

ACADEMIC ENTREPRENEURSHIP AND ORGANISATIONAL SUPPORT FACTORS

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ABSTRACT

Academic entrepreneurship has gained popularity in recent decades as a critical element for the advancement of commercialisation and innovation. Research shows that the organisational context can facilitate or impede academic entrepreneurship. However, academics are often faced with a weak set of institutional and organisational factors which inhibit the commercialisation and technology innovation process. This article builds in the direction of an emerging stream of research and empirically investigates the relationship between various factors such as management support, rewards, and time allocation in relation to measurable academic entrepreneurship outputs. Following a survey of academics, the results reveal several positive relationships between the hypothesised study variables. In particular, rewards were found to have a significant impact on academic entrepreneurship outputs. Implications relate to management interventions to design and implement harmonised academic entrepreneurship support mechanisms which focus on organisational rewards and incentives.

Keywords: academic entrepreneurship, organisational, rewards, support, time allocation, South Africa.

INTRODUCTION

Recognising that innovation “translates knowledge into economic growth that contributes to the well-being of society” (Jakovljevic 2018, 110), there is an increasing sense of awareness for the need to foster entrepreneurial activities at educational institutions and science councils for economic and social development purposes (Allessandrini, Klose and Pepper 2013, 207; Audretsch and Caiazza 2016; Urban 2019). Over the past few decades scholarly attention to academic entrepreneurship has increased steadily over various disciplines and in several fields of management (e.g., literature reviews in Rothaermel, Agung and Jian 2007; Siegel and Wright 2015). Several studies indicate that investments in academic entrepreneurship at “higher

educational institutions” (HEIs) play “an important role in regional development and regional innovation systems where the higher education system must therefore provide the requisite research, knowledge and a highly skilled workforce if the nation is to compete globally” (Caiazza 2104, 104; Etzkowitz et al. 2008; Perkmann et al. 2013). The trend of utilising “research and development (R&D)” from universities¹ has its origins in the “Bayh-Dole Act in 1980”, where essentially universities own and manage their intellectual property providing them with a greater flexibility in engaging with industry in terms of entrepreneurial activity (Phan and Seigel 2006, 78; Chantson and Urban 2018, 115).

Similarly in South Africa the “Intellectual Property Rights on Publicly Financed Research and Development (IPR PFRD) Act No 51, was promulgated in 2010 (DST 2012), where HEIs and Science Councils were required to establish Technology Transfer Offices (TTO)” in order to bridge the “innovation chasm” by addressing some of the factors that inhibit commercialisation (DST 2015; RSA 2008; Sibanda 2017). In South Africa, HEIs are expected to contribute to regional innovation and often play a significant role in the commercialisation of technologies (Kruss and Visser 2017; Urban 2019). Additionally, it has been proposed that while commercialisation success depends on the beneficial exploitation, industrial application and absorption of the intellectual property (IP) into the market, the organisational context in which commercialisation and technology transfer takes place is of utmost importance (Nelson 2014; Pouris and Pouris 2011).

The concept of “academic entrepreneurship” has gained popularity in recent decades (OECD 2003; Rothaermel et al. 2007; Wood 2011) and typically includes patenting, licensing and spin-offs as part of its definition. Academic entrepreneurship is a multi-level phenomenon which is “determined by both the characteristics of individuals as well as the organizational and institutional context in which they work” (Perkmann et al. 2013, 431). Several studies highlight that universities need to create an environment that supports commercialisation and potentially reduce the conflict of interest between traditional and entrepreneurship efforts (Urbano and Guerrero 2013, 227). For academic entrepreneurship to flourish various organisational mechanisms need to be in place to facilitate commercialisation (Etzkowitz 2008, 13). In this regard Alessandrini et al. (2013) argue that key success factors for academic entrepreneurship include clear policies, top management commitment and a supportive work environment. Studies investigating environmental and organisational conditions that allow academic entrepreneurship to succeed, suggest that universities should create a culture which is supportive towards start-ups and also provide tangible investments such as TTO, “incubators and science parks” (Huyghe and Knockaert 2014; Nelson 2014). Similarly, Huyghe and Knockaert (2014, 145) argue that the “organisational context can facilitate or impede academic

entrepreneurship above and beyond individual-related characteristics”.

