Using entrepreneurial competencies and action to profile entrepreneurs: a CHAID analysis approach

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Abstract

Purpose – Entrepreneurial trait and behaviour approaches are used to identify differing entrepreneurial profiles. Specifically, this study aims to determine which entrepreneurial competencies (ECs) can predict entrepreneurial action (EA) for distinct profiles, such as male versus female, start-up versus established and for entrepreneurs within different age groups and educational levels.

Design/methodology/approach – The research was conducted using a survey method on a large sample of 1,150 South African entrepreneurs. Chi-squared automatic interaction detection (CHAID) algorithms were used to build decision trees to illustrate distinct entrepreneurial profiles.

Findings – Each profile has a different set of ECs that predict EA, with a growth mindset being the most significant predictor of action. Therefore, this study confirms that a "one-size-fits-all" approach cannot be applied when profiling entrepreneurs.

Research limitations/implications – From a pedagogical standpoint, different combinations of these ECs for each profile provide priority information for identification of appropriate candidates (e.g. the highest potential for success) and training initiatives, effective pedagogies and programme design (e.g. which individual ECs should be trained and how should they be trained).

Originality/value – Previous work has mostly focused on demographic variables and included a single sample to profile entrepreneurs. This study maintains much wider applicability in terms of examining profiles in a systematic way. The large sample size supports quantitative analysis of the comparisons between different entrepreneurial profiles using unconventional analyses. Furthermore, as far as can be determined, this represents the first CHAID conducted in a developing country context, especially South Africa, focusing on individual ECs predicting EA.

Keywords Profiling entrepreneurs, Entrepreneurial action, Entrepreneurial competencies, CHAID analysis, Emerging economies

Paper type Research paper

1. Introduction

Researchers and policymakers have acknowledged entrepreneurship as a major driver of economic growth across the globe (Pradhan *et al.*, 2020). However, entrepreneurial activity

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remains slow in developing countries – including South Africa. Yet, recent findings indicate that entrepreneurial activity in South Africa is improving, with SMEs showing signs of going beyond the start-up to the growth stage (Bowmaker-Falconer and Meyer, 2022). Prior evidence suggests that entrepreneurship training and support programmes, typically focus on the entrepreneur as a single homogeneous group, resulting in programmes providing "blanket" support (Morris *et al.*, 2013). This is also true for earlier work regarding the pedagogy to teach entrepreneurship; some scholars suggest that a single method or approach can be applied regardless of the individuals being trained (Pittaway and Cope, 2007). However, more recent research indicates that the pedagogy used to teach entrepreneurial competencies (ECs) is often applied to diverse groups that are made up of individuals with varying demographic characteristics (Mitchelmore and Rowley, 2010), behaviours and learning styles and, therefore, a one-size-fits-all teaching approach does not always work effectively (Baird, 2023). Mitchelmore and Rowley (2010) argue that ECs need to be trained and developed at various stages of the entrepreneurial venture, owing to the different competencies required at each stage. Beyond these venture lifecycle stages, entrepreneurs differ with regard to their ECs (Morris *et al.*, 2013), intentions (Nikou *et al.*, 2019) and other demographic characteristics such as gender, age and educational levels (Del Bosco *et al.*, 2021; Nikou *et al.*, 2019). Heterogeneous profiles are therefore required to understand which ECs should be developed, trained and supported for entrepreneurs of different ages, genders, levels of education and at various stages of the venture life cycle (Mitchelmore and Rowley, 2010).

Different approaches can be used in profiling entrepreneurs, including the trait approach, the behaviour approach or the mixed approach (Gartner, 1988). This paper focuses on the mixed approach and includes demographic variables (trait approach), 19 individual ECs (trait and behaviour approach) and entrepreneurial action (EA) (behaviours approach). EA is a purposeful human activity undertaken by entrepreneurs to create something new to make profits (Wood *et al.*, 2021). ECs, on the other hand, are a higher level characteristic, comprising skills, knowledge and personality traits (Man *et al.*, 2002). ECs allow people to perform tasks (Mitchelmore and Rowley, 2010) and facilitate the emergence of new ventures (Rasmussen *et al.*, 2014). There is evidence that ECs can predict EA (Mitchelmore and Rowley, 2010; Morris *et al.*, 2013). However, in this paper, we determine which individual ECs can predict EA for different entrepreneurial profiles. By including the predictability of EA, the development of the behaviour approach is advanced by illustrating different entrepreneurial profiles according to their predictability of EA.

Typically, entrepreneurs are classified in the venture lifecycle as either potential, nascent, start-up, established, or discontinuing entrepreneurs (Hill *et al.*, 2022). This classification scheme is used as a basis for sampling entrepreneurs in this study, whereby a sample of start-up and established entrepreneurs is included. A start-up entrepreneur, also known as a new business owner, is an entrepreneur who has progressed beyond the nascent stage and paid salaries and wages for more than three months but less than 42 months through the business's operations. An established business/entrepreneur is one that has earned or paid wages for at least 42 months (Hill *et al.*, 2022). Therefore, an established entrepreneur's business is a venture that has progressed from a start-up to a fully-fledged business venture, making the entrepreneur an established business owner. This study focused on entrepreneurs in the start-up and established stages, because these entrepreneurs have crossed the Rubicon model and moved beyond the motivational stage into the implementation stage of action (Gollwitzer, 2012). The mindset theory (Delanoë-Gueguen and Liñán, 2019) suggests that an individual's mindset develops as he or she advances through the various phases of action.

Juric *et al.* (2019) point out that existing research for developing profiles of entrepreneurs mostly uses standard statistical methods such as regression analysis and one-way ANOVA. However, to advance the development of the profiles of entrepreneurs, a more robust methodology is required. The purpose of this paper is therefore to use the Chi-squared automatic interaction detection (CHAID) decision tree analysis to profile South African entrepreneurs according to the similarities and differences in terms of their individual ECs and other demographic characteristics such as gender, age, education levels and venture lifecycle stages; and to determine which individual ECs can predict EA for various profiles of entrepreneurs. CHAID analysis is a robust and useful methodology for analysing large numbers of predictor variables (it is a nonparametric and nonlinear approach, making it superior to more popular statistical techniques) (Kass, 1980). By using these features, it is not necessary to assume normality and homogeneity in the data (Murphy and Comiskey, 2013). Neither linear relationships nor dependence between variables are assumed and the model can be applied to independent or dependent variables in either continuous or discrete form.

The overall findings of this paper indicate that individual ECs such as growth mindset, opportunity assessment, self-efficacy and innovation can predict EA. When profiling start-up entrepreneurs, social intelligence and value creation ECs are the most statistically significant predictors of EA, whereas growth mindset, opportunity assessment, flexibility and adaptability ECs are statistically significant predictors for established entrepreneurs. Also, growth mindset, opportunity assessment and self-efficacy are the key statistically significant predictors for male entrepreneurs, while the ECs of value creation and leadership are the key statistically significant predictors for women entrepreneurs. Similarly, specific ECs can predict EA for individuals of a specific age group as well as educational level. The findings can encourage entrepreneurial marketing (EM) scholars to pay closer attention to specific ECs such as value creation (Acs *et al.*, 2016; Sarasvathy and Venkataraman, 2011) and opportunity recognition and assessment (Whalen and Akaka, 2016), which are established concepts in the EM field (Morris *et al.*, 2002; Peterson, 2020).

The findings have implications for both theory and practice. Firstly, the study is conducted on a sample of start-up and established entrepreneurs to explore how best to categorise and describe the profiles of the sample. Prior research mostly conducted profiling research on one distinct group, such as a student sample (Saunders *et al.*, 2016), a graduate sample (Peters and Brijlal, 2011), tourism entrepreneurs (Çakmak *et al.*, 2019) and women entrepreneurs (Hemalatha and Nayaki, 2014). We, therefore, contribute to theory by providing a more systematic grouping of entrepreneurs based on the distinct characteristics investigated in this study. From a practical point of view, the differing identified profiles not only serve as a marketing tool for identifying appropriate candidates to be selected for specific entrepreneurship interventions and support programmes but can also assist EM educators to design pedagogy to teach and develop specific ECs. Hence, we confirm that a one-size-fits-all approach cannot be applied when designing pedagogy to teach ECs more effectively to different entrepreneurial profiles. For example, when designing EC pedagogy for a women entrepreneur profile, the value creation and leadership ECs should be developed, whereas for a male entrepreneur profile, the pedagogy that focuses on the growth mindset, opportunity assessment and self-efficacy ECs should be applied. In a recent study, Stenholm *et al.* (2021) used the Entrecomp framework to determine which pedagogy and teaching methods support each individual EC development. For example, they suggest that the leadership and autonomy (*locus* of control) ECs are developed through pedagogies such as conducting capstone and other real-life case projects, e.g. working in teams (team-based projects). Down and Warren (2008) argue that entrepreneurial narratives play a role in

entrepreneurial identity formation (behaviour). They suggest that ECs such as social Intelligence, calculated risk-taking, growth mindset, self-efficacy and autonomy (*locus* of control) can be developed through entrepreneurial narratives and identities.

