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A BUSINESS SUCCESS VERSUS FAILURE PREDICTION MODEL FOR ENTREPRENEURS WITH 0-10 EMPLOYEES

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ABSTRACT

This empirical survey study presents a success versus failure (S/F) prediction model (S/F = f [advisors, planning, education, minority business ownership, staffing, parents owned a business, record keeping and financial control, capital, industry experience, economic timing]). Using stepwise discriminant analysis, the predictor variables explained 54% of the variance in S/F. The model accurately predicted 75.00% of the surveyed 96 matched pairs firms as being successful or failed. The model will predict a group of businesses as successful or failed more accurately than random classification over 99% of the time (model p=.0006).

INTRODUCTION

The important role of small business suggests that an understanding of why firms fail and succeed is crucial to the stability and health of the economy (Gaskill, Van Auken, and Manning 1993). Of major concern to any would-be entrepreneur is the chance of success for the proposed business. Success versus failure prediction research benefits entrepreneurs, those who assist, train and advise them, those who provide capital for their ventures, suppliers, and public policy makers (Altman 1983; Ballantin, Cleveland, and Koeller 1992; Cameron, Kim, and Whetten 1987; D'Aveni 1989; Dugan and Zavgren 1989; Koh and Killough 1990; Lussier 1995a&b, Pech and Alistair 1993; Storey, Keasey, Watson, and Wynarczyk 1987).

There are many studies to better understand business success versus failure. However, as Gaskill, Van Auken, and Manning (1993) stated: there are many questions still to be resolved and warrant additional exploration... previous studies do not provide a comprehensive or unified explanation for small firm failure... comparisons are needed between successful and failed small business owners.

Prior empirical studies of failure have concentrated almost exclusively on financial ratio data, though other studies of failure usually cite managerial variables as being critical (Scherr 1989). The usefulness of ratio-based business failure prediction models has been questioned (e.g., Alves 1978; Corman and Lussier 1991; Lussier and Corman 1995; Gilbert, Menon, and Schwartz 1990; Shelton 1986; Stockton 1989; Sommers and Koc 1987). For example, El-Zayaty (1986) found ratio models to be poor predictors of bankruptcy: of 132 businesses predicted to fail, only 5 were discontinued over a five-year period. These models had about a

97 percent Type II error rate. Storey et al. (1987) indicated that qualitative data can provide at least as good predictions as traditional financial ratios.

Scherr (1989) recommended virgin research to search for links between management's ability and failure. This study is not based on financial ratios, but on quantitative and qualitative managerial factors contributing to success or failure. To date, the author has found only two major nonratio empirical studies (Cooper et al. 1990 + 1991 and Reynolds and Miller 1987 + 1989) similar to this study. However, the Reynolds and Miller model cannot predict failure of a business before it starts because the age of the business, and the first year sales are needed to predict failure. The major differences between this study and the Cooper et al. studies are: 1. Their sample includes businesses one to three years old whereas this sample includes ages one to ten. 2. Their sample was limited to members of the National Federation of Independent Business (NFIB); this sample is not. 3. They do not survey failed businesses; this study does. 4. Their sample does not include matched pairs whereas this design does. They surveyed firms conducting business; then after a year or longer, some of the firms failed. At that time, they compared the responses of the failed firms and the surviving firms to analyze the differences without ever questioning the failures to ask them why they failed. This matched pairs design avoids comparing larger businesses to smaller ones, retailers to manufacturers or construction companies, and businesses from different locations.

Purpose

The purpose of this research is to develop and test a generic nonfinancial model that will predict young businesses with 0 - 10 employees as successful or failed.

This study adopts Dun & Bradstreet's (1994: i) definitions of failure and discontinuance. Business failures are firms involved in court proceedings or voluntary actions involving losses to creditors. Chapter 7 and Chapter 11 companies are both considered failures due to loss to creditors. Chapter 7 companies liquidate whereas Chapter 11 companies restructure their debt and stay in business. Firms going out of business without loss to creditors are not considered business failures: they are discontinued businesses. To be considered a success the business must make at least industry average profits. A young firm is 0 to 10 years old.