Although there is mounting interest in academic entrepreneurship in South Africa (Grundling and Steynberg 2008; Sibanda 2017; Urban 2019), empirical evidence reveals that there are generally “low rates of academic start-ups and low levels of commercialization” (Allessandrini et al. 2013, 206). Studies indicate that “academics are often constrained with their work overload, and that there is insufficient modelling of innovative behaviour and inadequate funding support” (Jakovljevic 2018, 114). Some researchers propose that academics seldom understand the “flow between innovation and invention and the process how to develop innovative and inventive skills” (Jakovljevic 2013, 69), while others have identified “multiple reasons why university research in South Africa does not generally result in IP registration”. These reasons include, “unfavourable ownership provisions of the IP Act and the university’s IP policy, IP registration and commercialisation is not viewed as a primary goal of research, novelty is destroyed by publication, and supervisors and researchers are unable to identify the potential intellectual property rights arising from students’ or their own research” (Jakovljevic 2018; Pouris 2007; Sibanda 2017). Moreover, it has been suggested that TTOs at HEIs in South Africa tend to concentrate more on the identification and protection of IP, and devote less attention on start-ups (Pouris 2007; 2012), and subsequently low levels of academic entrepreneurship at HEIs are due to a weak set of institutional and organisational factors which inhibit the commercialisation and technology innovation process (Boshoff et al. 2018; Chantson and Urban 2018).

The motivation for this article is justified on the abovementioned challenges which many universities face in terms of academic entrepreneurship both in South Africa and globally. Accepting that it is imperative to appreciate the organisational factors which foster academic entrepreneurship activity (Huyghe and Knockaer 2014; Nelson 2014), the purpose of this article is to expand on this emerging stream of research and empirically investigate the relationship between organisational factors (senior management support, rewards and incentives, time allocation) and measurable academic entrepreneurship outputs.

While previous research has focused on “entrepreneurial intentions” in relation to academic entrepreneurship (Chantson and Urban 2018); this article concentrates on specific organizational factors and academic entrepreneurship. In this way the article is able to provide contributions to the literature by hypothesising specific links between perceived organisational factors and actual academic entrepreneurship outputs. It must also be acknowledged that while many studies on “academic entrepreneurship is predominantly Western in nature, very few if any reflecting on the African context” (Urban 2019, 193). In this regard, the measurement instruments used in this study are “tested for reliability and validity” to assess the adequacy of

these measures in an African setting. University research managers and specialised research administrators in the public sector may gain a more nuanced understanding of which factors stimulate greater academic entrepreneurship outputs. Furthermore, the study findings may prove valuable as it is increasingly “recognised that universities do not only participate in research and teaching, but are increasingly active in the so-called ‘third mission’, to stimulate global competitiveness through academic entrepreneurship” (Etzkowitz et al. 2008, 682; Guerrero and Urbano 2012; Mok 2005).

The first is structured as follows: The first section provides a brief literature overview upon which the hypotheses are articulated. Then the methodological design of the empirical work is discussed and results are presented. The last section interprets the study results in the context of prior theory, considers their consequences for research managers, and highlights future research options.

THEORETICAL OVERVIEW

Academic entrepreneurship: Different perspectives

It is widely acknowledged by scholars “academic entrepreneurship encompasses not only licensing, and spinoff activities, but includes a wide variety of entrepreneurial activities ranging from contract research and collaboration” (Jain, George and Maltarich 2009, 925). For the purpose of this article, academic entrepreneurship is conceptualised on the basis of Abreu and Grinevich’s (2013, 408) definition as “as any activity that occurs beyond the traditional roles of teaching and research, which is innovative and comprises an element of risk and may lead to commercialisation”.