Several profiling studies focus on the demographic characteristics (e.g. trait approach) of entrepreneurs in different stages of the venture lifecycle. However, few concentrate on the differences in the entrepreneurial profiles of individual ECs and how these competencies differ (behaviour approach) between them (Mueller, 2006). Thus, this paper makes a significant theoretical contribution to entrepreneurial research and literature by applying both the trait and behaviour approaches to profile entrepreneurs. Furthermore, this paper also makes a methodological contribution as we used CHAID decision trees to analyse the differing entrepreneurial profiles, particularly with respect to their ECs. Even though the CHAID analysis has not been used widely, a need to examine profiles in a systematic way has called for this investigation (Mair *et al.*, 2012). As far as can be determined, this represents the first CHAID study to be conducted in a developing country context, focusing on individual ECs and EAs.

2. Theoretical framework and hypothesis development

2.1 Entrepreneurship and entrepreneurs in the emerging economy context

Recent evidence indicates that in 2022, South Africa had the highest unemployment rate of 34.5% in Africa (Saleh, 2023). Because of South Africa's high unemployment rate, the government has implemented policies to encourage citizens to become entrepreneurs (Moos *et al.*, 2022). In spite of the government's efforts, other factors, such as a lack of entrepreneurial skills and competencies, persist. Emerging economic contexts in particular represent contexts in which entrepreneurs must compete and operate in highly volatile, uncertain and risky environments (Persinger *et al.*, 2007). As a result, entrepreneurs operating in such environments (including South Africa) may require skills that differ from those required in the more traditional business-creation processes of advanced economies. EA, on the other hand, has also been found to be influenced by the environment and support that entrepreneurs receive in their home country (Trivedi, 2017). The aforementioned implies that ECs and EAs are factors that differ between emerging and advanced economies and this distinction also influences the profiling of entrepreneurs.

2.2 Previous literature on profiling entrepreneurs

Previous research indicates that when attempting to profile entrepreneurs, the *trait* approach focuses on identifying entrepreneurial characteristics, personalities and competencies (Alda-Varas *et al.*, 2012; Gartner, 1988). Entrepreneurs can also be classified based on socio-demographic characteristics, occupation, educational attainment and attitude towards learning and motivational factors affecting new venture creation (Birdthistle, 2006). Furthermore, human competencies such as strong leadership and organisational skills, entrepreneurial intent, risk-taking, innovativeness and self-efficacy are used to profile entrepreneurs (Brice and Spencer, 2007; Moraes *et al.*, 2022). Entrepreneurs have also been profiled on a cultural basis, with a focus on entrepreneurial commitment across different cultures (Tasnim *et al.*, 2018). Other studies have focused on profiling a specific segment of entrepreneurs, such as tourism entrepreneurs (Çakmak *et al.*, 2019) and women entrepreneurs (Hemalatha and Nayaki, 2014). However, Gartner (1988) argues that studies such as these do not consider the heterogeneous spheres or the entrepreneurial process in which the entrepreneur operates. Notably, profiling a specific segment of entrepreneurs alone is insufficient to explain the entrepreneurial initiative phenomenon (Gartner, 1988) or to reach a definition thereof (Alda-Varas *et al.*, 2012).

The second profiling outlook, the *behaviour* approach, focuses on the entrepreneurial process and the behaviours that entrepreneurs perform (Alda-Varas *et al.*, 2012). Scholars (Drucker, 1985; Gartner, 1988) support this approach, as it emphasises the action taken in terms of entrepreneurial behaviour activities more than solely focusing on the trait and demographic variables. This perspective proposes specific ECs that an entrepreneur must have to enhance EA (Alda-Varas *et al.*, 2012). The third approach is a combination of the *trait and behaviour* approaches and is therefore the most comprehensive approach when conducting the profiling of entrepreneurs (Gartner, 1988). However, the majority of profiling studies followed either the trait or behaviour approach, and a gap exists in profiling entrepreneurs by following a mixed approach – the trait and behavioural approach (Alda-Varas *et al.*, 2012), which is the focus of this study.

2.3 Entrepreneurial competencies research

Ahmad (2007) describes inherent ECs as the combination of attributes and behaviours that enable an entrepreneur to achieve and maintain business success. Man *et al.* (2002) define ECs as the abilities of an entrepreneur to successfully perform their job function. In essence, ECs facilitate the development of a new venture by providing the ability to build the set of resources required for its growth (Rasmussen *et al.*, 2014). Sánchez (2013) agrees that entrepreneurial capacity, or competencies, determine the success and competitiveness of a business, which is integral to participating in the business world. Kyndt and Baert (2015) further state that ECs can be gained through experience, training and the ability to adapt according to the situation.

Morris *et al.* (2013) conducted a meta-analysis and Delphi study that identified 13 ECs that are related to EA. Other scholars (Man *et al.*, 2002; Mitchelmore and Rowley, 2010; Rasmussen *et al.*, 2011) went a step further to identify six more ECs, for a total of 19 ECs. These 19 competencies include opportunity recognition, opportunity assessment, innovation, need for achievement (motivation), autonomy/*locus* of control, creative problem-solving, curiosity, perseverance, flexibility and adaptability, resourcefulness, values-driven, ethics, action-orientation, calculated risk-taking, value creation, growth mindset, leadership, self-efficacy and social intelligence. We therefore include these 19 ECs that were cited the most to determine which ECs can predict EA during the start-up and established stages of the venture lifecycle. Appendix 1 outlines definitions for the 19 ECs that are supported by the entrepreneurship literature.

Stenholm *et al.* (2021) found that ECs are not developed in isolation and that pedagogies should effectively be applied to support the development of different competences at the same time. They suggest that crafting business and marketing plans, analysing new, imaginary ventures and use of art-based activities such as dance, play and role play develop the innovation EC. Crafting business plans and developing company strategies together with local companies and solving real-life company problems in projects develop opportunity recognition, opportunity assessment and problem-solving ECs. Using self- and group-based evaluations develops self-efficacy EC. Crafting business plans and developing company strategy and conducting financial calculations develop the calculated risk-taking EC. Flipped classroom, co-designing course content, conducting capstones and other real-life case projects develop the action orientation EC. Conducting capstone and other real-life case projects and working in teams develop the leadership and autonomy (*locus* of control) ECs. At the same time, Down and Warren (2008) suggest that preparing entrepreneurial narratives can play a role in the formulation of an entrepreneurial identity. Specifically, their research suggests that identity is constructed through clichés and metaphors, which can develop the ECs of social intelligence, calculated risk-taking, growth mindset, self-efficacy

and autonomy (*locus* of control). Alvesson and Willmott (2002) agree and find that a set of characteristics, such as bravery, ambition, success, autonomy and self-sufficiency, might be imitated and acquired through processes of identity work.

2.4 Entrepreneurial action

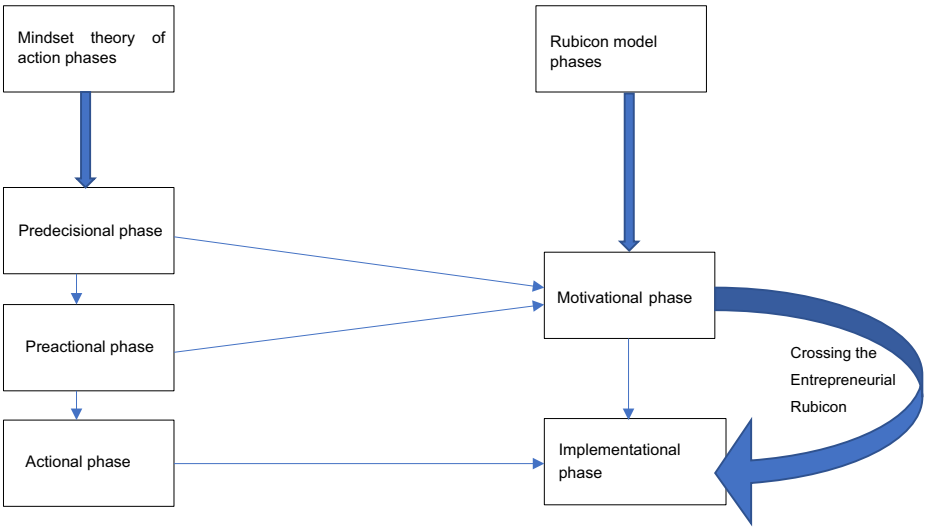
2.4.1 Mindset theory of action phases and entrepreneurial Rubicon crossing. Mindset theory suggests that an individual's mindset develops as he/she advances through the various phases of action (Delanoë-Gueguen and Liñán, 2019; Gollwitzer, 2012). Therefore, to understand the impact of individual ECs on EA, it is crucial to determine the constituent phases of EA. Mindset theory suggests that EAs can be grouped into three different phases, namely, the pre-decisional, pre-actional or actional phases (Delanoë-Gueguen and Fayolle, 2019). These authors further point out that the mindset theory's pre-decisional and pre-actional phases align with the Rubicon model's motivational phase, and the implementation (actional phase) of the Rubicon model aligns with the mindset theory's action phase (Delanoë-Gueguen and Fayolle, 2019).