METHODOLOGICAL DEVELOPMENT AND TESTING OF THE LITERATURE MODEL

There is no generally accepted list of variables distinguishing business success from failure. Prior research has created discrepancies within the literature by reporting different variables as contributing factors to success or failure. The two most commonly stated distinguishing variables are capital and management experience. However, in 20 journal articles only 14 (70%) specifically state that these two variables contribute to success versus failure. To help clarify discrepancies, this study supports or does not support each of the major variables in the literature later in the implications section of this article.

The model in this study was developed by including the fifteen major variables, identified in 20 journal articles, as contributing to success versus failure. See Table 1 for an explanation

of the 15 variables, and Table 2 for a comparison of the 20 studies that support, do not support, or do not mention each variable.

Table 1
EXPLANATION OF SUCCESS VERSUS FAILURE VARIABLES

1. **Capital (capt).** Businesses that start undercapitalized have a greater chance of failure than firms that start with adequate capital.

2. **Record keeping and financial control (rkfc).** Businesses that do not keep updated and accurate records and do not use adequate financial controls have a greater chance of failure than firms that do.

3. **Industry Experience (inex).** Businesses managed by people without prior industry experience have a greater chance of failure than firms managed by people with prior industry experience.

4. **Management Experience (maex).** Businesses managed by people without prior management experience have a greater chance of failure than firms that are managed by people with prior management experience.

5 **Planning (plan).** Businesses that do not develop specific business plans have a greater chance of failure than firms that do.

6 **Professional Advisors (prad).** Businesses that do not use professional advisors have a greater chance of failure than firms using professional advisors.

7 **Education (educ).** People without any college education who start a business have a greater chance of failure than people with one or more years of college education.

8. **Staffing (staff).** Businesses that cannot attract and retain quality employees have a greater chance of failure than firms that can.

9. **Product/Service Timing (psti).** Businesses that select products/services that are too new or too old have a greater chance of failure than firms that select products/services that are in the growth stage.

10. **Economic Timing (ecti).** Businesses that start during a recession have a greater chance of failure than firms that start during expansion periods.

11 **Age (age).** Younger people who start a business have a greater chance of failure than older people starting a business.

12 **Partners (part).** A business started by one person has a greater chance of failure than a firm started by more than one person.

13 **Parents (pent).** Business owners whose parents did not own a business have a greater chance of failure than owners whose parents did own a business.

14. **Minority (mior).** Minorities have a greater chance of failure than nonminorities.

15 **Marketing (mrkt).** Business owners without marketing skills have a greater chance of failure than owners with marketing skills.

Table 2

A COMPARISON OF VARIABLES IDENTIFIED IN THE LITERATURE AS FACTORS CONTRIBUTING TO BUSINESS SUCCESS VERSUS FAILURE

Senior Author	Independent Variables														
	capt	rkfc	inex	maex	plan	prad	educ	staf	psti	ecti	age	part	pent	mior	mrkt
Barsley	F	-	F	F	F	F	-	-	-	-	-	-	-	-	-
Bruno	F	F	-	F	F	-	-	F	F	F	-	-	-	-	F
Cooper 90	F	-	N	N	F	F	N	-	F	F	F	F	-	F	-
Cooper 91	F	-	F	N	-	F	F	-	N	N	N	N	F	F	-
Crawford	-	-	F	-	-	F	F	-	-	N	N	-	-	-	-
D+B St.	F	F	F	F	-	-	-	-	-	F	-	-	-	-	-
Flahvin	F	F	F	F	-	F	-	F	-	-	-	-	-	-	-
Gaskill	N	F	F	F	F	F	N	-	-	N	-	-	-	-	F
Hoad	-	-	F	N	N	F	F	-	-	-	-	-	-	-	-
Kennedy	F	-	-	F	F	-	-	-	-	F	-	-	-	-	-
Lauzen	F	F	-	F	F	-	-	F	-	-	-	-	-	-	-
McQueen	F	-	F	F	-	-	-	-	-	-	-	-	-	-	F
Reynolds 87	F	F	-	-	F	-	-	N	F	-	-	-	-	-	N
Reynolds 89	F	F	-	-	F	-	N	N	F	-	N	F	-	-	-
Sage	F	-	-	F	-	-	F	-	-	-	-	-	-	-	-
Sommers	-	-	-	F	F	-	-	F	-	-	-	-	-	-	-
Thompson	N	-	-	F	F	-	-	F	F	-	-	-	-	-	F
Vesper	F	F	F	F	N	F	F	-	F	F	-	F	-	-	F
Wight	F	F	-	F	-	F	-	-	-	-	-	-	-	-	-
Wood 89	-	F	F	F	F	-	F	-	-	-	-	-	-	-	-
Total F	14	10	10	14	11	9	6	5	6	5	1	3	1	2	5
Total N	2	0	1	3	2	0	3	2	1	3	3	1	0	0	1
Total -	4	10	9	3	7	11	11	13	13	12	16	16	19	18	14

