Schmidt et al. (2010) studied the effect of curriculum structure, namely the time-for-self-study given by this structure to students, in their probability to graduate. To do so, they tracked almost 14,000 students that attended eight Dutch medical schools during the period of 1989–1998. Hinrichs (2014) assessed the effect of state wide affirmative action bans on graduation rates of students from five American states where affirmative action programmes were significant, by tracking minority students who firstly enrolled in 1996–2003 and graduated in 2002–2009. Robinson (2004) examined the pathways patterns of undergraduate students attending a public Australian university, by tracking their progression from their first enrolment in 1994, to eventual graduation in 2000.

Other longitudinal studies are prospective: they follow-up students' careers and institutional characteristics forwards, from the present year(s) of enrolment to the future year (s) of graduation (Murray, 2014; Carpenter et al., 1998). For example, in order to understand the influence of students' socioeconomic background on graduation rate, Carpenter et al. (1998) have followed two cohorts of young Australian students, born in 1961 and 1965, from their secondary education, entry to HE in 1980 and 1984 until graduation in 1984 and 1988, respectively. For those born in 1961, the follow-up began in 1978 when they were at secondary education, passed through their entry to HE in 1980 when they were aged 19; in 1984, they were administered a survey, which was repeated in 1991, when they were 30 years old. Murray (2014) has also followed University of Kwazulu-Natal's students, in South Africa, from their enrolment in 2004 until their different outcome (graduation or dropout) in 2012. Drawing from competing risks approach, Murray was interested in determining how student and institutional-related factors influence the different types of students' outcomes.

The *second* insight underneath Cook and Pullaro (2010)'s analysis is *the methodology or types of study design* used to examine and explain graduation rates. Traditionally, studies on graduation rates have been quantitative, consisting of testing hypotheses and variables based on national or institutional (transcripts) available databases. Different types of regression analysis, such as logistic regression, multilevel model technique, survival function, event history models have often been used to correlate different variables and determine their significance in whatsoever outcome of students (Santelices et al., 2016 for Chile; Theune 2015 for Germany; for studies targeting US, see Consuelo and Nora, 2007; Titus, 2006; Desjardins et al., 2002). Other studies have combined national or institutional databases with surveys and interviews to students, administered either retrospectively or prospectively, through a follow up (Carpenter et al., 1998; for Australia; Carnoy et al., 2012; for Spain). For example, Carnoy et al. (2012) have combined regression analysis and phone survey to examine how demographic characteristics of students attending virtual University of Catalonia in Spain, and the nature of programmes attended, influenced their probability and timeliness to graduate.

But the validity of these methodologies and graduation rate itself are not exempted from criticisms. Before addressing major criticism to using graduation rate as an indicator of institutional performance, let us focus on criticisms against using regression analysis and surveys to measure and explain graduation rates. Based on enrolments and graduation from 187 US universities, Archibald and Feldman (2008) have argued that regression analyses are not the best tools to assess graduation rates, because they measure the *average* practices of institutions in combining inputs to get outputs, but not the *best* (most efficient) practices of combining inputs to get the best possible outcomes. Given the fact that a graduation rate of 100% is a fallacy, focus should be stressed not upon getting the highest possible graduation rate, but the most efficient graduation rate, considering available inputs and contexts in which a university operates. Archibald and Feldman (2008:93) argue "*in favour of using a production frontier*" to measure graduation rates, "*instead of or in addition to the more commonly used regression analysis*". Another criticism against regression analysis, also drawn from the US context, is what Pike and Graunke (2015) have christened as unobserved heterogeneity, i.e., the omitted variables in calculations, either because they are unknown, difficult to measure or are known but their respective data is unavailable. Pike and Graunke (2015)'s calculations have shown that omitted variables have a significant statistical relevance, and this suggests that regression analyses do not fully explain graduation rates. Concerning follow-up surveys, the main shortcomings are concerned with time-consumption, possible unreliability of graduates' responses and potential uselessness of results for policy-making given their old age.

The *third* insight to deduce from Cook and Pullaro (2010)'s analysis is the *kind of variables* used to explain dropout, retention and graduation rates. Specialised literature often examines two types of variables: student and institutional characteristics. Student-specific characteristics include age, gender (Taniguchi and Kaufman, 2005; Smyth and McArdle, 2004), race/ethnicity (Rodgers, 2013; Consuelo and Nora, 2007; Sibulkin and Butler, 2005), socioeconomic status (family wealth, parents' educational and occupational background, see Carpenter et al., 1998), parenthood (Sibulkin and Butler, 2005), working status (Theune, 2015). Apart from demographic and socioeconomic characteristics, student's academic readiness and attitudes are also examined, namely student pre-college preparedness (Consuelo and Nora, 2007; DeBrock et al., 1996), academic commitment, integration (Tinto, 1993), involvement and engagement (Astin, 1993; Kuh et al., 2008), and the climate and influence exerted by peers (Consuelo and Nora, 2007; Oseguera and Rhee, 2009). While some studies focus on one or two of these factors, the common approach is combining different student's characteristics to measure their statistical significance in degree completion (Theune, 2015; conducted such a study in Germany; Desjardins et al., 2002, did the same in US). Findings from these studies are not consistent, particularly as far as students' demographic and socioeconomic characteristics are concerned. For example, Sibulkin and Butler (2005) found out that White students tend to graduate more if compared with Black and Hispanic peers in the US, but Rodgers (2013) nuanced this conclusion with findings from UK, suggesting that race/ethnicity seems to not have a significant effect when students from different ethnic groups have similar socio-economic backgrounds. Likewise, despite acknowledging that students' socioeconomic background constrain their persistence (see Carpenter et al., 1998 for Spanish context), it seems that research is more consensual in considering the academic readiness of students as the most significant variable (Consuelo and Nora, 2007; for US context).

Institutional characteristics include the type of institutions attended (public/private/virtual), their selectivity and size (see Carnoy et al., 2012 for Spanish context; Hinrichs, 2014; Melguizo, 2008; Bailey et al., 2006; Smyth and McArdle, 2004 for the US context), their financial health and expenditures (Santelices et al., 2016; for Chilean context; Garcıa-Estevez and Duch-Brown, 2014, for Spanish context; Titus, 2006; Gansemer-Topf and Shuh, 2006, for the US context), type of programme pursued (graduate or undergraduate, full-time, part-time or online, length and volume of credits, the nature of curriculum) (Carnoy et al., 2012,for the Spanish context; Schmidt et al., 2010 for the Dutch context), facilities and resources available to students, including the quality of mentorship (Lau, 2003; for the US context). As for student characteristics, literature on institutional characteristics is not consensual. While there are consistent findings suggesting that financial expenditure, institutional selectivity, programmes with full-time students and availability of material and academic support are positively related to timely completion rates, these findings are challenged by those who see the impact of institutional factors biased by characteristics of entering cohorts of students. Based on US national longitudinal data, Astin (1997), for example, argues that differences in graduation rates may be more related to differences in student academic preparedness than to differences in institutional quality.

