

The Moderator Effect of Cognitive Ability on the Relationship Between Planning Strategies and Business Success of Small Scale Business Owners in South Africa: A Longitudinal Study

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Abstract

This article makes a case that there is a moderator effect of cognitive ability on the relationship between planning and business success. Two contradictory hypotheses were tested: either people with a high degree of cognitive ability are able to use planning more efficiently, and, therefore, profit more from planning; or, there is a compensatory effect as people with a low degree of cognitive ability profit more from planning than owners with high cognitive ability. This was tested on South African small-scale business owners who participated in a cross-sectional (N = 140) and longitudinal study (N = 51). A compensation effect was found, which means that business owners with low cognitive ability could compensate their low degree of cognitive ability with detailed planning. In such a case, they could achieve the same success as owners with a high degree of cognitive ability. For high cognitive ability owners, it did not matter much whether they planned or not.

Key words: Cognitive ability, planning strategies, moderator effect, business success, developing country

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This article deals with the interaction of cognitive ability and planning on business success among small business owners. It is well established that cognitive ability affects performance (Hunter & Hunter, 1984), although it appears that cognitive ability of business owners and business success has not been studied in developing countries. Moreover, it is established that there is a small positive relationship between planning and business success (Schwenk & Schrader, 1993). However, the interaction between cognitive ability and planning has not been studied. This is surprising because there are good theoretical and practical reasons to be interested in this interaction.

Background

Cognitive Ability

Cognitive ability relates to being able to learn quickly in new situations and to deal with new situations (Eysenck, Arnold, & Meili, 1972). Cognitive ability helps to develop skills and knowledge (Hunter, 1986) and produces higher performance (Hunter & Hunter, 1984; Schmidt & Hunter, 1998). It appears that there is surprisingly little empirical work on the cognitive ability of the owners and their economic success. One problem in many areas of this type of research is the restriction of variance. This is a reason why many studies do not show a high correlation, although appropriate adjustments show high correlations with performance (Hunter & Hunter, 1984). In Western countries, founders of businesses tend to be highly educated (Reynolds, Hay, Bygrave, Camp & Autio, 2000) and they probably have high cognitive ability. In developing countries, there is pressure to develop businesses and, therefore, there is a higher variance of cognitive ability. This may help to produce the interaction effects that are hypothesized in the current study.

Moderator Effect

Two contradictory hypotheses are considered in understanding the interaction between planning and cognitive ability. First, according to cognitive resource theory (Kanfer & Ackerman, 1989) planning uses one of the cognitive resources, that is, cognitive ability. This theory suggests an augmentation hypothesis: A high degree of cognitive ability and planning should be highly related to economic success. According to this hypothesis planning can and should be used primarily by people with low cognitive ability. Owners with high cognitive ability do not need to preplan for events because they can develop an adequate plan of action on the spot; therefore, for them planning is not that useful.

Second, the planning-ability compensation hypothesis (Frese, Albrecht, Kreuzcher, von Papstein, Prümper, & Schulte-Göcking, 1995) argues that planning can and should be used primarily by people with low cognitive ability. In contrast, owners with a low degree of cognitive ability profit more from planning because it gives them a good structure to deal with the uncertainties of business. This leads to the

hypothesis that cognitive ability shows a compensatory relationship with planning. Such a hypothesis is similar to the compensatory relationship with environmental conditions (Rauch & Frese, 1998): Planning is more useful when there are a small number of cognitive or environmental resources available. In difficult environments, or in situations with few cognitive resources, it helps to plan because preplanning structures situations better and surprises occur less often if one preplans for unlikely events.

Practically, this question has important implications, because it implies different strategies: First, if cognitive ability makes it easier to plan and the interaction of both produce higher economic success, cognitive ability should be used as a selection device. However, if there are compensatory relationships, it may be more useful to teach planning, particularly to those who are low in cognitive ability. There do not appear to be any longitudinal studies on small-scale business owners in Africa. Yet, it would seem critical that policy recommendations be made only on the basis of longitudinal studies, as there is better evidence of causal effects in such research.