Brandstätter *et al.* (2003) highlight that to achieve actual action, a shift is needed from the goal (i.e. predecisional and preactional phases) to the implementation phase. However, for this shift to take place, entrepreneurs need to progress through the various phases of EA (Teague and Gartner, 2017). For example, to become an entrepreneur during the pre-decisional and pre-action phases (i.e. when an individual crosses the entrepreneurial Rubicon), people no longer follow motivation but rather act from choice (Delanoë-Gueguen and Fayolle, 2019). In this model, the role of intention in explaining behaviour seems to vanish once individuals cross the Rubicon (Delanoë-Gueguen and Fayolle, 2019). Hence, the study focuses on the implementation phase of the entrepreneurial Rubicon. Therefore, we will investigate the profiling of entrepreneurs who have already crossed the Rubicon and engaged in EA by focusing on the actual action phase. Figure 1 illustrates the interrelationship between the mindset theory of action and the entrepreneurial Rubicon.

2.4.2 Predictability of entrepreneurial competencies on entrepreneurial action. Prior evidence suggests that ECs are directly related to EAs (Morris *et al.*, 2013). Kyndt and Baert (2015), who share a similar view, state that ECs can predict future entrepreneurial activity. At the same time, the measurement of ECs is done through behaviour measurement (Draksler and Širec, 2018). According to Man *et al.* (2002), behavioural indicators that are used as ECs can be enhanced through an individual's behaviour and actions. It is imperative to identify which ECs predict EA so that organisations, businesses and higher education institutions can influence their development (Kyndt and Baert, 2015). Empirical research on the predictability of individual ECs to EA is scarce, and this paper will shed light on it.

H1. Entrepreneurs in South Africa can be profiled according to the predictability of individual ECs to EA.

2.4.3 Start-up entrepreneurs and established entrepreneur entrepreneurial competencies contrasted. Rasmussen *et al.* (2011) confirm that ECs are not fully developed at the beginning of the venture life cycle, particularly at the potential and nascent stages, but ECs emerge and develop as the entrepreneur progresses through the venture lifecycle. Research indicates that ECs are more important during the early stages of a venture's life cycle, whereas managerial competencies are required later when the business is running and growing (Morris *et al.*, 2013). This is probably where the distinction comes in between start-ups and established entrepreneurs. However, the initial stages and emergence of business and organisational development (Lichtenstein *et al.*, 2006) have been remarkably neglected



Source: Authors' own creation

Figure 1. Interrelationship between the mindset theory of action and the entrepreneurial Rubicon

(Davidsson and Honig, 2003), particularly with regard to the ECs required and how these change as the venture lifecycle progresses (Morris *et al.*, 2013). They are, thus, essential to understanding these processes, because developed capabilities and competencies based on established ventures may not be transferable from one firm to another (Zahra *et al.*, 2006).

Start-up entrepreneurs need to exhibit essential dimensions that the founder must learn to enable the growth of their business so that they are able to reach the next stage in the venture lifecycle (Kaiser and Müller, 2015). Mitton (1989) posits that specific actions, behaviours and skills reflect ECs. Such actions and skills allow start-up entrepreneurs to identify market opportunities, evaluate the opportunities, develop goals and source the necessary resources needed to effectively run a business to achieve industry effectiveness and business growth (Botha *et al.*, 2015). High levels of tenacity (Yang *et al.*, 2005) and need for achievement (Ademiluyi and Salami, 2022) are exhibited by start-up entrepreneurs, which result in their ability to create a business. In addition, start-up entrepreneurs constantly evaluate and analyse the opportunities they pursue so that they are more able to discard the opportunity if it lacks the promise of success (Dimov, 2010). It therefore appears that ECs such as the need for achievement, opportunity identification and opportunity assessment may be more important for start-up entrepreneurs than established entrepreneurs. Innovation is seen as important to both start-ups and established entrepreneurs. The right ECs can be strong drivers of competitive advantage (Fillis, 2002) and are found in the ability to offer quality, efficiency, speed and flexibility while incorporating mainstream capabilities. Combining these two aspects leads to a dynamic and sustainable strategic position, which makes the organisation a constantly moving target for competitors (Lawson and Samson, 2001).

In contrast, perseverance is described by Muehlfeld *et al.* (2017) as the determination to pursue an opportunity after committing to running a business. Bashant (2014) posits that a core mindset that supports perseverance is called the "Growth mindset". Entrepreneurs who prioritise growth will see their business activities grow. Established entrepreneurs have

probably developed significant perseverance and a growth mindset through previous experience, which will equip them to meet future challenges compared to nascent entrepreneurs (Morris *et al.*, 2013). Furthermore, self-efficacy is essential and expected of both new and established entrepreneurs, as it determines whether a person engages in business-related behaviours (Moraes *et al.*, 2022). The importance of entrepreneurial intention and activity has been demonstrated as a key antecedent of entrepreneurship (Chen *et al.*, 1998; Fuller *et al.*, 2018). However, self-efficacy levels are higher when a person has previous experience and familiarity with the circumstances they currently face (Boyd and Vozikis, 1994). Therefore, established entrepreneurs probably exhibit increased entrepreneurial self-efficacy, perseverance and growth mindset compared to nascent entrepreneurs (Hsu *et al.*, 2017) It is, therefore, hypothesised that:

H2. The individual ECs that predict EA differ between the start-up and established entrepreneurial profiles in South Africa.

2.4.4 Entrepreneurs' demographic characteristics, entrepreneurial competencies and entrepreneurial action. Herrington *et al.* (2017) found a definite relationship between age and entrepreneurial activity levels. For example, the lowest EA rates were found among South Africans aged 25–34 years in 2016. However, entrepreneur participation among the 45–54 age group has been rising consistently over the past three years. More than a quarter of all early-stage EA in 2019 was accounted for by people in this age group. A previous South African survey supports this argument, with clear distinctions made between the entrepreneurial activity levels at the various venture lifecycle stages based on age (FinScope, 2021). Various antecedents have been linked to this increase in entrepreneurial activity, such as older workers becoming redundant in the normal job market and older workers having developed greater experience and resources, such as ECs, capital and network ties, which make entrepreneurial activity more likely (Bowmaker-Falconer and Meyer, 2022). Based on this evidence, it appears that entrepreneurs can be segmented into specific groups based on age, with the likelihood that each age group will have varying ECs, activity levels and motivation for engaging in entrepreneurship.

H3. The individual ECs that predict EA differ for the younger and older entrepreneurial profiles in South Africa.

Furthermore, GEM, the Global Entrepreneurship Monitor, has demonstrated the inextricable relationship between education, entrepreneurial intentions, perceived ECs and, ultimately, the growth of a successful business venture (Bowmaker-Falconer and Meyer, 2022). For example, entrepreneurs at the early stages of their careers are most likely to have had some secondary education or a secondary degree in South Africa (Bignotti and Le Roux, 2020; Van der Westhuizen, 2019). In addition to the accumulation of explicit knowledge, greater levels of education and previous managerial experiences contribute to the provision of entrepreneurial skills (competencies) (Peters and Brijlal, 2011). In this regard, education also appears to be a factor linked to age, as older entrepreneurs have had time to gain the requisite skills through education.

H4. The individual ECs that predict EA differ for the less and more educated entrepreneurial profiles in South Africa.