The assumption that both student and institutional characteristics impact graduation rates resulted in studies, particularly in US context, that consider both dimensions (DeAngelo et al., 2011; Cragg, 2009; Smyth and McArdle, 2004). Cragg (2009) has argued that the probability of graduation increases if students' characteristics match or fit institutional characteristics. Smyth and McArdle (2004) tested the hypothesis that pre-college academic preparation and college selectivity explain graduation rates of science, maths and engineering students from different ethnic backgrounds and gender. Besides student and institutional characteristics, other scholars argue that the surrounding context, in which HEIs operate, impact graduation rates (see Roksa, 2010 for his study on US context). But to date, as highlighted by Pike and Graunke (2015), literature does not know or have not tested all variables that affect graduation rates.

2.3. Rationale for measuring and explaining graduation rates at UEM

Based on these conceptual and methodological insights, this paper seeks to measure and explain some determinants of graduation rates at UEM. The rationale for focusing on UEM is threefold. Firstly, as elsewhere in SSA, and in Mozambique, graduation rate at UEM is thought as the ratio graduates vs. enrolled students. Based on this formula, in its assessment of the strategic plan 2008–2014, UEM estimated its graduation rate to be no higher than 8% during 2008–2014 (UEM, 2015b, p. 20), a rate close to 9% indicated by Bunting and Cloete (2012) above. Our claim is that this concept is misleading, simplistic and less reliable, since it does not involve the time taken by students to graduate. The unavailability of rigorous studies to measure and explain

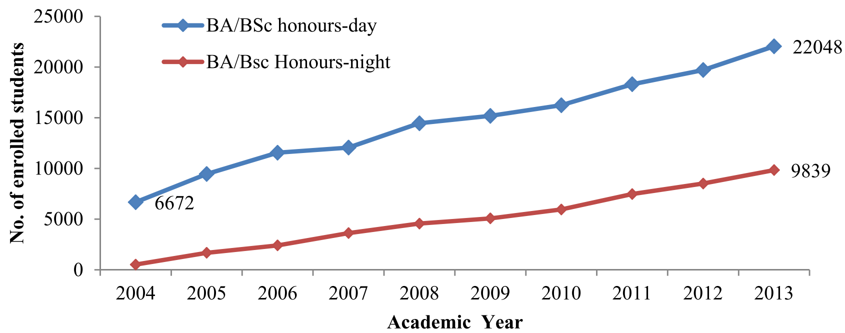

Fig. 1. Evolution of BA/BSc students' enrolments (Source: UEM planning office).

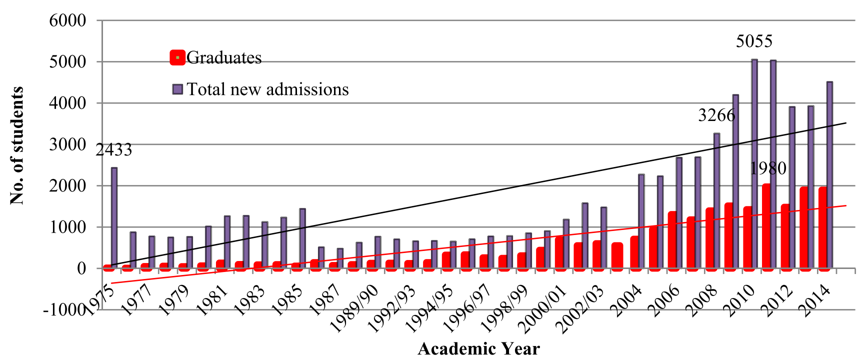

Fig. 2. Evolution graduates/new admissions at BA/BSc level (Source: UEM Planning Office).

graduation rate does not help UEM's leadership to strategically take informed decisions on institutional quality and efficiency matters, despite its commitment with these issues (Zavale et al., 2015).

Secondly, UEM is the oldest, most multi-disciplinary, largest, highly selective and arguably the most prestigious Mozambican HEI. Established in 1962 and following overall trends of HE expansion across SSA (Mohamedbhai, 2014) and within the Mozambican HE system (Zavale et al., 2015; Langa and Zavale, 2015), UEM has experienced deep transformation since mid-1990s, characterised by increase in enrolments and diversification of academic programmes. Students BA/BSc enrolments have increased from 7247 in 2004 when the institution offered almost only BA/BSc day programmes, to 31,887 in 2013, after having opened its gates to evening BA/BSc programmes (Fig. 1). Over the period of 2004–2013, BA/BSc programmes have increased as well, from 42 (34 for day shift, 8 for night-shift) to 123. Moreover, UEM is a very selective institution: about 20,000 prospective students apply annually for BA/BSc programmes and only about 4500 are admitted (Statistics concerning 2004–2014, UEM Department of Admissions). Nevertheless, increase in enrolment has not proportionately been coupled with increase in graduates (Fig. 2), and this perception is reinforced by the formula used to calculate graduation rate. All this pressures UEM to be more efficient and challenges it to produce more accurate data on itself to shift from a common-sense to strategic data-driven decision-making process.

Thirdly, UEM is a public institution. While it has other sources of funding, including self-generated funds from fees (particularly from night-shift students), the largest share of its budget comes from the State (Statistics on UEM budget concerning 2007–2012, UEM Finance Directorate). This raises accountability concerns of the money from taxpayers. We recognise that graduation rate is perhaps not the only suitable indicator of institutional efficiency. As some scholars have argued (Pike and Graunke, 2015; Archibald and Feldman, 2008; Astin, 1997), graduation rates may be reflecting the quality of students admitted and not necessarily the quality of the institution. However, the fact that institutional conditions matter for students to graduate, no matter how academically good they were at admission, makes graduation rate relevant for researchers and policy-makers. The relevance of graduation rate as a (partial) portrait of institutional efficiency is also suggested by the existence of a significant body of specialised literature, as that examined above.