The contemporary South African environment is an especially relevant context within which to examine these relationships. Small and micro-enterprises, especially in the informal sector (businesses which are not paying tax and are not registered), are crucial for the economic and the employment situation in South Africa and many other developing nations (Manuel, Minister of Trade and Industry in South Africa, in white paper, 1995). Small businesses absorb almost half of the people formally employed in the private sector and contribute about 37% to the country's Gross Domestic Product (Crothers, 1997).

Planning and Strategy Process Characteristics

Strategy process characteristics have been differentiated into complete planning strategy, critical point planning strategy, opportunistic strategy, and reactive strategy by Frese, van Gelderen and Ombach (2000). These characteristics have been shown to be important in a developing country such as Namibia (Frese, Brantjes & Hoorn, in this issue). In this article, the two aspects of complete and critical point planning receive emphasis. A person, who uses a complete planning strategy is goal oriented, proactive and has planned things out in some degree of detail. For example, if a business owner producing window frames wants to buy a spray painting machine to paint window frames, he or she would think about a number of details; for example, where he or she would get the capital required to buy this machine, whether there would be enough demand for the machine, what would happen if the machine breaks down and who could repair it, and whether he would have to employ a new person and who this new person could be.

Critical point planning implies that one does not develop a full plan of action, but that the owner concentrates on the most important issues and develops a plan for them. Later he or she then plans out other aspects that appear to be important at the time. This type of planning could also be called localized planning and makes

efficient use of cognitive capacities, time and money (Sonnentag, 1996). In the example of a window frame producer, a critical point planner would plan in detail the financial aspect of buying the new machine (where to get the money and whether it would be profitable), but he or she would not worry about new employees until after the machine was purchased.

Method

Small-scale business owners in Cape Town who ran their businesses for at least one year and who had at least one, but not more than 50 employees were included in this study. The participants were recruited from industrial hives in which the business owners there had small units. The cross-sectional sample consisted of 140 business owners, of whom 42% were Black and the rest "Coloured" (The term Coloured is still used in South Africa to denote people of mixed heritage. Since discrimination against Coloureds was less during Apartheid years than against Blacks, Coloureds were allowed to own a business and could get a better education than the Blacks of African heritage. Therefore, this categorization has important sociological implications). The longitudinal study included 51 persons who were re-interviewed in 1999. Of the original 101 business owners who participated at t_1 between September 1997 and March 1998 (Van Steekelenburg, Lauw, & Frese, 2000), 27 businesses had gone bankrupt, 16 businesses had moved and could not be found, four refused to participate or the owner was absent, two business owners had retired and one had died. The descriptive characteristics did not vary much between the longitudinal and the cross-sectional samples.

Interview

The interview procedure was developed in the course of studies reported in Frese (2000), Frese et al. (2001), and Frese, Brantjes & Hoorn (in this issue) and was utilized in the same way. During the interview the interviewer took notes on a protocol sheet to record the answers of the participants. Inter-rater correlations ($n = 140$, who participated in the cross-sectional design) were generally between $r_{rr} = .64$ and $r_{rr} = .99$. Directly after the interview the interviewer estimated several items concerning the participant, for example, IQ or demographic aspects.

Operationalization of the Variables

The measures are described in Table 1 (except the two planning strategies). Two types of planning are of concern in this article: *complete* and *critical point planning*. The two planning strategies were assessed as part of a general procedure to measure strategy process characteristics (see Frese, van Gelderen, & Ombach, 2000 and Frese et al., in this issue).