Previous research on women entrepreneurs indicates that, in general, the number of women pursuing entrepreneurship is lower than the number of men (Koellinger *et al.*, 2013; Piva and Rovelli, 2022). In a developing country context such as South Africa, the situation is no

different (Bowmaker-Falconer and Meyer, 2022). Thus, there is a general consensus that women and men entrepreneurs differ in their respective ECs. The gender gap can be attributed to individual and contextual factors such as attitudes, family history and socio-demographic characteristics (Brieger and Gielnik, 2021). According to Koellinger *et al.* (2013), the entrepreneurial self-efficacy of women is lower than that of men, at least at the individual level. In addition, women have a greater fear of failure, which makes them more reluctant to take risks than men (Wagner, 2007).

H5. The individual ECs that predict EA differ for the male and female entrepreneurial profiles in South Africa.

3. Method

3.1 Sampling and sample size

Entrepreneurs were surveyed to determine their level of ECs using a quantitative research design based on a structured research questionnaire (survey). The final realised sample consisted of 1,150 entrepreneurs, which are split into two sub-samples: 354 (30.8%) start-up entrepreneurs and 796 (69.2%) established entrepreneurs. In this study, a non-probability sampling method, specifically proportionate quota sampling, was used, yielding a response rate of 6.38% from a target population of 18,000 entrepreneurs (Saunders *et al.*, 2016). Thus, caution should be applied when generalising the results to the entire population of entrepreneurs (Clow and James, 2013). Quota control variables were used to ensure representativeness, including the industry in which the entrepreneur's main business operated (i.e. their industry background), as well as the stages of the venture lifecycle in which the entrepreneur was operating (start-up or established). Hence, this sample size of 1,150 is effective to represent the statistical power (VanVoorhis and Morgan, 2007) and representativeness (Saunders *et al.*, 2016) of entrepreneurs in a developing country such as South Africa.

The demographic profile distribution of the sample consisted of gender, age and educational qualifications. There were 70% male respondents and 30% female respondents. The average age of the respondents was 52 years, and 41% of the sample had a post-graduate degree, while 38% had an undergraduate degree or diploma. Furthermore, the businesses of the entrepreneurs in the sample contributed to a broad range of industries, of which the most popular were the retail (34%); business and financial services (25%); and manufacturing and construction (15%) industries.

3.2 Measures

3.2.1 Entrepreneurial competencies. After an extensive literature review on EC work, 19 individual competencies that were included in most studies (Man *et al.*, 2002; Mitchelmore and Rowley, 2010; Morris *et al.*, 2013) were measured in this paper (refer to the EFA results for a list of the 19 ECs). The scales validated by Morris *et al.* (2013) were adapted to fit the geographical scope of the study and were specifically used in this paper. The individual EC scales were composed of four to five items on a Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree).

3.2.2 Entrepreneurial action. McMullen and Shepherd (2006) provided a 17-item EA scale consisting of five-point Likert-type items. The survey asked respondents whether they had participated in the listed start-up activities during the past three years, ranging from 1 (never) to 5 (always). Consistent with the work of Delanoë-Gueguen and Fayolle (2019), the 17 items can be categorised into three action phases, as outlined by the Rubicon

entrepreneurial model. This model divides EA into three phases: pre-decisional, pre-actional and actional (Delanoë-Gueguen and Fayolle, 2019). For the purpose of this study, the CHAID analysis was only conducted on the actional phase factor, as it involves the actual action activities and the implementation thereof.

3.3 Chi-squared automatic interaction detection

CHAID analysis is an effective decision tree that is used to build a predictive model by segmenting populations into meaningful sub-groups or segments by repeatedly splitting segments into two or more nodes (Michael and Gordon, 2004). CHAID uses predictor variables (e.g. EA) to split the sample into a series of subgroups that share similar characteristics called a "decision tree" and the decision tree splits nodes into sub-nodes, creating a tree-like hierarchy of branches. In decision-tree models, variables and statistically significant structures are highlighted and the data sets are divided into subgroups using decision rules. This analysis identifies the independent variable that best explains the dependent variable through a comparison of all independent variables, and the data set is divided into subgroups based on the independent variable selected (Kass, 1980). As more subgroups are generated for significant variables, the relationships between them can also be seen. For each explanatory variable, a significant difference is calculated between the categories, and Bonferroni p-values and χ^2 or F-statistics are calculated by creating contingency tables based on the dependent variable (Michael and Gordon, 2004). For each explanatory variable, the data are grouped into subgroups determined by the Bonferroni p-values of the categories that have the lowest Bonferroni p-values. Based on the best explanatory variable, selected explanatory variables were re-analysed and separated (SPSS, 2012). CHAID was the preferred analysis in this study as it enables all possible entrepreneurial profiles to be selected by illustrating the relationships between the predicted and predicting variables in detail (Horner *et al.*, 2010). A further advantage is that its output is highly visible, with multiple trees, and the profiling of entrepreneurs can be presented visually.

4. Results

4.1 Factor analysis

The EA and EC scales have been adapted for a developing country context; thus, as confirmation of the unidimensionality of each of the 19 ECs as well as the 17 EA items, exploratory factor analysis (EFA) was conducted. Factors with eigenvalues above 1 were accepted in the factor structures. EFA was carried out using the principal axis factoring extraction method to determine the similar behavioural groupings of the ECs. Promax rotation was used when multiple factors were extracted. The Cronbach's alpha coefficient was used to determine the consistency (reliability) of each of the identified factors. Cronbach's alpha values exceeding 0.8 are regarded as excellent values (Nunnally, 1978). However, Bagozzi and Yi (1988) indicate that values greater than 0.6 are acceptable for exploratory research. Previous entrepreneurship research studies in an African context have used alpha values of 0.6 to conduct their analyses (Farrington *et al.*, 2012, p. 336). Consequently, the Cronbach's alpha coefficient of 0.6 for this scale is deemed acceptable for the present study.

The EFA results indicated that all 19 factors were acceptable with Cronbach's alpha values above 0.6, except for resourcefulness. Resourcefulness had Cronbach's alpha values below the threshold of 0.6 (Factor 1: 0.533; Factor 2: 498) and was therefore excluded in the CHAID analyses that follow. Two acceptable factors are loaded for action orientation

(Factor 1: 0.653; Factor 2: 0.699). Therefore, 19 EC factors were identified and used in further analysis.

The 17 EA items were split into three factors with eigenvalues above 1; three items did not load within a single factor and could therefore not be included in the EA factor structure (refer to Appendix 2). The three EA factors are supported by the mindset theory in the literature, which suggests that EAs can be grouped into three different phases, namely, the pre-decisional, pre-actional or actional phases (Delanoë-Gueguen and Fayolle, 2019). It is further supported by the entrepreneurial Rubicon, which consists of the goal, motivational and implementation phases. Therefore, the three EA factors are labelled as follows:

(1) Factor 1: pre-decisional activities;

(2) Factor 2: pre-actional activities; and

(3) Factor 3: action activities.

The Cronbach's alpha values of 0.715 for Factor 1, 0.752 for Factor 2 and 0.728 for Factor 3 (all values above 0.6) indicate internal consistency (reliability) of the scale used for EA and confirm that the three EA factors can be used in further analyses. Consistent with the literature presented on the EA phases and the Rubicon model of action, it is evident that the items loaded under Factor 1 have more to do with the activities that take place when deciding and planning (having a goal) to start a business. On the other hand, the items that loaded under Factor 2, the pre-actional activities, and more specifically under Factor 3, involve more of the actual action (start-up) activities (implementation). Variables loaded under each of the three EAs below indicate the variables that were loaded under each of the three EAs.

Variables loaded under each of the three EAs are as follows:

(1) *Factor 1: pre-decisional activities*

- I have spent a lot of time thinking about starting a business before I actually started my business.
- I have organised a start-up team.
- I have identified market opportunities.
- I have prepared a business plan.

(2) *Factor 2: pre-actional activities*

- I have purchased or leased major items, such as equipment, facilities or property.
- I have purchased raw materials, inventory or other supply.
- I have developed models or procedures for a product/service.
- I have started marketing or promotional activities.
- I am devoted full time to the business.
- I have appointed employees.

(3) *Factor 3: action activities*

- I have selected a business name.
- I have created a legal entity.
- I have registered with the tax authorities.
- I have invested some of my own money in the business.

Source: Author's own contribution

However, to achieve concrete action, a distinct switch from a goal (i.e. pre-decisional and pre-actional phases) to an implementation intention (i.e. actional phase) is required (Brandstätter *et al.*, 2003; Gollwitzer, 2012). Therefore, we will investigate the profiling of entrepreneurs who have already crossed the Rubicon and engaged in EA by focusing on the actual action phase. The CHAID analysis presented next is therefore only conducted on the actional phase of EA (e.g. EA 3 in this paper).