While academic entrepreneurship has gained some legitimacy in the HEI space, tensions between academic entrepreneurship versus traditional academic activities have been noted. A “traditional academic ethos (Merton 1973 cited in Renault 2006, 231) is described as having four elements: disinterestedness, universalism, organized scepticism and communism of intellectual property. This so-called Mertonian ethos is in conflict to the ethos of academic entrepreneurship, where authors (e.g., Owen-Smith and Powell 2001) have detailed a multi-dimensional array of faculty attitudes toward academic entrepreneurship.” For instance, some authors argue that even though academic researchers may “improve their reputation, earn more income and gain more satisfaction, faculty remain sceptical and attitudes vary considerably when engaging in academic entrepreneurship” (Etzkowitz 2008). In some cases, “faculty express concerns about the loss of traditional values, especially openness, since academic entrepreneurship appears to have changed collegial relationships from trust-based exchanges to

now contract-based” (Owen-Smith and Powell 2001, 102; Renault 2006).

Furthermore, critical voices (see, Barnett 2015; Beckman and Cooper 2013; Giroux 2014) claim that entrepreneurship is a “part of the neoliberal agenda and that the corporatisation of the academy puts academic standards at risk and make a mockery of higher education. These authors warn against the ‘deceptive beauty’ of an entrepreneurial university culture” (Steenkamp 2017, 150). In this regard Steenkamp (2017) provides a useful categorisation in terms of “(1) bodies of thought against the entrepreneurial university, (2) bodies of thought regarding the entrepreneurial university and (3) examples of developments at entrepreneurial HEIs”. From this analyses Steenkamp (2017, 151) concludes that in general “arguments against the entrepreneurial university will not withstand the overwhelming progress made and advantages gained from the Anglo-American model of HE”.

While the controversy of academic entrepreneurship is acknowledged, it is beyond the scope of this article to interrogate the legitimacy of academic entrepreneurship from a neoliberal perspective. Indeed it has been argued that a better “understanding of this phenomenon will best be achieved by means of arguments based on bodies of thought, facts and cases for and against it” (Steenkamp 2017, 152), all of which could prove highly valuable.

Organisational factors supporting academic entrepreneurship

Studies on entrepreneurship are now emerging which shed light on which organisational factors are noteworthy in the public sector context (Meynhardt and Diefenbach 2012), and include some of the same organisational factors found in the private sector (Kearney, Hisrich and Roche 2009). These organisational factors include, “top management support, work autonomy, rewards, time availability, and organisational boundaries” (Kuratko, Hornsby and Covin 2014; Meynhardt and Diefenbach 2012; Urban 2017). Nelles and Vorley (2010) who studied relevant entrepreneurial architecture which enables universities to attain their third mission observed that institutions need a collection of internal factors that will assist in creating entrepreneurial agendas which include institutional communicative, co-ordination and cultural elements. Institutions can be seen as “multifaceted long-lasting social structures made of symbolic elements, social activities and material resources, managed by centralised regulations, values and norms” (Huyghe and Knockaert 2014, 151). Others note that even if the top management recognises the need to change, it needs to modify incentives and allocates resources to create a conducive environment for commercialisation (McInnis 2001, 45). However existing routines and norms more frequently than not, impede the organisational transformation, particularly where there is a strong tradition with deep rooted norms of behaviour (Bercovitz and Feldman 2008, 71).

An analytical review of the literature reveals that academic entrepreneurship has mainly been implemented as bottom-up organisational approach where researchers are expected to deliver on the third mission without the university top management playing a role in fostering “academic entrepreneurship” (Kirby, Urbano and Guerrero 2011; Rothaermel et al. 2007; Wood 2011). McInnis (2001, 48) argues that “efforts to transform the university to an entrepreneurial culture will be challenging, if not fruitless, if the top management and leaders do not take cognisance of the skills, desires and perceptions of academics”.

Following this line of argument, it seems that senior managers at universities need to develop and support interactions between “institutions and other stakeholders in order to generate entrepreneurial capacity and enhance the socio-economic impact of universities” (Guerrero and Urbano 2012, 45). This implies that universities must design and foster “open communication channels” and establish collaborations with the “different agents involved in the innovation and entrepreneurial actions (government, enterprises, research centres, and society, among other)”. Research further emphasises that senior managers also need to understand how academic entrepreneurship “outcomes could be transformed into determinants of economic development or factors of production function” (Audretsch and Caiazza 2016, 1250). This line of theorising leads to the first hypothesis.