An attempt by business owners to achieve their goals was the starting point in the interviews. After their goals were identified, the participants were asked how they went about reaching these goals. Prompts were used as long as the interviewer

Table 1: Characteristics of the Main Scales, Indices and Variables

Scale	Items	α	M	SD	Range	N	Corrected Item-Total Correlation
Economic Success Index: Growth ^{1,2}			.00	.62	-1.10-2.54	139	
	Average increase of number of employees		.93	1.61	-.64-11.67	139	.3347
	Development of profits over the last 3 years in %		.00	1.00	-1.09-7.42	130	.3566
	Average development of customers, sales, Average growth of value equipment/assets		.00	1.00	-2.43-.93	139	.4833
Economics Success Scale: Size ^{1,2}			.00	1.00	-.44-7.42	139	.4816
	Turnover during the last year		.00	.73	-.59-2.99	140	
	Current number of employees		.00	1.00	-.64-5.59	138	.4787
Subjective Success Scale ¹			6.10	10.38	.00-70.00	140	.4787
		.79	.00	.73	-2.26-1.13	139	
	Distribution of success over time (chart)		3.90	1.18	1-5	139	.5305
	... others say you are successful as a business owner?		3.68	1.01	1-5	139	.5249
Interviewer Success Estimation	... successful compared to your competitors?		3.64	1.06	1-5	139	.6548
	How satisfied are you with your work?		1.76	1.43	-3-3	139	.5553
	How satisfied are you with your current income		.76	1.73	-3-3	139	.5452
	General impression of business success		2.90	1.27	1-5	140	

(continued on following page)

Table 1: (continued)

Scale	Items	α	M	SD	Range	N	Corrected Item-Total Correlation
Overall Success Scale ¹		.84	.00	.64	-1.34-1.50	139	
	Economic success: Growth		.00	.62	-1.10-2.54	139	.6307
	Economic success: Size		.00	.73	-.59-2.99	140	.6239
	Subjective success rating		.00	.73	-2.26-1.13	139	.7000
External Success Rating ¹	Interviewer success rating		2.90	1.27	1-5	140	.8043
		.90	.00	.87	-1.63-1.49	133	
	success in terms of development, reinvestment,		3.18	1.57	1-5	133	.8206
	success in terms of making profit and making money		3.19	1.33	1-5	133	.8696
	Ranking of the owners concerning their success		.00	1.00	-1.82-1.73	118	.7818
Cognitive Ability ¹	Distribution of success over time (chart)		3.39	1.08	1-5	118	.6335
		.82	.00	.87	-2.09-2.28	139	
	Estimate of IQ (evaluation sheet)		3.45	.89	1-5	140	.7376
	Digit span test forward		7.51	2.29	2-13	139	.6454
	Digit span test backward		5.67	2.08	1-14	139	.6507

Note: ¹ = z-standardized ² = no alpha computed because it is an index

could not make a decision as to which specific process characteristic was the most typical approach to a particular goal (complete and critical point planning). Consider an illustration. One of the owners wanted to buy less expensive supplies and to do this had planned to pool with other owners. If this owner was using a complete planning strategy, he or she would plan out such things as: how many people should participate at a minimum to get a better price; whether there was enough readiness on the side of the colleagues/competitors to participate; whether this was actually good for his business (the other ones might reduce their price for their products); whether there was an alternative plan, where he or she could do it alone; etc.

Alternatively, in the case of an owner using a critical point strategy, he or she would have a detailed plan about the price issue and how much reduction could be achieved by how many participants in a pool and whether there were enough potential participants known by this owner. All other things would be determined after he had asked potential participants. All participants received a low or a high score on all of the process strategies. The inter-rater correlations for the strategies were: $r = .94$ for complete planning, $r = .92$ for critical point planning. In the longitudinal analysis, a single index for the two planning strategies was formed at t1.

Cognitive ability was measured with a digit span test (forward and backward digit span, a subtest of the Wechsler Intelligence Test for Adults). The digit span test has been suggested to be a good proxy test for cognitive ability because it has a high loading on general intelligence (Jensen, 1985). It is efficient because it takes little time to complete it in the field and it is socially acceptable to do it within an interview. In addition, the interviewers also gave a general estimate of the cognitive ability on a 1–5-point Likert scale. The interrater correlation for this cognitive ability estimate was $r = .80$. The correlations of all the items of cognitive ability are presented in Table 2. The general cognitive ability estimate of the interviewer correlated highly with the results of the digit span test. We used all items together as a cognitive ability scale ($\alpha = .82$). During the first measurement the digit span test had not been used; however, the interviewers provided their estimates. The cognitive ability scale correlated $r = .65$ with the estimate of cognitive ability in the first study (this high correlation conforms with our expectations because cognitive ability is supposed to be a stable concept – it also shows that the interviewers gave quite good estimates).