4.2 Chi -squared automatic interaction detection results

4.2.1 19 Entrepreneurial competencies and entrepreneurial action 3: total sample. The first set of CHAID results was conducted on all 19 ECs and EA 3. This is done to determine which ECs predict the actual action activities (EA 3) for the total sample of 1,150.

From Figure 2, it is evident that the growth mindset EC is the strongest predictor of the actual action activities (EA 3). A total of 186 respondents with a growth mindset score above 6.75 also had the highest level of EA 3 (4.727) and respondents with a growth mindset score lower than 4.25 had the lowest level of EA 3 (3.895). The next best predictor of the respondents' EA 3 (i.e. next layer of "branches") depends on their level of the growth mindset EC (i.e. the first layer of "branches"). For respondents who had a growth mindset score between 4.25 and 5.25 or between 6 and 6.75, the next best predictor is opportunity assessment, while for those respondents who had a score between 5.25 and 6, the next best predictor was self-efficacy. At the third level, innovation was identified as a statistically significant predictor. Continuing to expand the CHAID tree to the last layer (also known as "twigs"), one predictor emerged, namely, innovation, which was linked with respondents who had a self-efficacy score higher than 3.2. Nine different segments (paths) can be observed within this CHAID analysis. Table 1 indicates Pearson's correlation analysis, which was run to confirm the CHAID findings in Figure 2.

4.2.2 19 Entrepreneurial competencies and entrepreneurial action 3: venture lifecycle stages. The second set of CHAID results were conducted on all 19 ECs, the actual action factor (EA 3), and the venture lifecycle stages of entrepreneurs in this sample, namely, start-

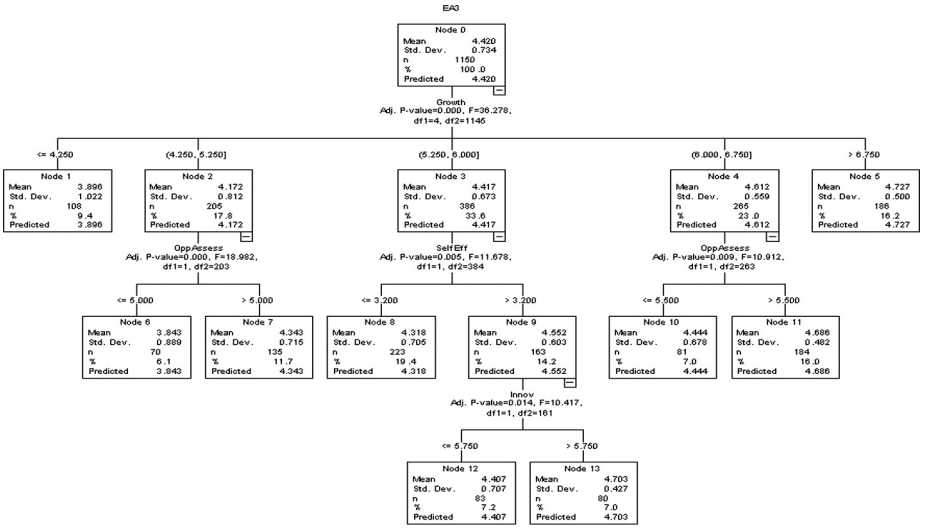


Figure 2.
Actual action activities (EA 3) and the 19 ECs

Source: Author's own contribution

Actual action activities	Opportunity recognition	Opportunity assessment	Social intelligence	Creative problem-solving	Innovation	Flexibility and adaptability	Motivation	Autonomy	Curiosity	Values driven
EA3	0.183**	0.292**	0.192**	0.238**	0.289**	0.233**	0.246**	0.180**	0.280**	0.209**

Notes: **Correlation is significant at the 0.01 level (two-tailed)
Source: Author's own contribution

(*continued*)

Table 1.
Pearson's correlation analysis confirming CHAID findings

Table 1.

Actual action activities	Calculated risk-taking	Value creation	Growth mindset	Self-efficacy	Ethics	Leadership	Action orientation (F1)	Action orientation (F2)	Perseverance
EA3	0.227**	0.302**	0.342**	0.231**	0.040	0.287**	0.181**	0.150**	0.138**

up and established entrepreneurs, separately. This was done to determine which of the ECs are the strongest predictors of each venture lifecycle stage. Because of page limitations, the CHAID Figures for the rest of the results are illustrated in Appendices 3–6.

From Appendix 3, it is evident that the growth mindset EC is the strongest predictor for the established entrepreneur sample ($n = 796$). The 281 respondents with a growth mindset score above 6 also had the highest level of EA 3 (4.648), and respondents with a growth mindset score lower than 4 had the lowest level of EA 3 (3.803). The next best predictor of the established entrepreneur respondents' EA 3 depends on their level of growth mindset EC. For respondents who had a growth mindset score between 4 and 5.25, the next best predictor was opportunity assessment; for those respondents who had a score between 5.25 and 6, the next best predictor was flexibility and adaptability; and for the respondents who had a score above 6, the next best predictor was opportunity recognition. At the third level, opportunity assessment was identified as a statistically significant predictor. Continuing to expand the CHAID tree to the last layer, one predictor emerged, namely, opportunity assessment, which was linked with respondents who had an opportunity recognition competency score higher than 5.6. Eight different segments (paths) can be observed within this CHAID analysis.

For the start-up sample ($n = 354$), the social intelligence EC is the strongest predictor, and for the respondents who had a social intelligence EC above 5.2, the next best predictor is value creation. Furthermore, it was linked with respondents who had a value creation score lower than 5.6, as well as respondents with scores above 5.6. Three different segments (paths) can be observed within this CHAID analysis.

4.2.3 19 Entrepreneurial competencies and entrepreneurial action 3: gender. The third set of CHAID results were conducted on all 19 ECs, the actual action factor (EA 3) and gender, namely, male and female entrepreneurs. This was done to determine which of the ECs are the strongest predictors for male versus female entrepreneurs.

From Appendix 4, it is evident that the growth mindset EC is the strongest predictor for male entrepreneurs ($n = 804$). The 115 respondents with a growth mindset score of above 6.75 also had the highest level of EA 3 (4.767), and respondents with a growth mindset score of lower than 4.25 had the lowest level of EA 3 (3.907). The next best predictor of the males' respondents' EA 3 depends on their level of growth mindset EC. For respondents who had a growth mindset score between 4 and 5.25, the next best predictor was opportunity assessment. For those respondents who had a growth mindset score between 5.25 and 6, the next best predictor was self-efficacy and for the respondents who had a growth mindset score between 6 and 6.75, the next best predictor was opportunity assessment. At the third level, value creation and perseverance were identified as the two statistically significant predictors. Continuing to expand the CHAID tree to the last layer, two predictors emerged, namely, value creation, which was linked with respondents who had a self-efficacy score higher than 3.2, and perseverance, which was linked with respondents who had an opportunity assessment score higher than 5.5. Ten different segments can be observed within this CHAID analysis.

The value creation EC is the strongest predictor for female entrepreneurs ($n = 346$). The next best predictor for the female entrepreneur respondents depends on their level of value creation EC. For respondents who had a value creation EC above 4.6, the next best predictor was leadership. Furthermore, it was linked with respondents who had a leadership score lower than 5.5, respondents with a leadership score between 5.5 and 6, as well as respondents with scores above 6. Four different paths can be observed within this CHAID analysis.

4.2.4 19 Entrepreneurial competencies and entrepreneurial action 3: age. The fourth set of CHAID results was conducted on all 19 ECs, the actual action factor (EA 3) and the age groups of respondents. This was done to determine which of the ECs are the strongest predictors for younger as opposed to older entrepreneurs. The CHAID analysis for age was initially conducted on respondents younger than 35 to measure these respondents as youth entrepreneurs. However, the sample was too small to conduct meaningful CHAID trees. Therefore, the first group was categorised as the younger entrepreneur sample, and entrepreneurs who were 40 years and younger were categorised in this group. The second group consisted of entrepreneurs older than 41 and was categorised as the older entrepreneur sample.

From Appendix 5, it is evident that the growth mindset EC is again the strongest predictor for the older entrepreneur sample ($n = 1\,003$). The 373 respondents with a growth mindset EC score of above 6 also had the highest level of EA 3 (4.655), and respondents with a growth mindset score of lower than 4.25 had the lowest level of EA 3 (3.889). The next best predictor of the older respondents' EA 3 depends on their level of growth mindset EC. For respondents who had a growth mindset score between 4.25 and 5.25, the next best predictor was innovation; for those respondents who had a growth mindset score above 6, the next best predictor was opportunity assessment. At the third level, self-efficacy was identified as a statistically significant predictor. Continuing to expand the CHAID tree to the last layer, one predictor emerged, namely, self-efficacy, which was linked with respondents who had an opportunity assessment EC score higher than 5.75. Eight different segments can be observed within this CHAID analysis.