3. Methodology

3.1. Modelling, method and variables selection

Graduation rates were calculated per cohort, as the percentage of students enrolled in the same year that graduated within the official duration.[2] of the BA/BSc programme+ 2 and 4 years. Students who did not graduate by the end of this period were considered as non-graduates. UEM academic regulation stipulates that, beyond the prescribed study duration, a student has an additional maximum time of 4 years to complete the programme. However, during the first 2 of these 4 additional years, the student continues to attend the programme without suffering any penalty, but in the 3rd and 4th years, fees are aggravated (UEM, 2010; Articles 20, 21). To measure graduation rate and explain some of its underlying determinants, a logistic regression analysis was used for data modelling, followed by stepwise procedure to select the main variables with statistical significance. The rationale for preferring logistic regression analysis over other possible approaches (e.g. probit, survival analysis, multi-level technique

[2] At UEM, the majority of BA/BSc degree programmes have a prescribed duration of 4 years, excepting Medicine, Veterinary and Architecture, which last 6 years.

model) is threefold. Firstly, logistic regression analysis enables to describe the relationship between a discrete binary dependent variable and one or more continuous or discrete independent variables. Secondly, the approach is suitable for the characteristic of the dependent variable: it is a binary variable (1 if a student graduate within course duration +4 years and 0 if the student does not graduate). Thirdly, logistic regression analysis allows identifying the main factors with potential significance in affecting the probability of a student to graduate. According to Gujarati and Porter (2009), a logistic regression model is presented by Eq. (1) below:

$$E(Y) = \frac{\exp(\beta_0 + \beta_1 X_1 + \ldots + \beta_p X_p)}{1 + \exp(\beta_0 + \beta_1 X_1 + \ldots + \beta_p X_p)} \quad (1)$$

where:E(Y)-is the probability of a random variable Y assume value Y = 1 or Y = 0.β_0,.. β_1-Parameters of the model to be estimated; $X_1 \ldots X_p$-Independent variables.

The logistic regression model was used to test the influence of 8 independent variables to 1 dependent variable. The dependent variable was described as the propensity of students to graduate or not during programme duration +4 years. This is a binary variable and assumes two possible values: "value 1", if a student graduates within the maximum period (programme duration +4 years), and "value 0", if a student does not graduate within this period. The influence of 8 independent variables (6 student-specific, 1 institutional-specific and 1 both student and institutional-specific) on students' propensity to graduate was tested. Based on literature on students' characteristics influencing their likelihood to graduate, namely socio-demographic (Taniguchi and Kaufman, 2005; Smyth and McArdle, 2004), academic readiness and commitment (Consuelo and Nora, 2007; DeBrock et al., 1996; Tinto, 1993; Astin, 1993), 6 student-specific variables were selected: 2 concerning socio-demographic profile, namely gender and age at admission, 2 concerning academic readiness and commitment, namely average grade obtained in admission exams and number of courses failed during the study period, and 2 concerning particular students' choices, namely the year students have chosen to take entrance exams and were admitted, and the eventual students' decision to change the academic programme throughout their training.

Apart from student-specific characteristics, 2 more variables were examined. Firstly, the programme duration. Programme duration is an institutional variable, since the duration is established by the institution, not by the student. At UEM, for example, some BA/Bsc honours programmes have a legal duration of 4 years (e.g. social sciences and humanities), while others, of 6 years (e.g. Medicine, Veterinary). The rationale underlying testing the study duration lies on the assumption that differences in programmes duration may lead to differences in graduation rates. Secondly, the regime or shift attended by students, whether daytime and night-shift. The regime seems to embed both student and institutional characteristics. When choosing a regime, student often ponders three factors: his/her financial situation, since tuition fees are far higher in night-shift programmes than in daytime; the time at his/her disposal to attend the programme (night-shift programmes fit well to working students); and the likelihood to get admission: while entrance exams and criteria are uniform for both night and daytime regimes, the competition is less fierce in night-shift[3] Thus, the propensity to graduate is partly affected by the characteristics of students admitted to each regime. However, after being admitted, the institutional conditions available for day-time and night-shift (e.g. differences in tuition fees, fatigue in lecturers as they are literally the same teaching during the daytime) may affect students' likelihood to graduate.

The 8 tested independent variables were: (i) gender, which assumes two possible values, "1" if a student is male and "0" if a student is female; (ii) student's age at admission; (iii) year of admission; (iv) average admission grade (0–20 marks); (i) number of failed courses; (vi) change of academic programme, "1" if a student did change to another program and "0" if a student did not change; (vii) programme duration; and (viii) regime, "1 if a student attends daytime and '0' if a student attends evening time.

In the meantime individual variables were tested, those variables that were found to be statistically significant were combined and re-tested to find out whether their effect on the propensity of students to graduate was constant or not, depending on whether they are tested as single variables or as combined variables in interaction with each other. The rationale for testing interactions was that one variable, tested alone, would not eventually fully explain the graduation rates. For example, while both regime and admission grades would be statistically significant in influencing graduation rates, the effect of admission grades would be different depending on whether a student attends a day or night-shift programmes, or if the student is a male or female. Four interactions were tested: (i) interaction between gender and regime; (ii) interaction between gender and admission grade; (iii) interaction between regime and admission grade; (iv) and interaction between gender and number of failed courses

Despite being relevant, other student-specific variables examined in specialised literature have not been considered in this study because of lack of data at UEM's registrar central and departmental offices. These include race/ethnicity (see, e.g. studies conducted by Murray, 2014 in South Africa and Rodgers, 2013 in UK); wealth, education and occupation, (see studies conducted by Carpenter et al., 1998 in Australia and Titus, 2006 in US); academic integration, involvement and climate, particularly studies conducted in US (Oseguera and Rhee, 2009; Kuh et al., 2008; Tinto, 1993). Also, the unavailability/inaccuracy of data at UEM hampered the possibility of examining further institutional variables, such as students' academic and social support-related expenses (see Santelices et al., 2016 for the study conducted in Chile), facilities and resources available to students, and the quality and availability of faculty for mentorship (Lau, 2003; for the US context). These limitations reinforce Pike and Graunke (2015)'s claim on "unobserved heterogeneity", i.e., the difficulties of fully explaining graduation rates because of omitted variables in calculations, either because they are unknown, difficult to measure or known but their respective data is unavailable. Thus, this study does not explain all variables likely to affect graduation rates, but those variables whose data is available. Further variables will be targeted in future studies, if data is available.

The logistic regression model considered in this study is described by the Eq. (2) below:

$$E(Y) = \frac{\exp(\beta_0 + \beta_1 X_1 + \ldots + \beta_{11} X_{11})}{1 + \exp(\beta_0 + \beta_1 X_1 + \ldots + \beta_{11} X_{11})} \quad (2)$$

Where:

E(Y) – probability of a student to graduate

Y – Propensity of a student to graduate, assumes two possible values,"1" if a student graduates within the maximum period

[3] At UEM, only prospective undergraduate programmes are submitted to entrance exams, and there is no difference in exams attended and criteria used for day and night-shift. Also, there is no minimum admission grade. Candidates are admitted depending on how well they are ranked among peers, on admission grade obtained, and on the number of vacancies available for each programme. For example, if 30 places are available for daytime Medicine, and if the top 30 of the candidates get admission grade above 17, a candidate who gets 14 marks will not be admitted. However, if 40 places are available for night-shift Medicine, and if none candidate gets 10 marks, a candidate who gets 8 may be admitted provided that he/she ranks in the top 40.