H1: “Senior management support for entrepreneurial activities at universities has a positive influence on academic entrepreneurship outputs.”

Additionally, prior research shows that introducing a rewards system is one of the more effective strategic actions to motivate for academic entrepreneurship (Bernasconi 2005). However, a critical analysis of the findings in this regard reveals that TTO activities and rewards systems for commercialisation at universities are often misaligned (Phan and Siegel 2006). Renault (2006) asserts that as long as there is a misalignment between intellectual property and promotion policies to guide the faculty on what is appropriate and a desired outcome on commercialisation, institutions will experience reluctance in participation on these activities from researchers.

To counteract such tendencies, Nelles and Vorley (2011) argue that rewards and incentives for university staff must be part of the university strategy be institutionalised. The rewards can be monetary through bonuses, profit sharing or non-monetary in the form of promotion and recognition (Kirby et al. 2011). Research confirms that “academics and scientists working at universities who obtain rewards for entrepreneurial endeavours were found to possess higher levels of spin-off and patenting or licensing intentions” (Chantson and Urban 2018, 115).

Following these prior findings where positive findings are reported in terms of rewards and academic entrepreneurship outputs it is hypothesized that:

H2: “University reward systems focused on academic entrepreneurial activity have a positive influence on academic entrepreneurship outputs.”

Prior studies highlight that robust “university policies permit faculty to work part time in start-up companies and even allow sabbatical leave for the purposes of transferring technology to start-ups” (Perkmann et al. 2013, 425). On the other hand, some studies reveal that the amplified participation of faculty in entrepreneurial activities introduces the danger of distracting their “time and efforts away from academic knowledge generation and publications. One study which examined these effects involved 150 full-time faculty members who founded firms and found that prior to start-up formation, academic entrepreneurs published more than their peers. Nonetheless, once the start-up was formed their rates of publishing did not decrease and, in some cases, research output even increased” (Lowe and Gonzalez-Brambila 2007, 175). Notwithstanding that organisational support factors, appear to realise some expected and other somewhat unexpected results (Lee 2000), the importance of time allocation as an organizational inducement for greater academic entrepreneurship shapes the last hypothesis insofar it is predicted that:

H3: “Time allocation as an organisational support factor for entrepreneurial activity at universities has a positive influence on academic entrepreneurship outputs.”

RESEARCH DESIGN

Considering the intention of the study was to establish associations between variables, a quantitative survey based design was adopted which is similar to prior studies investigating organisational factors and academic entrepreneurship (Huyghe and Knockaert 2014; Chantson and Urban 2018). The population of the study comprised of post-doctoral fellows and academic researchers at universities and research councils in Gauteng, South Africa. The rationale for selecting these respondents is that “well-functioning academic entrepreneurship initiatives require that several different actors such as researchers, post-doctoral fellows and university officials and are aligned” (Lowe and Gonzalez-Brambila 2007, 177).

In South Africa 26 public universities are distributed across nine provinces (Universities SA 2018). Non-probability convenience sampling was employed and several research intensive universes as well as universities of technology were surveyed (Universities SA 2016). It is

recognised that across the world, that “universities should deliver on their respective roles so that the diverse needs of the economy and society can be addressed collectively. Under these circumstances, some institutions produce vocational and technical skills, others develop first degree graduates and professionals, whilst research-intensive institutions foster masters, PhDs, research outputs and technological innovations” (Habib and Phakeng 2018). With regards to a science council, which are largely publicly-funded and for the purpose of this study the “Council of Scientific and Industrial Research (CSIR)” was selected as the CSIR staff complement consists of scientists, engineers and technologists (CSIR 2018).