The values-driven EC is the strongest predictor for the younger age group of entrepreneurs ($n = 146$). The next best predictor for the younger entrepreneur respondents depends on their level of values-driven EC. For respondents who had a values-driven EC below 5.57, the next best predictor is creative problem-solving. Furthermore, it was linked with respondents who had a creative problem-solving score lower than 5.6 as well as above 5.6. Three different paths can be observed within this CHAID analysis.

4.2.5 19 Entrepreneurial competencies and entrepreneurial action 3: level of education. The final set of CHAID results is conducted on all 19 ECs, the actual action factor (EA 3) and the respondents' level of education. This is done to determine which of the ECs are the strongest predictors for more educated as against less educated entrepreneurs. For the purpose of this analysis, the respondents are divided into two groups according to the highest level of education that they completed. The first group is categorised as the less educated entrepreneur sample, and entrepreneurs who completed Grade 12 or less (secondary education) are categorised into this group. The second group consists of entrepreneurs who completed a university degree or above (tertiary education) and are categorised as the more educated entrepreneur sample.

From Appendix 6, it is evident that the growth mindset EC is again the strongest predictor for the more educated entrepreneur sample ($n = 652$ respondents). The 263 respondents with a growth mindset score above 6 also had the highest level of EA 3 (4.660) and respondents with a growth mindset score lower than 4.25 had the lowest level of EA 3 (3.873). The next best predictor of the more educated respondents' EA 3 depends on their level of growth mindset EC. For respondents who had a growth mindset score between 5.5 and 6, the next best predictor is innovation, and for those respondents who had a growth mindset score above 6, the next best predictor is value creation. Six different segments can be observed within this CHAID analysis.

The growth mindset EC is also the strongest predictor for the less educated group of entrepreneurs ($n = 494$). The next best predictor for the less educated respondents depends on their level of growth mindset EC. For respondents who had a growth mindset EC below 5.25, the next best predictor is leadership. Furthermore, it was linked with respondents who

had a leadership score lower than 5 as well as above 5. Four different paths can be observed within this CHAID analysis.

5. Discussion of the results

The first set of CHAID results, conducted on the total group (n = 1,150), indicates that growth mindset, self-efficacy and innovation are the key statistically significant predictors of actual action activities (EA 3). The results confirm the literature, for example. Bashant (2014) and Gundry and Welsch (2001) argue that entrepreneurs should have growth as a priority for their businesses. At the same time, self-efficacy has been shown to be important, and both new and established entrepreneurs should offer some indication of it, as it is an essential determinant of whether a person attempts behaviours relevant to starting a business (Bandura, 1986). It has been demonstrated that entrepreneurial self-efficacy is an essential antecedent in the relationship between entrepreneurial intention and action (Chen *et al.*, 1998; Fuller *et al.*, 2018). All entrepreneurs, regardless of the venture lifecycle stage that they are in, view innovation as an important element of their competitive advantage because it is supported by mainstream capabilities in quality, efficiency, speed and flexibility (Lawson and Samson, 2001).

The second set of CHAID results regarding the venture lifecycle that entrepreneurs are in indicate that the ECs of social intelligence and value creation are the key statistically significant predictors for the start-up entrepreneur sample, while the ECs of growth mindset, opportunity recognition, flexibility and adaptability as well as opportunity assessment are the key statistically significant predictors for the established entrepreneur sample. According to Morris *et al.* (2013), established entrepreneurs develop significant perseverance and a growth mindset through prior experience, which then equips them to meet future challenges more readily compared to nascent entrepreneurs. Dimov (2010) states that start-up entrepreneurs constantly evaluate and analyse the opportunities they pursue so that they are able to discard the opportunity if it lacks the promise of success. Our findings could not confirm this for the start-up sample in this study; however, this seems to be the case and even more so for established entrepreneurs in this study.

The third set of CHAID results, specifically focusing on gender, indicates that the ECs of value creation and leadership are the key statistically significant predictors for female entrepreneurs, while the ECs of growth mindset, opportunity assessment and self-efficacy are the key statistically significant predictors for male entrepreneurs. Another significant path identified for male entrepreneurs is the following: value creation and perseverance. The findings of this study indicate a general consensus that women and men entrepreneurs differ in their respective ECs. Previous research on women entrepreneurs indicates that the entrepreneurial self-efficacy of women is lower than that of men (Koellinger *et al.*, 2013), and it is confirmed in this study. In addition, our findings agree with the literature that women have a greater fear of failure, which makes them more reluctant to take risks and grow their businesses (Wagner, 2007).

The fourth set of CHAID results, specifically focusing on age, indicates that the ECs of values-driven and creative problem-solving are the key statistically significant predictors for the younger entrepreneur sample (younger than 40 years), while the ECs of growth mindset, innovation and opportunity assessment are the key statistically significant predictors for the older entrepreneur sample (older than 41 years). According to Herrington *et al.* (2017), there is a direct correlation between age and entrepreneurial activity. Similarly, FinScope (2021) makes clear distinctions between the entrepreneurial activity levels based on age at different stages of the venture lifecycle. The increase in entrepreneurial activity has been linked to various antecedents, including older workers having more experience and

resources, such as networks, capital and ECs in general (Bowmaker-Falconer and Meyer, 2022).

The final set of CHAID results, specifically focusing on the respondents' level of education, indicates that the ECs of growth mindset and leadership are the key statistically significant predictors for the less educated entrepreneur sample (secondary education), while the ECs of growth mindset, innovation and value creation are the key statistically significant predictors for the more educated entrepreneur sample (tertiary education). The findings of this study correlate with previous research indicating that a secondary education or a secondary degree is most likely to have been acquired by entrepreneurs at the beginning of their careers in South Africa (Amoros and Bosma, 2013). Organisations, businesses and higher education institutions need to identify which ECs predict EA when they want to influence their development (Kyndt and Baert, 2015). In addition, studies have shown an inextricable relationship between education, entrepreneurial intentions, perceptions of ECs and ultimately the success of a business venture (Bowmaker-Falconer and Meyer, 2022). In addition to explicit knowledge and previous management experiences, higher levels of education are important factors for acquiring entrepreneurial skills (competencies) (Peters and Brijlal, 2011). Education also seems to be correlated with age, as older entrepreneurs have had more time to obtain the necessary skills through education (Herrington *et al.*, 2017).

6. Conclusion

This paper identifies the ECs that can predict EA for heterogeneous profiles. These profiles are necessary to determine the most effective pedagogies, development and support of entrepreneurs across various venture lifecycle stages. Decision tree models reveal that the entrepreneurial profiles differ in terms of the predictive variables and indicate that a one-size-fits-all approach cannot be applied when profiling entrepreneurs.

This study's results reveal that specific ECs such as growth mindset, opportunity assessment, self-efficacy and innovation can indeed be predictors of EA for entrepreneurs in general, regardless of which venture lifecycle stage they are in. However, for new entrepreneurs who recently started businesses and have been in business for at least three and a half years, social intelligence and value creation are deemed to be the best predictors and should be developed in the early stages of the venture lifecycle. Yet, if an entrepreneur wishes to be in business longer than three and a half years and ensure longevity, growth mindset, opportunity recognition and assessment as well as flexibility and adaptability are the most significant ECs that these entrepreneurs should have. These findings indicate that greater focus should be on value creation for start-up entrepreneurs, and for established entrepreneurs, opportunity recognition is needed. Both value creation (Acs *et al.*, 2016; Sarasvathy and Venkataraman, 2011) and opportunity recognition and assessment (Whalen and Akaka, 2016) are established concepts in the EM field (Morris *et al.*, 2002; Peterson, 2020). Similarly, the profiles of women versus male entrepreneurs; younger versus older entrepreneurs; and less educated versus more educated entrepreneurs differed in terms of their ECs that can predict EA. For example, from a practical viewpoint, if an entrepreneur has the following profile: She is a young (younger than 40 years old), start-up, well-educated (has a university degree) woman entrepreneur, the ECs of social intelligence, value creation, leadership, values-driven, creative problem-solving, growth mindset and innovation should be developed. Stenholm *et al.* (2021) suggest the pedagogies of crafting business and marketing plans; analyses for new, imaginary ventures; use of art-based activities such as dance, play and role play; solving real-life company problems in projects; flipped classroom; co-designing course content; conducting capstones; and other real-life case projects, which

could be used to develop the ECs as identified in the above example profile. At the same time, Down and Warren (2008) suggest that entrepreneurial narratives, in particular cliches and metaphors, can be used to develop most of the ECs for the above woman entrepreneur profile example.