Table 1
Stratified sample size by colleges.

Colleges	n	percentage
College of Arts and Social Science	485	26.37%
College of Science	391	21.26%
College of Economy	291	15.82%
College of Engineering	205	11.15%
College of law	164	8.92%
College of Medicine	106	5.76%
College of Agronomy and Forestry Engineering	81	4.40%
College of Arts and Communication	43	2.34%
College of Education	27	1.47%
College of Veterinary	24	1.31%
College of Architecture	22	1.20%
Total	1839	100.00%

(programme duration + 4 years), and “0” if a student does not graduate within such period.

β_0–Intercept
β_1–Parameter for gender effect
β_2–Parameter for regime effect
β_3–Parameter for admission grade effect
β_4–Parameter for effect of students' age
β_5–Parameter for effect of program's duration
β_6–Parameter for number of failed courses
β_7–Parameter for change of academic program
β_8–Parameter for interaction between gender and regime
β_9–Parameter for interaction between gender and admission grade
β_{10}–Parameter for interaction between regime and admission grade
β_{11}–Parameter for interaction between gender and number of failed courses
X_1–Gender (assumes two values, 1 for male and 0 for female)
X_2–Regime (1 for daytime and 0 for evening)
X_3–Admission grade (0 to 20 marks)
X_4–Student's age at admission
X_5–Program's duration
X_6–Number of failed courses
X_7–Change of academic program
X_8–Interaction between gender and regime
X_9–Interaction between gender and admission grade
X_{10}–Interaction between regime and admission grade
X_{11}–Interaction between gender and number of failed courses

The modelling consisted of three steps. Firstly, a complete model including all independent variables and their interactions (cf. empirical model in Eq. (2) above) was developed and, based on Z test ($p > 0.05$), it was found that some variables had no significant effect in the probability of students graduating. Secondly, in order to generate a model with high goodness of fit among all possible models, a stepwise logistic regression analysis was applied. This process consisted in removing all variables without any significant effect in the model, using a log likelihood ratio test. Thirdly and finally, the effect of a given independent variable and interaction between variables in the probability of a student graduating was determined by a marginal effect of that (those) independent variable (s). All variables were measured at the student level, excluding the programme duration, since this is an institutional variable.

3.2. Databases and sampling

The study focused on 2003–2006 cohorts for two reasons (only undergraduate students were targeted, graduate students were not included). Firstly, this period enabled to trace all undergraduate student cohorts throughout their programme duration +4 years. For example, the last cohort of students admitted to UEM in 2006 was traced until 2010, 2011 or 2012 (depending on whether its programme had a duration of 4, 5 or 6 years), plus 4 additional years. Secondly, over this period, UEM has begun to experience dramatic increase in enrolments, introduced nightly-run privately-paid programmes and diversified its undergraduate programmes. Prior to this period (particularly from independence in 1975–2001), UEM offered BA/BSc daytime programmes, and the number of admissions and graduates followed regular trend. But this trend has dramatically changed since 2001 (cf. Fig. 2).

In order to measure graduation rates for this particular period, a database was created, from two sources. The first source consisted of lists of students that passed UEM' admission exams from 2003 to 2006, recorded by the central department of entrance exams. Based on these lists, data were introduced into the database, organised by student name, year of admission, gender, college, admission exam grades, programme admitted to, and regime. Further information was collected at each college registrar and inserted into the database (e.g. student's province of residence, year of birth, number of failed courses and final graduation grade; also, based on information collected at college level, student who passed entrance exams but never registered at UEM were excluded from the database).The second source consisted of lists of graduates from 2007 to 2014, produced by UEM central registrar office, as well as by colleges. These lists were used to add the year of graduation into the database. The final database consisted of undergraduate 6.282 students, admitted to UEM from 2003 up to 2006. From this database, a representative stratified sample of 1839 students (Table 1) was selected. The stratified sample was constructed to be proportionately representative of colleges, programmes at each college, regime, and number of undergraduate students admitted to UEM during 2003–2006. The sample size was calculated based on the discrete variables approach, since the dependent variable was the proportion of students who graduated

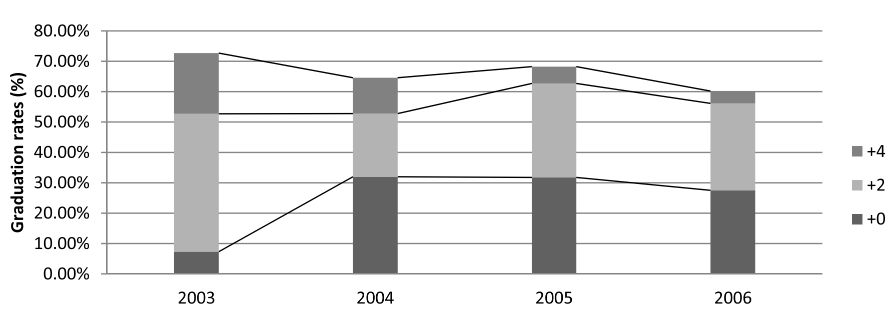

Fig. 3. Graduation rates of 2003–2006 per cohort (sample 1839).

Table 3
Confidence interval for graduation rate by cohort and graduation group.

Cohort	Graduation group	Graduation rate (%)	Stand. Error	Confidence interval – 95%	
				Lower	Upper
2003	+0	7.31	1.61	4.45	11.18
	+2	45.38	3.09	39.22	51.65
	+4	20.00	2.48	15.31	25.39
2004	+0	31.99	2.59	26.92	37.39
	+2	20.81	2.26	16.50	25.65
	+4	11.80	1.79	8.49	15.84
2005	+0	31.76	1.91	28.04	35.67
	+2	30.92	1.89	27.22	34.81
	+4	5.54	0.93	3.84	7.70
2006	+0	27.53	1.73	24.16	31.11
	+2	28.59	1.76	25.17	32.22
	+4	4.08	0.76	2.71	5.89

