



CHEC

Cape Higher Education Consortium

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THEME: CHECH WCG INNOVATION GRANT 2019

PROJECT: Harnessing the Power of Machine Learning to
Identify Nascent Entrepreneurs.

REPORTING PERIOD: June 2021

ABSTRACT

The potential impact of the Fourth Industrial Revolution (4IR) on the world of work is not yet fully understood. One thing, however, is certain: the rapid changes that will be brought about by digitization will have a knock-on effect on the economy and will determine which types of jobs “survive” these changes. Entrepreneurs and SMMEs play a critical role in both the formal and informal sectors of the South African economy, where currently one in three adult workers are unemployed (Stats SA, 2018). However, funding and development opportunities have not kept pace with the large inflow of young job seekers into the formal and informal sectors of the economy. The current project aims to make use of machine learning and big data algorithms to optimise the scoring of Assessment Centre data, so that high-potential nascent entrepreneurs can be identified.

INTRODUCTION AND AIMS

The primary objective of this project is to harness the use of technology to facilitate the selection and development of entrepreneurs in a more cost- and time-effective manner. As discussed above, entrepreneurs are viewed as a catalyst for economic advancement and job creation at both a provincial and national level.

As a secondary objective, we are interested in furthering the research around Assessment Centres (ACs) and Situational Judgement Tests (SJTs). The use of technology is a popular area of discussion and study in the personnel psychology field, with psychometric tests (such as personality and cognitive ability measures) typically receiving greater focus. ACs and SJTs have been limited in practice by the time and cost involved in their administration, although they offer several important advantages over the use of psychometric tests (less bias and greater predictive validity). Based on our research, a scoring algorithm that incorporates

the use of artificial intelligence (AI) and machine learning has not been used before in a South African context, and can therefore benefit funders, small businesses, governmental initiatives, local researchers, test publishers, and organisations who wish to make use of this technology. The primary advantage of the technology is that it significantly brings down the cost of assessment while at the same time improving the strength of prediction.

RESEARCH APPROACH AND METHODS

The primary objectives of the project are:

- To create a competency model that is able to provide a valid prediction of entrepreneurship performance amongst South African candidates.
- To map the competency model to an Assessment Centre (AC) exercise that can be administered to candidates.
- To build a self-scoring algorithm based on the work of Professor Born and colleagues that incorporates cutting-edge machine learning and AI.
- To assess and score a pilot study using entrepreneurs to validate both the AC and the scoring algorithm.

A validated, machine learning driven AC can be used to select and develop South African entrepreneurs in a highly cost- and time-effective manner. These cost and time savings will be achieved through the use of machine learning algorithms to screen free text responses to AC data. According to the proposed project plan, the key milestones that should have been achieved by June 2021 include:

- Development of the competency model
- Development of AC exercises
- Development of scoring algorithm

- Pilot testing of the algorithm

I am happy to report that we have achieved all these milestones. We have a basic scoring algorithm that seems to work well. We tested the model against ten post-graduate students who have shown an interest in pursuing a career in entrepreneurship after graduation. The competency framework is developed from literature based on the latest thinking in the field of entrepreneurship. The following competencies are measured by the SJT:

- 1. Opportunity Spotting
- 2. Risk Taking Propensity
- 3. Social Intelligence
- 4. Persistence
- 5. Technical Skills

The feedback report is auto generated and no human/clinical interaction is needed to process the report. The feedback report is easy to understand and provides valuable feedback on how to build on strengths, and develop areas of weakness, to aspiring entrepreneurs. The user interface is easy to understand and the SJT can be completed on a web interface or mobile phone. I am attaching a sample report for your perusal. Please see link to the web-based application (http://www.data4.co.za/sjt/user_maintenance.aspx?form=0).

We have achieved the objectives of our study insofar as:

1. The assessment takes approximately 20 minutes to complete
2. The minimum scholastic requirement is a grade 9 education
3. It is cost effective
4. It is scalable, and
- 5 The assessment and its scoring are fully automated.