7. Implications and future research avenues

This study has several theoretical and practical implications that can impact entrepreneurs, EM educators and society at large. The first theoretical contribution is that we used a theoretical mixed-approach by including both trait (ECs and demographic variables) and behaviour (ECs) approaches to identify differing entrepreneurial profiles, particularly with respect to their ECs and EAs. Limited previous work concentrated on these differences, in respect of which individual ECs are of most importance in distinguishing between each entrepreneurial profile and how these competencies differ between them (Mueller, 2006). Secondly, as far as can be determined, this paper represents the first CHAID conducted in a developing country context, focusing on individual ECs and EA. In addition to this, the study was conducted within the South African context, which provides insight into the emerging economy entrepreneurial community. Thirdly, by profiling entrepreneurs, this study identifies that specific ECs, such as value creation, are strongly linked to start-up entrepreneurial profiles, and opportunity recognition is linked to established entrepreneurial profiles. At the same time, value creation (Acs *et al.*, 2016; Sarasvathy and Venkataraman, 2011) and opportunity recognition (Whalen and Akaka, 2016) are strongly related to EM studies (Peterson, 2020), which can encourage other EM scholars to take a close look at the areas of value creation and opportunity seeking within the EM field (Morris *et al.*, 2002).

From a practical viewpoint, EM educators, support and development organisations can benefit from the results of this study by understanding that different profiles of entrepreneurs require different EC pedagogies, development and support. Educators should adapt their training programmes and combinations of ECs to enhance skills transfer for a specific profile of entrepreneurs that are being trained and developed. Down and Warren (2008) encourage entrepreneurship educators to create (self)assessment and (self-)reflection tools that reflect contemporary designs of self and identity.

Further, this study makes a methodological contribution as CHAID analysis is applied to a sample of entrepreneurs from various groups (start-up and established entrepreneurs) to explore how best to categorise and describe the profiles of the sample. Existing research mostly conducted profiling research on one distinct group, whereas this paper contributed by providing a more systematic grouping of entrepreneurs based on the distinct characteristics investigated in this study, which may serve as a marketing tool for designing interventions and support programmes that can more effectively promote entrepreneurship for differing entrepreneur profiles. A further contribution is that, as other studies have used non-linear techniques to profile entrepreneurs, using CHAID decision trees provides a graphical illustration of the ECs necessary for each profile that is generated. This paper provides a platform for examining the behaviours of different groups of entrepreneurs, including their ECs and their EAs. In addition, this approach allows us to compare groups with, for example, different levels and types of experience.

In particular, the large sample size supports quantitative analysis of the comparisons between different groups of entrepreneurs within this study. Other researchers could use this study as a platform for conducting further research on specific aspects. For example, in this paper, the focus was on the implementation phase, which included start-ups and established entrepreneurs only. Future research could include nascent and potential entrepreneurs in the motivational phase of the Rubicon model. Our study revealed 19

specific individual ECs that should be developed for different profiles of entrepreneurs; future research could focus on other ECs neglected in this paper. Furthermore, additional research is needed on how entrepreneurial support programmes can market these ECs, as well as how they are developed. The pedagogies that are most effective to transfer the relevant ECs for each entrepreneurial profile should empirically be tested. Future studies could conduct a longitudinal study to empirically test whether the pedagogies suggested by Stenholm *et al.* (2021) and Down and Warren (2008) are effective in transferring ECs to each distinct profile.

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Appendix 1

Table A1.
Definitions of the 19 individual ECs

Variable	Definition	Reference
Self-efficacy	Self-efficacy can be described as the task-specific confidence that allows an entrepreneurs' perception of their capabilities to reach high outcomes	Ahlin *et al.* (2014); Jain (2011); Khedhaouria *et al.* (2014); Mauer *et al.* (2017); Morris *et al.* (2013)
Opportunity assessment	Opportunity assessment is described as the process of evaluating the opportunity and idea to establish if there is adequate financial, market and strategic return in the pursuit of the opportunity	Hirschi *et al.* (2017); Morris *et al.* (2013); Shepherd and Patzelt (2017)
Creative problem-solving	Creative problem-solving refers to the ability to identify problems, redefine those problems and develop new and creative solutions to overcome difficulties and challenges	Basadur *et al.* (2014); Marr *et al.* (2004); McMullen and Kier (2017); Morris *et al.* (2013)
Perseverance	Perseverance is the energy and direction that are asserted to overcome obstacles and difficulties that limit a firm's ability to achieve its goals. It refers to the dedication to a specific course of action and a commitment without being daunted by obstacles and adversity that may be encountered	Morris *et al.* (2013), Muehlfeld *et al.* (2017); Thatcher and Patel (2012); van der Zwan *et al.*, (2012)
Opportunity recognition	Opportunity recognition can be defined as the activity of identifying and recognising new ideas that could be successfully exploited to generate a profit	Ireland *et al.* (2009); McAllister *et al.* (2016); Rauch *et al.* (2009)
Value creation	Value creation by observing a customer's real actions when using the product and developing/adapting products, services or operations to provide value to the customer and ensure a reasonable return. Value creation is in the form of challenging the generally accepted or expected way of providing value	Batova *et al.* (2016); Hartman *et al.* (1994); Parris and McInnis-Bowers (2014)
Social intelligence	Social intelligence is the capacity to know oneself and to know others	Boyles (2012); Cheetham and Chivers (1996); Jena and Kumar Sahoo (2014)
Innovation	Innovation refers to the ability to convert imaginative and creative ideas into reality	Boyles (2012); Jain (2011)
Flexibility and adaptability	Refers to an entrepreneur's ability to adapt to changing conditions both within the internal and external environment of the firm	Matthyssens *et al.* (2005)
Need for achievement (motivation)	This can be described as the entrepreneurs' need for success or attainment of excellence	Mitchelmore and Rowley (2010, p. 102), Jain (2011); Man *et al.* (2008, p. 265); Matthews and Brueggemann (2015, p. 5) Lefcourt (1991); Spector (1988)

(*continued*)

Table A1.

Variable	Definition	Reference
Autonomy/locus of control	Locus of control refers to the extent to which a person believes they can influence the outcome of their lives rather than external forces beyond their control	
Curiosity	This is defined as a person's strong desire to learn or know about something	Fletcher (2011); Steyaert *et al.* (2011)
Resourcefulness	Resourcefulness is the process of creatively and effectively using limited resources or resources as a whole in a synergistic process	Morris *et al.* (2013), Morris *et al.* (2002); Tang, Kacmar and Busenitz (2010)
Values-driven	Measures how committed a person is to following their values and their commitment to following them	De Bruin and Buchner (2010); Mussig (2003)
Ethics	Moral principles govern a person's behaviour or the conduct of an activity	Cheetham and Chivers (1996); Jena and Kumar Sahoo (2012, p. 21)
Action orientation	An action orientation or personal initiative is a persistent, proactive, self-starting orientation that aims to influence the environment	Frese *et al.* (1996); Low (2001)
Calculated risk-taking	Systematically monitors, assesses, hedges, transfers and/or exploits the risks that can arise as an innovation project unfolds	Baum *et al.* (1998); Dencker and Gruber (2015); Pillay and Morris (2016); Thekdi and Aven (2016); Vonortas and Kim (2015)
Growth mindset	Having the ability to think of future growth and applying a growth mindset to all activities of the business	Dweck (2015); Gundry and Welsch (2001)
Leadership	Leaders are able to establish a clear vision and communicate that vision to others so they will follow willingly. Leaders provide the information, knowledge and methods to achieve that vision, and coordinate and balance the conflicting interests of all members and stakeholders. In difficult circumstances, a leader is able to think and act creatively to overcome the situation	Cogliser and Brigham (2004); Yıldız *et al.* (2014)