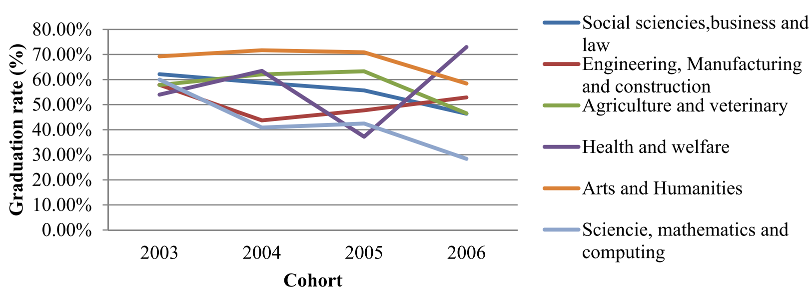

Fig. 4. Summary of evolution of graduation rates per academic fields.

or not, during programme duration+ 4 years. Eq. (3) was used to calculate the sample size:

$$n = \frac{N * Z_{\alpha/2}^2 * p * q}{(N-1) * E^2 + p * q * Z_{\alpha/2}^2} \tag{3}$$

Where:

n-Sample size

N-Population size (number of students admitted to UEM through admission exams from 2003 to 2006–6282 students)

$Z_{\alpha/2}$ -Critical value of standard normal distribution (1.96 for $\alpha = 5\%$)

E-Sample error (0.02)

p *and* q-proportion of individuals that present the main characteristics of the study and those that do not present, p and q are generally unknown (assume p = 0.5 and q = 0.5).

3.3. Data collection and analysis

Since lists of admitted, enrolled and graduated students, collected at the central registrar boards, department of entrance exams and colleges were not systematically organised and often not computerised, data entry had to be undertaken manually based on individual records of students. Data from colleges was collected from September to December 2015. 11 colleges (out of 17 UEM) were targeted (see Table 1 above). 6 colleges were excluded from the sample either because they were located outside the capital city (College of Tourism) or because they were recently established and had not yet produced graduates during the period under study (Colleges of Philosophy, Sports, Rural Development, Business and Entrepreneurship, Marine Sciences). Data analysis was carried out using STATA 13 software.

4. Results

4.1. Results concerning graduation rates

This subsection reports the main findings of the study concerning graduation rates. Fig. 3 displays two general results: firstly, that, on average, more than 25% of students graduate within the prescribed duration of programmes, almost 30% within the duration +2 additional years, and less than 10% within the duration +4 years; secondly, that almost 40% of students do not graduate within the allowed maximum time, i.e., programme duration +4 years. In details, Fig. 3 shows four main results. Firstly, that if the whole timeframe of programme duration +4 years is considered, the graduation rate has decreased, from about 70% for the 2003 cohort, to less than that for the 2004, 2005, 2006 cohorts (the 2003 cohort have graduated more students than the three subsequent cohorts). Secondly, that the percentage of students who graduate in programme duration + 0 has increased from less than 10% for the 2003 cohort, to about 30% for the 2004 cohort, but for the 2005 and

Table 2
Sample size by graduation group.

Graduation group	N	Relative Frequency	Cumulative Frequency
+0	493	26.81%	26.81%
+2	558	30.34%	57.15%
+4	150	8.16%	65.31%
Non graduate	638	34.69%	100.00%
Total	1839	100.00%	100.00%

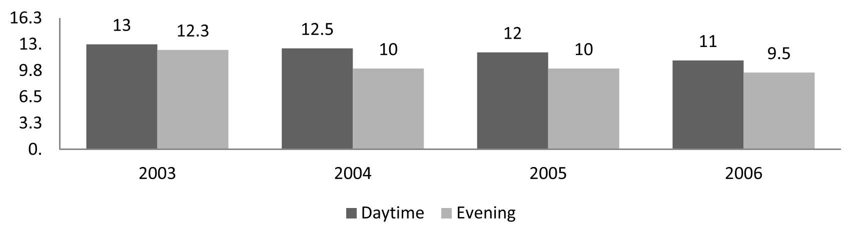

Fig. 6. Evolution of average admission grade from 2003 to 2006.

Table 5
Results from stepwise logistic regression (marginal effect of variables).

Variables	dy/dx	Stand. Error	Z	P > |Z|
Gender	−0.1278	0.0269	−4.74	**0.0000***
Regime	0.8269	0.0725	11.41	**0.0000***
Admission grade	0.0452	0.0114	3.98	**0.0000***
Regime * admission grade	−0.0506	0.0146	−3.47	**0.0010***
Program duration	0.0918	0.0257	3.57	**0.0000***
Nr. Of failed course	−0.0203	0.0022	−9.12	**0.0000***

The numbers in bold in Tables 4 and 5 correspond to the value *p*. This value is used as criterion for deciding the statistical significance of an independent variable on a dependent variable (in this study the dependent variable is the graduation rate). If the value *p* is less than 0.05 or 0.01 (levels of significance commonly used in statistics), then the variable under consideration has a significant influence on the dependent variable. The asterisk means that the value *p* is being compared with the nominal level of 1% (0.01). As the values are less than 0.01, all variables are statistically significant.

Table 4
Results from stepwise logistic regression.

Variables	Coef.	Stand. Error	Z	P > |Z|
Gender	−0.7788	0.1873	−4.16	**0.0000***
Regime	4.7131	0.9089	5.19	**0.0000***
Admission grade	0.2474	0.0614	4.03	**0.0000***
Regime * admission grade	−0.2769	0.0792	−3.49	**0.0010***
Program duration	0.5022	0.1432	3.51	**0.0000***
Nr. Of failed course	−3.4778	0.8272	−4.20	**0.0000***

Log likelihood = −573.94; Pseudo R^2 = 0.1712; Correctly classified = 76.65%.

2006 cohorts, there was a slight reduction. Thirdly, that the percentage of students who graduate within programme duration +2 years has decreased from more than 40% for the 2003 cohort, to almost 20% for the 2004 cohort, but since then it has increased to about 30% for the 2005 and 2006 cohorts. Fourthly, that the percentage of students who graduate in programme duration +4 years has been decreasing from about 20% for the 2003 cohort, to about 10% for the 2004 cohort and to about 5% to 2005 and 2006 cohorts.

Results from Fig. 3 are confirmed by the analysis undertaken to test the consistency and confidence of the sample size. The Table 2 displays the share of each cohort for the sample size, and the overall graduation rate for the concerned period; Table 3 displays, apart from the overall graduation rate for the concerned period per cohort, the respective confidence interval and standard error. As Table 2 visualises, the sample was composed of 65.1% of students who graduated within programme duration + 4 years (26,8% for programme duration +0 years, 30,3% for programme duration +2, and 8,2% for programme duration +4 years) and 34, 7% who did not graduate during the concerned period.