The study respondent was the individual where the sampling selection criterion was based on the conceptualisation of academic entrepreneurship, insofar the respondent was involved in “any activity that occurs beyond the traditional roles of teaching and research, which is innovative and comprises an element of risk and may lead to commercialisation” (Abreu and Grinevich 2013, 408). Based on the study population of public universities and science councils in South Africa and considering that all-encompassing sampling frames for academic entrepreneurship were unavailable, convenience sampling was used. From the initial 1100 questionnaires distributed in and around the university community and the CSIR, who met the sampling selection criteria, and after several reminders a final sample size of 264 was obtained. Respondents included academic researchers (52%), post-doctoral fellows (30%) and research scientists (20%). To test for potential bias the “total sample was split into two groups based on the time they were surveyed” (Cooper and Schindler 2014) which revealed no significant differences in age or gender ($p > .10$) supporting the notion that sampling bias was not a serious issue. Sample characteristics reveal that 54 percent of respondents were female and 46 percent were male, where the majority were in the 39–45 age group category.

Ethical considerations were taken into consideration by submitting a written invitation to the appropriate university research office as well as the CSIR regional office to obtain “the necessary permission for staff to participate and to administer the survey”. Furthermore, the letter stated that the “purpose of the study purpose and benefits to the participating respondents as well as the participant’s rights and protections was made explicit and explained at the start of the data collection process. Full and open information (informed consent) was made available to respondents, to ensure that no form of deception and misrepresentation was used to extract information from the respondents where their privacy and confidentiality was respected at all times.”

Prior studies were examined for measures which were suitable to test the hypotheses. Questions were measured on a “seven-point scale in which 1 represented strongly disagree and 7 represented strongly agree”. Furthermore the “commonly employed method that uses means

of all items to operationalize multi-item constructs was utilised” (Cooper and Schindler 2014, 421).

The independent variables (IVs) were operationalised to capture the constructs as per the hypotheses: “(1) Senior management support was surveyed as the willingness of top-level managers to facilitate and promote entrepreneurial behaviour, including the championing of innovative ideas and providing the resources people require to take entrepreneurial actions” (Bercovitz and Feldman 2008; Etzkowitz 2008; Kuratko et al. 2014; Guerrero and Urbano 2012; Kirby et al. 2011). Seven items were used to measure this construct and included questions such as “people are often encouraged to take calculated risks with new ideas around here”. (2) “Rewards were surveyed as “developing and using systems that reward performance by highlighting significant achievements and encouraging the pursuit of challenging work” (Huyghe and Knockaert 2014; McInnis 2001). Seven items were used to measure this construct and included questions such as “the rewards I receive are dependent upon my innovation on the job”. (3) Time availability was surveyed as “evaluating workloads to ensure that individuals and groups have the time needed to pursue innovations and that their jobs are structured in ways that support efforts to achieve short-and long-term organisational goals” (Lee 2000; Perkmann et al. 2013). Five items were used to measure this construct and included questions such as “I have just the right amount of time and workload to do everything well”.

For the dependent variable (DV) in terms of academic entrepreneurship outputs, primary data was collected in harmony with the South African IPR Act of 2010 provisions where “intellectual property emanates from publicly financed research and development which is identified, protected, utilised and commercialised for the benefit of the people of the Republic, whether it be for social, economic, military or other benefit” (DST 2012, 2015; RSA, 2008). Intellectual property including “academic research including licensing and/or start-up ventures” (Friedman and Silberman 2003, 18) was surveyed in terms of percentage increases over a 10 year period, where a Likert-type scale similar to the IVs was used to ensure compatibility in terms of statistical analyses.

All statistical analyses were performed with “SPSS 21 and first measures were scrutinised for validity and reliability testing. Following prior studies both the *ex ante* and *ex post* approaches to address common method bias” (Podsakoff, MacKenzie and Podsakoff 2012) were employed. The *ex ante* approach included addressing issues of questionnaire design and administration as well as running a “pilot test” (n = 30) to avoid ambiguity. In addition, the *ex post* approach entailed calculating a “Harman’s one factor test, for all multi item variables” (Podsakoff et al. 2012). Results provided three distinct factors, with the first factor explaining 21.34 percent, “suggesting no single factor accounted for the majority of the variance and

consequently common method bias was not a serious issue” (Podsakoff et al. 2012).