Source: Author's own contribution

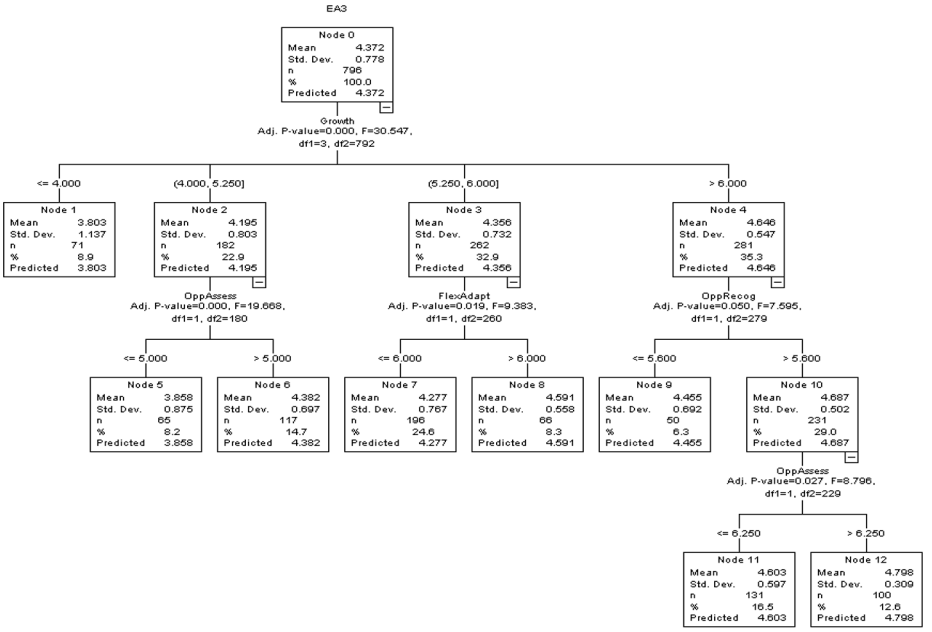
Appendix 2

Table A2.
Summary of the EFA for the 17 EAs in the total sample

Factor	KMO and Barlett's test (sig. value)	% Variance explained	Factor loadings 1	2	3	Cronbach's alpha
EA (business start-up activities)	0.869	52.57				
	$p < 0.001$					
I have spent a lot of time thinking about starting a business before I actually started my business			0.519			Factor 1: 0.715
I have organised a start-up team			0.694			
I have identified market opportunities			0.683			
I have prepared a business plan			0.612			
I have selected a business name					0.518	Factor 3: 0.728
I have created a legal entity					0.723	
I have registered with the tax authorities					0.798	
I have invested some of my own money in a business					0.445	
I have requested for and received financial assistance to start my business				No loading		
I have facilities and equipment in place that assisted me in starting a business				No loading		
I have purchased or leased major items, such as equipment, facilities or property				0.577		Factor 2: 0.752
I have purchased raw materials, inventory or other supply				0.662		
I have developed models or procedures for a product/service				0.536		
I have started marketing or promotional activities				0.485		
I am devoted full time to the business				0.336		
I have applied for licenses or patents				No loading		
I have appointed employees				0.548		

Source: Author's own contribution

Appendix 3



Source: Author's own contribution

Figure A1. Established entrepreneur sample, the 19 ECs and EA 3

Appendix 4

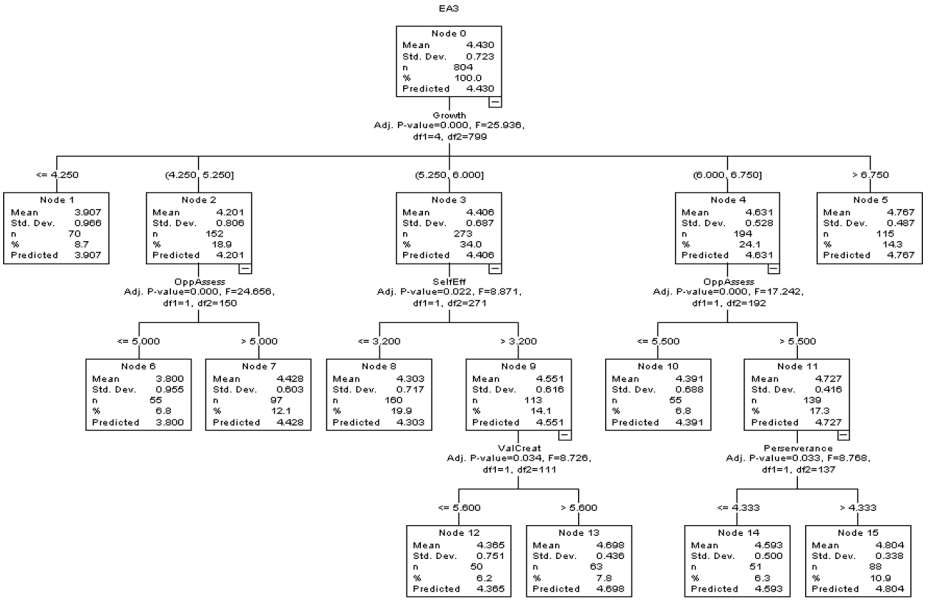


Figure A2.
Male entrepreneur sample, the 19 ECs and EA 3

Source: Author's own contribution

Appendix 5

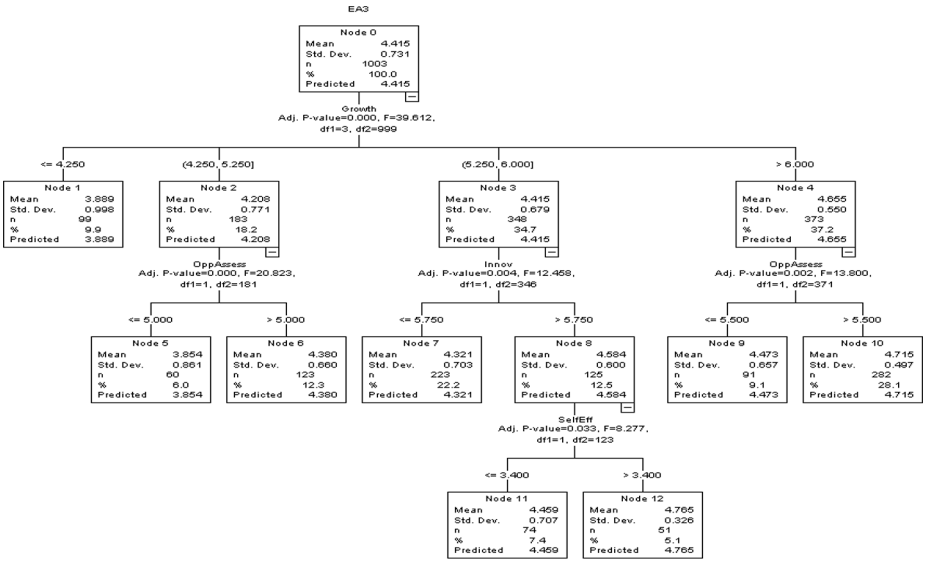


Figure A3.
Older entrepreneur sample, the 19 ECs and EA 3

Source: Author's own contribution

Appendix 6

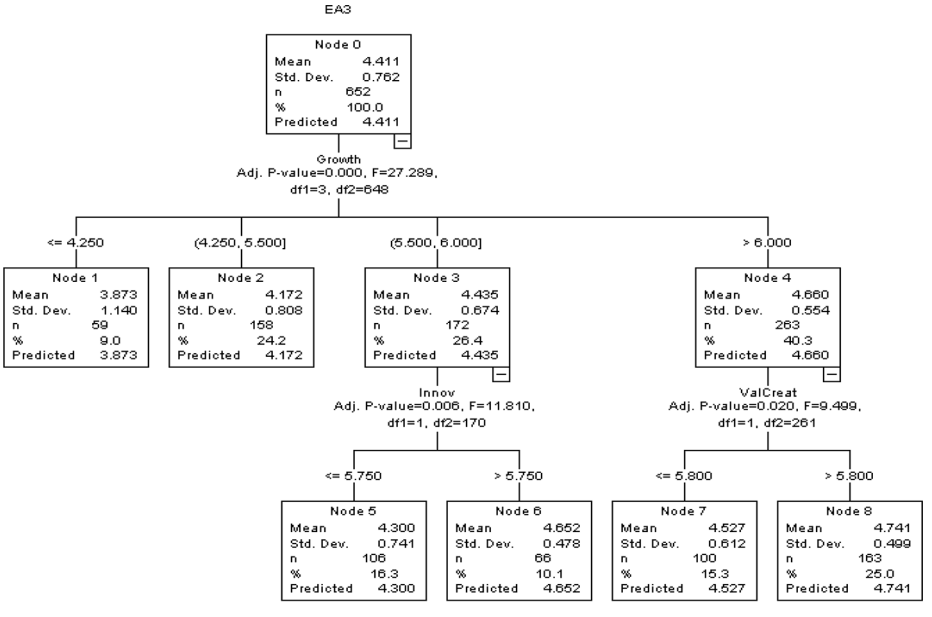


Figure A4.
More educated entrepreneur sample, the 19 ECs and EA 3

Source: Author's own contribution