In the moderated hierarchical regression analyses, we controlled for the following variables: Gender, starting capital in US dollars, year of establishment, line of business (dummy variables), and ethnic background (dummy variables).

Dependent Variables

In total, four different economic success measures were used: size, growth, self-estimate by the business owner, and an estimate by the interviewer. These four success measures were summed into a second order “overall success scale” (Cron-

Table 2: Correlation between the IQ-items (Longitudinal t1/t2)

Variables	1	2	3	4
1. IQ estimate by interviewer t1				
2. IQ estimate by interviewer t2	.65**			
3. Digit span test forwards t2	.57**	.60**		
4. Digit span test backwards t2	.43**	.64**	.52**	
5. Cognitive ability scale t2	.65**	.88**	.84**	.85**

Note: N = 51

*p < .05

**p < .01

bach’s Alpha .84). In addition, we used the hive manager’s estimate as a second success measure (external success rating). The main advantages of the external success rating were that the data could not be influenced directly by the business owners. Furthermore the hive manager was in most cases an experienced businessman and an independent person who was able to evaluate 15–30 business owners at one time. The two success measures, external success rating and overall success scale correlated substantially ($r = .69, p < .01$). There was also a certain amount of stability in success, as there was a substantial correlation of the success measures at t1 with the two main success scales of t2 ($r = .55$ and $.52$ of economic success at t1 with overall success and external success respectively; $r = .54$ and $.51$ of interviewer success rating with overall success and external success respectively).

Statistical Procedures

Hierarchical moderated regression analyses were used to test for moderator effects (Cohen & Cohen, 1983). In the first step, the controls were included (gender, starting capital in US dollars, year of establishment, line of business (dummy variables), and ethnic background (dummy variables)). The linear direct effect of the predictor and the moderator were added in the second step and in the third step the interaction term, the multiplication between predictor and moderator was inserted. In the longitudinal study, success at t1 (prior success) was controlled for in the first step, so that changes in success at t2 (compared with t1) could be predicted with our moderator variables. All predictor and moderator variables were centralized before they were entered into the hierarchical regression analysis. To avoid the problem of multicollinearity only one predictor was used in each

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regression analysis. As suggested by current literature in this area, we used a significance criterion of $p < .10$ for the moderator because moderator regression analyses are very conservative procedures (Aiken & West, 1991).

Results

There were significant cross-sectional and longitudinal correlations between cognitive ability and the two planning strategy process characteristics on the one hand and overall success and external success rating on the other hand (see Table 3 and for a fuller report Frese et al., 2001).

The critical issue for this article is whether planning strategy has an impact as a moderator on the relation between cognitive ability and success. All of the interaction terms were significant with the exception of one (using external success as a dependent variable; in this case, there was a reduced N in the analysis because there were fewer external success ratings. Because of lack of power, the interaction term did not become significant; however, the increment of the interaction to explained variance of 3% was about as high as the added explained variance in the cross-sectional study) (see Table 4). The explained additional variance was substantial, ranging from 2% additionally explained variance to 7% (in the longitudinal study).

Figures 1, 2, and 3 describe the significant moderator effects of cognitive ability on the relationship between planning and success. Planning and cognitive ability showed compensatory relationships. People with high cognitive ability do not show a relationship between planning and success, that is, people with high

Table 3: Intercorrelations of the Main Variables (Longitudinal Analysis)

Variables t2	Variables t1						
	Success economic size	Success entrepreneur rating	Success interviewer rating	Reactive strategy	Opportunistic strategy	Planning strategies	IQ
Overall success scale	.55**	.52**	.54**	-.42**	.03	.32*	.45**
External success rating	.52**	.47**	.51**	-.39**	.15	.25	.42**
Planning strategies	.53**	.36**	.51**	-.41**	-.15	.43**	.42**
Cognitive ability scale	.37**	.34**	.44**	-.25*	.04	.18	.65**