RESULTS

Construct validity and reliability

“Exploratory Factor Analysis (EFA) was used to assess the validity of the constructs based on the extraction Principal Component Analysis (PCA) method” (Cooper and Schindler 2014, 325). The “Kaiser-Meyer-Olkin (KMO) test was used to measure the sample adequacy, which should be at least 0.5 and the p-value should be significant” (< 0.5). The “KMO and the Bartlett’s Test of Sphericity” results are summarised for each of the constructs in Table 1. The “KMO was greater than 0.5 across all constructs and the Bartlett’s Test of Sphericity” showed significant results ($p\text{-value} = 0.000 < 0.05$), implying that the sample was good enough to run factor analysis.

In terms of the senior management support construct factor loadings ranging from 0.554 to 0.723 were observed where the minimum acceptable factor loading must be at least 0.4. Five items loaded onto one factor which explained 40.72 percent of variation, while two items were removed because they had low communalities (< 0.3). For time availability factor loadings ranging from 0.551 to 0.736 were observed where four items loaded onto one factor which explained 44.02 percent of variation, while one item was removed due to low communality (< 0.3). For the rewards construct factor loadings ranging from 0.497 to 0.690 were observed and seven items loaded onto one factor which explained 39.54 percent of variation.

In terms of reliability testing the following Cronbach’s Alpha were obtained: Rewards ($\alpha = 0.739$); time availability ($\alpha = 0.568$); and senior management support ($\alpha = 0.629$). In two cases the standard level of acceptability (0.70) (Nunnally 1978) was not obtained, however as Field (2009) maintains that a value less than 0.7 can be expected when dealing with psychological constructs, such as used in this article, and can in fact be as low as 0.5.

Table 1: Construct validity testing: “KMO and Bartlett’s Test”

“Kaiser-Meyer-Olkin Measure of Sampling Adequacy: Top management support”		.740
“Bartlett’s Test of Sphericity”	“Approx. Chi-Square”	124.157
	df	10
	Sig.	.000
“Kaiser-Meyer-Olkin Measure of Sampling Adequacy: Time availability”		.650
“Bartlett’s Test of Sphericity”	“Approx. Chi-Square”	85.570
	df	6
	Sig.	.000
“Kaiser-Meyer-Olkin Measure of Sampling Adequacy: Rewards”		.800
“Bartlett’s Test of Sphericity”	“Approx. Chi-Square”	296.614
	Df	21
	Sig.	.000

Descriptives and correlations

Table 2 shows descriptive statistics which indicate that the highest mean scores were detected on the rewards (4.19) and time allocation (4.19) factors. Apart from academic entrepreneurship outputs all mean scores were above the 1–7 Likert score average, with normal distributions of greater than 1.00 indicating relatively high standard deviations. The Pearson's correlation coefficients shows that there was a "significant positive relationship" between academic entrepreneurship outputs and each of the IVs in terms of rewards ($r = 0.444$, $p\text{-value} < 0.01$), senior management support ($r = 0.331$, $p\text{-value} < 0.01$) and time allocation ($r = 0.232$, $p\text{-value} < 0.01$). As the correlations amongst the IVs were not very high (> 0.7) the issue of multicollinearity did not seem problematic.

Table 2: Descriptives and correlation matrix

Factors	Mean	Std. Deviation	1.	2.	3.	4.
Rewards	4.19	1.05	1			
Senior management support	4.06	1.09	.577**	1		
Time allocation	4.19	1.03	.601**	.498**	1	
Academic Entrepreneurship outputs	3.34	1.64	.444**	.331**	.232**	1

** Correlation is significant at the 0.01 level (2-tailed)."

Testing the study hypotheses

A multiple regression model was fitted with the Log academic entrepreneurship outputs as the DV, and resources, senior management support and time allocation as the IVs. The DV, academic entrepreneurship outputs was transformed to the natural logarithmic of $DV + 1$, labelled as Log Academic Entrepreneurship Outputs. This was done since the DV was producing errors terms that were not close to the normal distribution.