To my mind, the SJT provides a practical and research-based assessment to select nascent entrepreneurs that show promise. More importantly, we have developed an easy-to-use interface for administrators to control test links, and to collate information for further validation and research. However, our study has revealed several components of the application that need more attention. Although we have a basic machine learning algorithm, much more data is needed for its adequate calibration and training. Secondly, the mobile user interface (which is at present optimized for google chrome) needs more software development to function across all major mobile phone and web browser platforms. Further, the cloud-based application is currently hosted on the developers' private server. The source code would need to be moved from this server to secure the integrity of the measure, and to comply with the latest stipulations of the South Africa Protection of Personal Information Act (2021). Finally, in order to comply with the Employment Equity Action section 8 (1998), the SJT needs to be validated, which would establish its reliability and validity, as well as ensure that it will not discriminate unfairly between ethnic groups.

We would like to introduce these valuable changes to the SJT in the next round, but this would require additional funding. We kindly request that the WCG consider this request. However, we would like to stress that the application is market-ready and can be deployed for the recruitment and selection of nascent entrepreneurs.



- . It is critically important that CHEC and WCG decide what they would like to do with the application, and where they would like to deploy it. **It is also important that the task team reach an agreement regarding the ownership of the IP associated with the project.** This is very important because the owners of the IP will need to invest in the hosting of the application, as well as the ongoing research, development, and legislative compliance.

I want to thank the Western Cape Government in association with CHEC for the research grant and the opportunity to contribute to the development and selection of nascent entrepreneurs. I believe that the outcomes from the current study made an important contribution towards this laudable regional and national goal.

Sincerely

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BUDGET

Description of budget line item		Budget	Spent
a.	<p>Phase one (one month): Development of the entrepreneurship competency model</p> <ul style="list-style-type: none"> • Masters' Students from Industrial Psychology acting as administrative assistants (R3,000 per month x 1 month) • Set-up of a workshop between project partners including representatives from Computer Science, Business/Entrepreneurship Studies, Industrial Psychology, and the WCG (cost includes board-room facilities, printing, catering and development of material) – R5,000 • Consultation fee: Design of Assessment Centre – R2500 	R15,500	R12, 500
b.	<p>Phase two (two months): Adaptation of the digital Assessment Centre in-basket exercise that will form the measurement basis of the project.</p> <ul style="list-style-type: none"> • Master's Student from Computer Science acting as an administrative assistant (R3,000 per month x 6 weeks) • Masters' Students from Industrial Psychology acting as administrative assistants (R3,000 per month x 6 weeks) • Salary of Lead Researcher 	R9,000	R9,000
c.	<p>Phase three (3 months): Development of the scoring algorithm, based on the previous work by Professor Born.</p> <ul style="list-style-type: none"> • Master's Student from Computer Science acting as an administrative assistant (R3,000 per month x 6 weeks) • Masters' Students from Industrial Psychology acting as administrative assistants (R3,000 per month x 6 weeks) • Technical consultation and integration of the algorithm into the digital platform by a relevant expert – R18,000 	R24,000	



d.	<p>Phase four (3 months): Pilot study for the scoring algorithm, by assessing potential entrepreneurs involved in funding/training initiatives.</p> <ul style="list-style-type: none"> • Master's Student from Computer Science acting as an administrative assistant (R3,000 per month x 3 months) • Masters' Students from Industrial Psychology acting as administrative assistants (R3,000 per month x 3 months) • Additional ad-hoc assistants who will facilitate the assessments (R1,000 per facilitation session x 5 sessions) • Travel costs to entrepreneurship funding initiatives (within Western Cape) (R1,000 per trip x 5 trips) • 	R28,000	
e.	<p>Phase five (3 months): Analysis of the outcomes and compilation of a comprehensive technical report and journal article(s).</p> <ul style="list-style-type: none"> • Masters' Students from Industrial Psychology acting as administrative assistants (R3,000 per month x 3 months) • Subscription to MPLUS analysis software (R12,500) • Travel costs to presentations for entrepreneurship funding initiatives (within Western Cape) (R1,000 per trip x 4 trips) • Office expenses and printing costs (R500) 	R26,000	
TOTAL		R100,000	