Note: N = 51

* $p < .05$

** $p < .01$

Table 4: Moderator Effect of Cognitive Ability on the Relationship between Strategy Process Characteristics and Success Measures (Results from Hierarchical Moderated Regression Analyses)

Success:		Cross-sectional Study ^a		Longitudinal Study ^b	
		Overall success	Extern	Overall success	Extern
Complete planning	β	-.20*	-.23*	-.31**	-.22
× cognitive ability	ΔR^2	.02*	.02*	.07**	.03
Critical point planning	β	-.14*	-.19*		
× cognitive ability	ΔR^2	.02*	.03*		

Note: Control variables were line of business (dummy variables), starting capital, year of establishment, gender, ethnic background (dummy variables); the linear influence of cognitive ability and process characteristics was also controlled for. In the longitudinal study the dependent variables were measured at t2 and the independent variables at t1. In the longitudinal study prior success was also controlled for. Complete and critical point planning were combined into one variable in the longitudinal analysis.

Extern = external success.

*p < .10 ^aN = 140

**p < .05 ^bN = 51

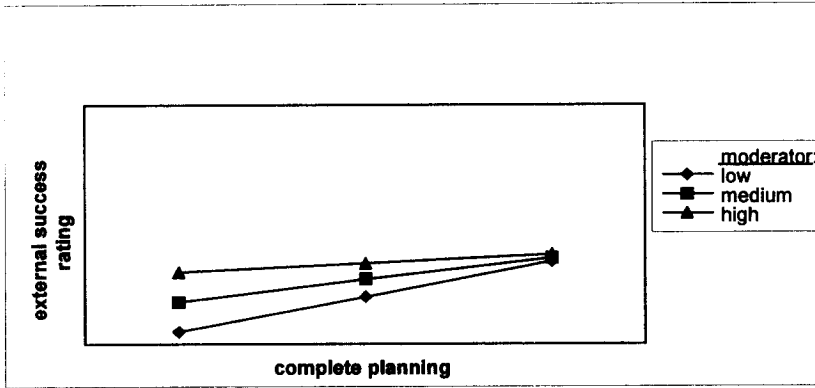
cognitive ability who plan a lot are not more successful than those who do not plan a lot. In contrast, there is a clear relationship between planning and success in the low cognitive ability group. Thus, it helps to plan a great deal, if cognitive ability is low. Planning compensates for lack of cognitive ability.

Apparently, business owners with a high degree of cognitive ability are successful simply because they are intelligent—they do not need to plan things out in detail. However, business owners with a low degree of cognitive ability can compensate for this lack of ability by utilizing a greater degree of planning. Since this is also true in the longitudinal study, we can conclude that people with low cognitive ability can become more successful if they plan things in detail. If they do not plan, they become less successful over time.

Discussion

In the framework of the present research, the moderator effect of cognitive ability on the relationship between planning strategies and entrepreneurial success was

Figure 1
Moderator Cognitive Ability on the Relation between Complete Planning and External Success Rating



explored. A clear moderator effect for cognitive ability was found. The results contradict the augmentation hypothesis, which was an extension of psychological resource theory (Kanfer & Ackerman, 1989) to entrepreneurship. The augmentation hypothesis argues that owners with a higher degree of resources (cognitive ability) are better able to deal with complex planning issues and are, therefore, more successful. This was not the case. On the contrary, the results support the compensation hypothesis; people of low cognitive ability can compensate for their lack of cognitive ability with more planning. On the other hand, business owners with a high degree of cognitive ability can be successful simply because they are intelligent and therefore do not need to plan things out in detail.