The summary results in Table 3 indicate that the IVs explain 19 percent of variation in the DV – academic entrepreneurship outputs – as indicated by the adjusted R^2 of .190. In the ANOVA section of Table 3, which assesses the overall statistical significance of the model, it can be deduced from the F-value of 20.139 ($p \leq 0.000$) that at least one of the IVs is significant in predicting academic entrepreneurship outputs. Table 3 also shows the regression coefficients where one of the predictors has a significant predictive value on the DV, as per the t-values with a significance level greater than 0.05. It is interesting to note that rewards (standardized beta = 0.414, $p\text{-value} = 0.009$) had the highest impact on the DV, followed by non-significant factors of senior management support (standardized beta = -0.124, $p\text{-values} = 0.089$) and time

allocation (standardized Beta = -0.088, p-values = 0.238). It is worth mentioning that while the coefficient value for the overall model was positive and significant (p-value = 0.001) indicating alignment to the theory underpinning the hypotheses, only H2 can be supported in terms of the significant results obtained from the regression analysis.

In terms of multicollinearity, as per the coefficients section in Table 3 it is noted that the VIF values were all less than 10, which implies that there was no problem of multicollinearity. Furthermore the conditions for fitting a regression model were not violated where the regression model in this case was formulated as: $\hat{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3$, and where \hat{y} was the predicted value for the Log academic entrepreneurship outputs, x_1 was rewards, x_2 was senior management support, and x_3 was time allocation. The final model results are then presented as: $\hat{y} = .715 + 0.301 x_1 + 0.087 x_2 - 0.065 x_3$.

Table 3: "Regression summary"

"Model"	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson"			
1	.448 ^a	.200	.190	.68469	.281			
^a Predictors: (Constant), Time Allocation, Senior Management Support, Rewards								
^b Dependent Variable: Log Academic Entrepreneurship Outputs								
"ANOVA Section"								
"Model"		Sum of Squares	df	Mean Square	F	Sig."		
1	Regression	28.324	3	9.441	20.139	.000 ^b		
	Residual	112.981	241	.469				
	Total	141.306	244					
^a Dependent Variable: Log Academic Entrepreneurship Outputs								
^b Predictors: (Constant), Time Allocation, Senior Management Support, Rewards								
"Coefficients ^a "								
"Model"		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics"	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.715	.210		3.400	.001		
	Rewards	.301	.057	.415	5.280	.000	.536	1.866
	Senior management	.087	.051	.124	1.710	.089	.631	1.585
	Time allocation	-.065	.055	-.088	-1.184	.238	.604	1.655
^a Dependent Variable: Log Academic Entrepreneurship Outputs								

DISCUSSION AND CONCLUSIONS

The aim of this article was to investigate the role of organizational factors as predictors of academic entrepreneurship in the broader university context. While several positive interrelationships between the organisational factors and academic entrepreneurship outputs were observed, only rewards were found to have a significant impact on academic entrepreneurship outputs. This finding is in line with Huyghe and Knockaert's (2014) theorising

that aligning rewards and incentives with commercialisation activities promotes academic entrepreneurship. There is sufficient evidence to show that the achievement of set goals, which is directly linked to a results-based incentive system, is critical to the promotion of entrepreneurship (Perkmann et al. 2013). Entrepreneurially managed organisations tend to base compensation on how individuals contribute to value creation (Kuratko et al. 2014), where reward systems should be “structured with clear goals, provide feedback mechanisms, place emphasis on individual responsibility, and must be results driven” (Kearney et al. 2009, 28).