Results from Fig. 3, Tables 2 and 3 display three main trends of UEM's graduation rates. Firstly, that if only programme duration + 0 and 2 years are considered, almost 50% (half) of students graduate; if this timeframe is considered, the graduation rate has even increased, from about 50% for the 2003 and 2004 cohorts to more than that for the 2005 and 2006 cohorts. Secondly, that almost 10% of students have graduated beyond programme duration +2 years and that this percentage of students who need additional time beyond +2 years has decreased to less than 10% for the 2005 and 2006 cohorts. Thus, the normal timeframe for students graduating is programme duration + 2 years; efficiency concerns should be considered when adding more years beyond this timeframe (additional time beyond +2 seems to not significantly change the graduation rate). Thirdly, if programme duration +4 is considered, graduation rate has decreased, from about 70% for the 2003 cohort to about 60% for the 2004, 2005, and 2006 cohorts. This rate implies that 35 to 40% of students do graduate during duration +4 years and that the percentage of dropouts has decreased since 2003 cohort. As discussed later, these rates raise implications in terms of academic debate on university graduation rates and institutional policies in Mozambique and SSA.

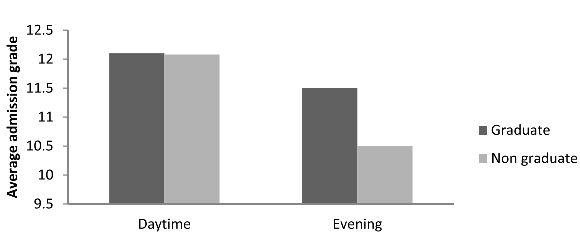

Fig. 5. Positive interaction between regime and admission grade on graduation rate.

In addition to graduation rates per cohort, graduation rates per academic programmes were also examined. Based on UNESCO's *International Standard Classification of Education* (ISCED, 1997[4]), academic programmes were grouped into 6 clustered fields to determine their patterns in terms of graduation rates. In this regard, Fig. 4 displays five relevant findings (rates displayed concern duration + 4 years) that summarise all the 6 clustered fields (for details of graduation rates of specific academic programmes of each clustered field, see Figs. A1–A6 in Appendices). Firstly, graduation rates have been decreasing since 2003 cohort in four fields, namely (i) arts and humanities, (ii) agriculture and veterinary, (iii) social sciences, business and law and (iv) sciences, mathematics and computing. Secondly, in 3 fields, the evolution of graduation rates follow a mixed pattern: from 2003 to 2004 cohort, there has been a decrease in the fields of engineering, manufacturing and construction and services, but from 2004 to

[4] ISCED (1997), consulted in http://www.uis.unesco.org/Library/Documents/isced97-en.pdf on 20th April 2016.

2006 cohorts, there was an increase; the field of health and welfare is more inconsistent, since its graduation rate increased for the 2004 cohort, decreased for 2005's and increased for 2006's. Thirdly, arts and humanities is, on average, the field with the highest graduation rates during the concerned period; besides, this is the field with the highest number of students at UEM (in Table 1 above, the College of Arts and Social Sciences occupies the largest share in the sample size); the field of science, mathematics and computing has, on average, the lowest graduation rate for all 2003–2006 cohorts. This is indeed a worth-worrying finding, since the College of Science is the second largest UEM College in number of students (see Table 1). Fourthly, Fig. 4 also shows that, for 2006 cohort, the field of health and welfare displays the highest graduation rates, followed by arts and humanities. However, this fourth finding needs caution, since the College of Medicine is among the smallest UEM's faculties in number of students (in Table 1 above, it represents 5,76% of the sample size). Fifthly, Fig. 4 shows that the field of engineering, manufacturing and construction has also a low graduation rate compared to other fields (average of 50%), but it is not the lowest, as it is often voiced by UEM's stakeholders' common-sense. The field of science, mathematics and computing has the lowest graduation rate for all four cohorts and, this rate has been worsening since 2003 cohort.

4.2. Results concerning variables affecting graduation rates

Tables 4 and 5 display results from stepwise logistic regression analysis, the method used to test the statistical significance of the selected variables in affecting the propensity of students to graduate within programme duration +4 years. The tables show that, among the selected variables, one demographic student-specific variable (gender), two academic student-specific variables (admission grade and number of failed courses), 1 institutional variables (programme duration) and one student and institutional-specific variable (regime) affect significantly the graduation rates of UEM students. Other tested variables, namely students' age at admission, year of admission and possibility of changing the programme were not statistically significant (these variables were deleted in the stepwise logistic regression analysis, see Section 3.1. above).

Regarding interaction between variables, Tables 4 and 5 show that only the interaction between regime and admission grade was found to be statistically significant; the interaction between gender with other variables (e.g. admission grade, number of failed disciplines) was not statistically significant. As Fig. 5 shows, while admission grade seems to not have a significant impact (remains constant) on graduation rates of daytime students, it matters for night-shift students. While daytime students graduate more than night shift students, a night shift student admitted with high grade is more likely to graduate than his/her colleague admitted with low grade. In fact, as Fig. 6 reveals, night-shift students graduate less partly because they are systematically admitted with lower grades than daytime students.

Table 5 also displays how statistically each of the significant variables has affected the likelihood of students graduating. The Table 5 shows that: male students were less likely to graduate compared to female students in 12.8%; students who obtained higher grades in admission exams were more likely to graduate in 4,5% than those with lower grades; students with less failed courses (subjects) were more likely to graduate (the more disciplines the student failed, his/her likelihood to graduate reduced in 2%); students who attended daytime regime had 82.7% more probability of graduating than those who attended evening classes; the longer the programme duration was, the probability of students graduating reduced in 9,18%; if students were admitted to attend evening regime with lower grades in admission exams, their probability to graduate reduced in 5%.

5. Discussion

These results highlight two main findings. Firstly, that about 65% of students graduate within programme duration +4 years (about 25% graduate on time, about 30% within programme duration+ 2 years and about 10% within programme duration +4 years, see Fig. 3, and Tables 2 and 3). This rate contrasts substantially with the graduation rate indicated by UEM (2015b) and by Bunting and Cloete (2012, p. 25) (in both, the estimation is about 9%). This rate was calculated using the formula graduates vs. enrolled students in a given same year. As we claim, the fact that graduation rate in SSA is seldom measured (except in South Africa), and when it does, it is hardly based on rigorous methods that consider time-to-degree, leads to a misleading, simplistic and erroneous portrait of graduation rate, and to difficulties in using it effectively to strategically inform policy-making and improve institutional efficiency. The rate of 9% gives the impression that UEM is graduating too few students and this puts pressure on leadership based on misleading data. While the UEM graduation rate of 65% within programme duration +4 years is still worth-worrying, if compared to some prestigious South African universities (e.g. 68% of 3-years undergraduate students graduate after 6 years at Stellenbosch and 64% at UCT, CHE, 2013, quoted in Cloete, 2014, p. 1), it is not so alarming as the common-sense often voices it, based on misleading calculations. The finding, about which UEM leadership should certainly be worried, in terms of efficiency, is the fact that only about 25% of undergraduate students obtain their diploma in the prescribed period. This is also the case in South Africa, where according to CHE (2013), only 25% of undergraduate students in face-to-face South African HEIs obtain their diploma on time. Both at UEM and in South Africa, this rate means that the optimal use of resources enables to get 1/4 of outputs. Graduation rates at UEM implies that two additional years of resource allocation are needed to get 2/4 of students out of university with a diploma and that 4 more additional years are needed to get an overall graduation rate of 65%. The remaining 35% may need more resources to obtain diplomas, or may quit the university without diploma, regardless of many more additional years of investment. This raises institutional efficiency and accountability concerns regarding public resources, and makes relevant the second main finding of the study, about the determinants of graduation rate.