Figure 2
Moderator Cognitive Ability on the Relation between Critical Point Planning and Overall Success Scale

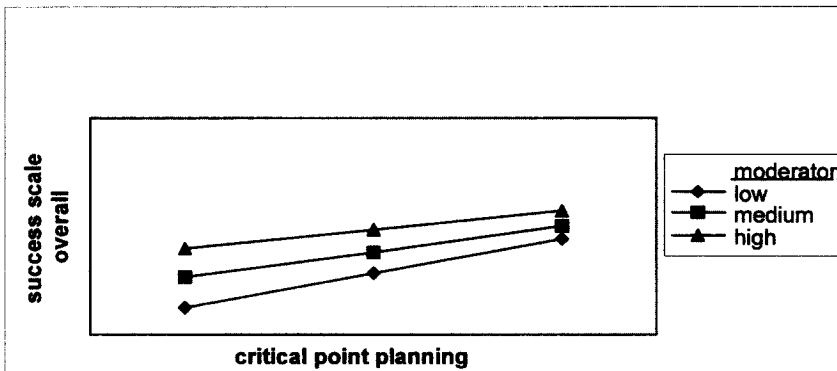
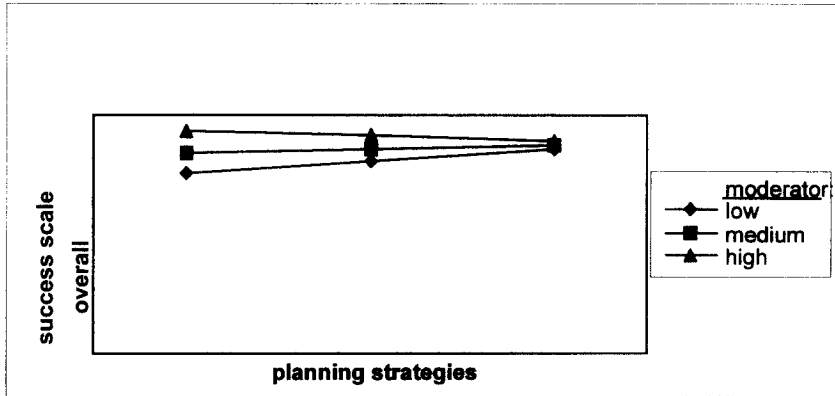


Figure 3
Moderator Cognitive Ability t2 on the Relation between Planning Strategies t1 and Overall Success Scale t2



Interestingly, one prior study on the relation between cognitive ability and planning orientation (Frese, Albrecht, Kreuschner, von Papenstein, Prümper, & Schulte-Göcking, 1995) also found a compensatory model to be true among German insurance sales agents (performance was measured as the amount of sales in this study). This supports a certain generalizability of the results.

A strength of this study was its longitudinal design and the external success rating; since the success ratings by hive managers were independent of what the business owner thought and felt. A limitation of the study is the measurement of IQ. We think it is useful to replicate the current study with a better measure of IQ. On the other hand, the measure is surprisingly consistent across time (cf. Table 2) and there are theoretical arguments that Wechsler's digit span is a good indicator of working memory (Jensen, 1985).

Conclusions

The current study holds important practical implications. Owners should be taught to improve their planning skills. This would imply that there are plans for potential surprises or threats. Such training should be more important for owners with low cognitive ability. This can be implemented through a larger investment in education and value development for small-scale business owners (Morris, Jones, & Nel, 1997). The presentation of the results in this article should not lead to the conclusion that there is only a moderator effect. There is also a direct relationship between planning and success, which was not the focus of this article (as is reported in detail in Frese et al., 2001, in press).

Business owners can compensate for low cognitive ability with a high degree of planning. This reinforces a general point discussed by Rauch and Frese (2000):

Business owners are not necessarily restricted by their personality or their abilities. The job of a business owner provides much flexibility in what he or she can do. Therefore, it is possible to shape one's actions to optimally compensate for one's weaknesses and limitations. In this study, owners with a low degree of cognitive ability who planned in detail were as successful as owners with a high degree of cognitive ability. Therefore, we would warn against selecting only high cognitive ability potential business owners, because low cognitive ability business owners are able to compensate with a high degree of proactive planning.

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