As per the study hypotheses, while it was expected that management support and time allocation would be perceived as significant factors in determining academic entrepreneurship outputs, non-significant findings were obtained. Comparable findings reveal that “informal factors (e.g., attitudes, role models) have a higher influence on university entrepreneurial activity than formal factors (e.g., support measures, education and training)” (Guerrero and Urbano 2012, 45). Consequently, it is acknowledged that academic entrepreneurial outcomes are only possible if individual faculty members perceive that this behaviour is desirable and feasible (Chantson and Urban 2018). In other words, management cannot enforce academic entrepreneurship – it is primarily a voluntary act. In this regard for HEIs to experience an increase in academic entrepreneurship, there needs to be a culture and climate that is conducive to entrepreneurship because the primary role of academics for years has been teaching and research not entrepreneurial thinking (Kirby et al 2011; Urbano and Guerrero 2013).

The study findings can be further interpreted in the context of recent conditions of increased “fiscal pressure” at HEIs, where it has become necessary for “management not only to maximise efficiency in the provision of services, but also to innovate and discover new ways of doing things (i.e. be entrepreneurial), in order to achieve more with less” (Chantson and Urban 2018, 115). Jakovljevic (2018) proposes a model that presents the “flow of an innovation process that is based on the foundations of a well-being society. In summary the model presents a basic innovative life cycle where institutions are responsible for initiating awareness programmes, developing training methods, and ensuring human resources in order to maintain and monitor the innovative cycles of academics.”

The article findings also have broader contextual and policy relevance, where recommendations are mainly management related:

- University management must design and implement simple and harmonised academic entrepreneurship support mechanisms allowing for academic entrepreneurship to flourish;
- Managers must understand what academics value and how to incentivise at both the team and individual level;

- There is a convincing need for universities to modify “promotion and tenure and remuneration systems” for academic staff so that commercialisation behaviours are appreciated;
- There needs to be an inducement agenda in place to reward individual and collective efforts, since the “participation of different agents, such as students, researchers, administrative and managerial staff is imperative to academic entrepreneurship” (Urban 2019, 194);
- Easier access to networks of individuals and technologies from diverse praxis spheres need to be encouraged and coordinated;
- Policies in academia should attempt to mitigate and manage potential risks of academic entrepreneurship participation, in particular the potential neglect of journal publishing;
- Finally, a comprehensive set of capabilities needs to be developed at universities, ranging from identifying and exploiting real opportunities, protecting innovations, and succeeding to control entrepreneurship academic outputs for future rents.

In challenging the notion of academic entrepreneurship, Beckman and Cooper (2013) present a strong argument in terms of “global neoliberalism and managerialism in HEIs and provide a warning against the entrepreneurial movement defined by the era of its marketization”. Their concerns are the transformation of the student into a “customer, and the false dichotomy of managerialism and collegiality” (Steenkamp 2017). Similarly, others note that HEIs in South Africa have unassumingly adopted leadership styles that focus on “high levels of productivity and heedlessly adhere with neoliberal, managerialist approaches to leadership in education, which in fact militates against the very idea of education and its intertwined practices – thereby undermining the Derridian notion of *community of thinking*” (Waghid and Davids 2016). These concerns need to be taken seriously as universities in South Africa have been influenced by the legacy of colonisation and apartheid, where a high Gini coefficient combined with high levels of poverty and inequality persist (Kruss and Visser 2017). Consequently, universities continue to be shaped by a historical social context and the idea of academic entrepreneurship needs to be applied with caution and should also involve a social entrepreneurship component. Social entrepreneurship plays a pivotal role in promoting entrepreneurial initiatives and building social capital to address social challenges in regions and local communities (Urban 2019).

The article has limitations which may offer opportunities for future research. The “cross-sectional nature of the study excludes any conclusions to be made about a possible causal relationship” between the organisational factors investigated and academic entrepreneurship

outputs. Future research could conduct a “longitudinal study to provide supplementary understandings and causal inferences into the relationship between these factors”. While the study depended on “perceptual data where responses may have been prejudiced by perceptual biases and social desirability, such bias was controlled via the *ex ante* method of countering common method bias” (Podsakoff et al. 2012). Despite these limitations this article still presents interesting questions and future researchers could build in this research direction and examine the interconnectedness of exogenous environmental and individual factors on academic entrepreneurship outputs.

NOTE

1. University or universities are used as shorthand for publicly funded HEIs and other research institutions such as the Science Council throughout the study.

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