From the set of variables tested in this study, gender, admission grade, number of failed subjects, regime, programme duration and interaction between admission grade and regime were statistically significant to students' probability of graduating. It is worth-emphasising, from the viewpoint of gender equality in HE, that female students' graduation rate is higher than male's. In fact, female students often face limited access to HE but once admitted, they seem to do better than their male counterparts. Darvas et al. (2014) have noticed that the participation of SSA female students in HE remains the lowest in the world. Despite having increased from 3,5% in 2000 to 5,24% in 2010, it remains the lowest (e.g. in OECD countries, female participation in HE has grown from about 50% in 2000 to about 70% in 2010; on average, the world female participation increased from about 20% to about 30%, see Darvas et al., 2014, p. 105–107). As elsewhere in SSA, the participation of female students in Mozambique is lower than male's, despite the progress made: in 2012, about 40% of the total 123,799 students enrolled in Mozambican 46 HEIs were women (MINED, 2014). This is also the case at UEM: while from 2008 to 2013, female students increased by 87,8% against 69,5% for male, in 2013 they still represented 33, 5% of the total enrolments. But these female students outperformed their male counterparts: although UEM continues to graduate more male students (in 2013, 67,1% of graduates were male), the proportion of female students who have graduated increased in 76% over 2008–2013, compared to the increase of 18,1% for male students (UEM, 2015b, p. 17). Therefore, if not denied access to HE, women seem to do better than men.

Other variables impacting graduation rates are related to academic characteristics of both students and the institution. In other words, graduation rates are affected by the student's academic profile and by how the institution organises and deals with academic issues. Admission grade represents a proxy for students' pre-college academic preparedness prior to entering into university. Consuelo and Rora (1997) have demonstrated the extent to which pre-college academic variables are significant in predicting graduation rates of Hispanic students attending US two-year community college. Despite referring to the US case, this finding is relevant to the UEM case in that it suggests that pre-college academic preparedness is critical for enhancing university graduation among students from low socio-economic backgrounds. While this study did not measure students' socio-economic background, because of lack of data, the significance of admission grade to graduation rate highlights the need to pay attention to studdents' academic preparedness prior to admission, if ones aspire to enhance their propensity to graduate. How students graduate at UEM may be affected by how they come prepared from secondary schools. The number of failed subjects is a proxy for students' achievement throughout college education and its statistical significance suggests that students' academic commitment affects their likelihood to graduate, as repeatedly demonstrated elsewhere (Tinto, 1993; Astin, 1993).

On the other hand, graduation rates are also affected by how UEM as an institution is organised and deals with academic issues. Among the two variables backing this claim, namely programme duration and regime, the last deserves more scrutiny. From early 2000s, and following the national (Langa and Zavale, 2015) and African (Mamdani, 2007) trends of privatisation and commercialisation of HE, UEM started to operate a privately-paid night-shift scheme, triggered by the increasing demand for tertiary education by prospective working students, and by the thirst for additional funds rather than by the scrutiny of the academic standards of the admitted students. It is not surprising that UEM has admitted, for the night shift, students with systematically lower grades than daytime[5] (Fig. 6). It is also not surprising that the interaction between admission grade and regime is statistically significant in predicting students' graduation: night-shift students admitted with lower grades are less likely to graduate (Fig. 5). However, the low graduation rate of night-shift students, particularly those admitted with low grades, may also be linked to UEM's inability to determine a minimum admission grade (i.e. a minimum acceptable academic level), and its inability to adapt its programmes to the profile of students attending evening programmes. The majority of night-shift students are workers and they have to work to pay fees, which are more than 50% higher than those practised in daytime period (UEM, 2014). In fact, as UEM does not have part-time programmes and the Mozambican labour market rarely employs, at least officially, students under a part-time scheme, night-shift students are actually full-time students and full-time workers. They stand on equal footing with their daytime counterparts. This situation constrains their likelihood to graduate.

[5] At UEM, as we referred to in footnote 3 above, admission criteria for both night and day-shift undergraduate prospective students are uniform and there is no minimum admission grade.

6. Conclusions and policy implications

Three major conclusions can be drawn from this study. Firstly, there is need to change the way graduation rates are perceived in Mozambique and in SSA. More rigorous procedures, in which time-to-degree is considered, are needed to measure and explain graduation rates on a regular basis. For that to happen, comprehensive and updated records on students' profile and graduates need to be kept at institutional level. Secondly, the fact that only 25% of students graduate in the prescribed period (65% in programme duration +4 years), and that after 4 more years beyond prescribed duration, there are still 35% of students who do not graduate, raises crucial concerns in terms of institutional efficiency and accountability. Thirdly, besides gender (female students have higher graduation rates than male), graduation rates are heavily affected by the academic aspects of both students and HEIs.

These conclusions raise three main policy implications for UEM. The first is the need to create conditions to allow graduation rates to be measured and explained in a more rigorous way and on regular basis, including the need to enlarge the institutional databases and records characterising students' profile to include other relevant variables influencing the propensity to graduate (e.g. socio-economic variables). The second is the need to enhance institutional efficiency and accountability. New regulations are needed to enforce students to graduate not beyond programme duration +2 years. UEM has made progress in this regard, by reducing the maximum time allowed for students to attend the institution, from 4 to 3 years (UEM, 2015a, article 21, 22). The finding from this study that only 10% of students graduate beyond programme duration +2 years reinforces the rationale for this new regulation. Nevertheless, mechanisms for enforcing its compliance are still lacking. While penalising with aggravated fees in the 3rd year beyond the prescribed time is a reasonable measure, its enforcement seems to be absent. Furthermore, students should effectively be impeded from enrolling after the maximum period, to make the institution more efficient and students more accountable.

The third implication regards the need for the institution to scrutinise students' academic issues. If students' pre-college academic readiness is relevant for their likelihood to graduate, then alternative mechanisms for admitting undergraduate students, other than entrance exams, are required. These may consist, for example, in recruiting the best students completing the secondary education by rigorously examining their academic profile and progression. One way of creating an excellent university is through recruiting excellent students. Another possible measure to scrutinise students' academic preparedness (particularly night-shift candidates) would be to establish a minimum grade (e.g. 10 marks) for admission, below which none students should be admitted, even if the number of available places are not fully filled. If the institution admits students with explicit academic gaps, specific academic adjustments programmes may then be required. In addition, for working students attending evening programmes, the institution may need to reform the curriculum to be more flexible and responsive to working students' workload and skills' needs. Last but not least is the need to identify the reasons why male students have less graduation rate than their female counterparts, and to devise remedial strategies.

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Appendix A

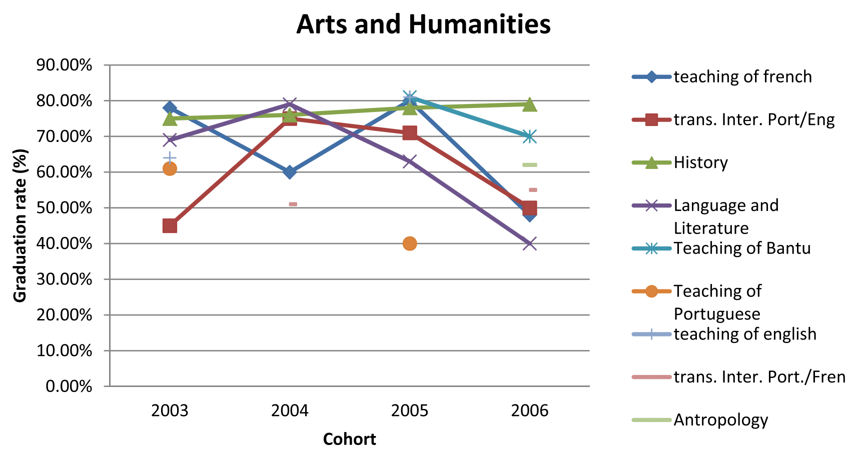

Fig. A1. Evolution of graduation rates for Arts and Humanities.

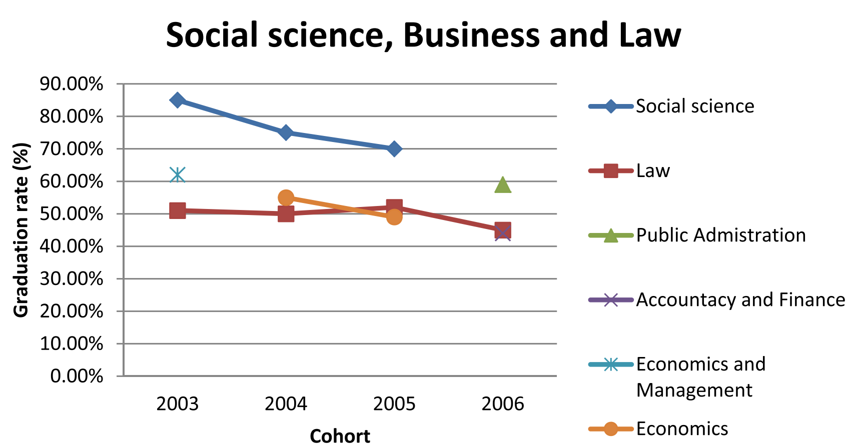

Fig. A2. Evolution of graduation rates for Social Sciences, Business and Law.

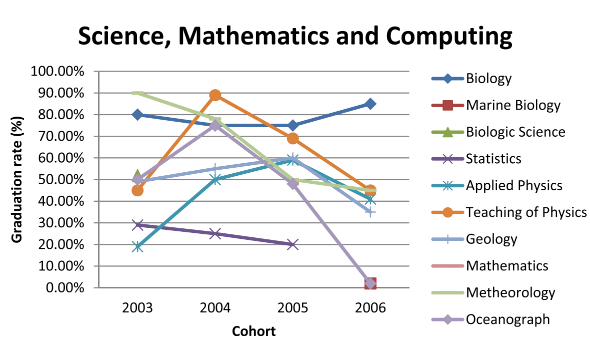

Fig. A3. Evolution of graduation rates for Science, Mathematics and Computing.

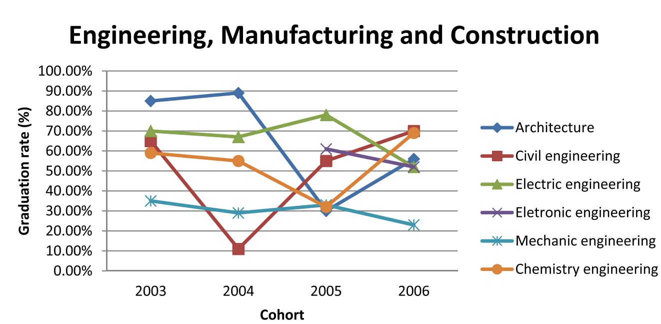

Fig. A4. Evolution of graduation rates for Engineering, Manufacturing and Construction.

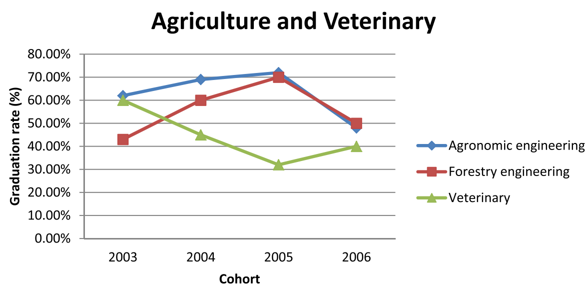

Fig. A5. Evolution of graduation rates for Agriculture and Veterinary.

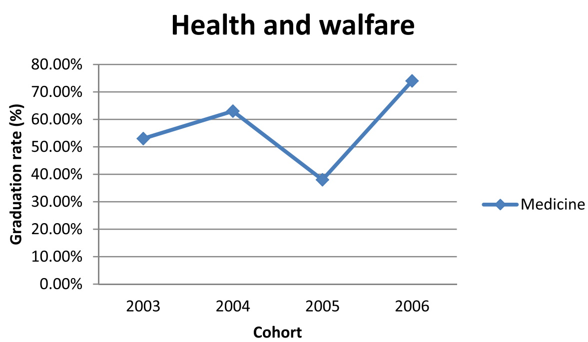

Fig. A6. Evolution of graduation rates for health and welfare.

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