F supports variable as a factor contributing to failure
N does not support variable a factor contributing to failure
- does not mention variable as a contributing factor

The Literature Model Variables

S/F = *f* (capital, record keeping and financial control,
industry experience, management experience,
planning, professional advisors, education,
staffing, product/service timing, economic timing,
age of owner, partners, parents owned a business,
minority, marketing skills)

Discriminant function analysis is used to predict group membership when the dependent variable is nominal/categorical. Therefore, discriminant analysis was used to predict the 96 sample businesses as successful or failed; based on the 15 independent variables. The stepwise procedure was run on all the variables in the model to identify those variables that do or do not distinguish success versus failure. The elimination of the variables without discriminant ability results in the development of the prediction model.

DESCRIPTIVE STATISTICAL RESULTS

The sample included approximately 20 percent from Connecticut, 5% Maine, 44% Massachusetts, 19% New Hampshire, 9% Rhode Island, and 6% Vermont. The mean age of

the failed and successful firms was 5.5 and 5.8. Industry representation (as classified by Dun + Bradstreet) includes approximately: 2% agriculture, 14% construction, 17% finance, 10% manufacturing, 22% retailing, 3% wholesale, 6% transportation and communication, and 25% services. For a comparison of the descriptive statistics, measurement of the 15 variables in the model, and correlation matrix see Table 3.

Table 3
DESCRIPTIVE STATISTICS AND CORRELATION MATRIX

Variables (Measurement method)	Failed Mean/ Frequency%	Failed s.d.	Success Mean/ Frequency%	Success s.d.
1. Capital (1 adequate - 7 inadequate)	4.09	1.52	4.58	1.37
2. Record keeping and financial control (1 poor - 7 good)	4.64	1.64	4.88	1.42
3. Industry experience (number of years)	9.20	8.26	6.74	7.15
4. Management experience (number of years)	9.22	7.78	6.26	8.15
5. Planning (1 specific - 7 no plan)	4.09	1.92	3.58	1.53
6. Professional advise (1 used - 7 not used)	3.71	1.71	4.52	1.75
7. Education (number of years)	15.84	3.28	14.54	2.53
8. Staffing (1 difficult - 7 easy)	5.13	1.56	4.48	1.80
9. Product/service timing (1 intro. - 7 decline)	3.84	1.49	3.90	1.33
10. Economic timing (1 recession - 7 expand)	4.07	1.79	4.40	1.69
11. Age of owner (number of years)	36.98	8.31	35.34	9.38
12. Partners (% with > 1 owner/part.)	40%		34%	
13. Parents (% parents own a business)	33%		44%	
14. Minority (% of minority owners)	7%		6%	
15. Marketing (1 unskilled - 7 skilled	4.44	1.84	3.74	1.78

Table 3 Continued

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
2	-.212*													
3	-.142	-.08												
4	-.34**	-.043	.39**											
5	.24*	-.37**	-.04	-.07										
6	.24*	-.30**	-.14	-.26*	.47**									
7	-.23*	.07	-.21*	.08	-.00	-.05								
8	-.01	.07	.10	.06	.01	-.10	-.05							
9	.07	.16	.06	-.09	-.17	-.18	-.05	.03						
10	-.03	-.16	-.02	.05	.13	.06	-.16	-.05	.00					
11	-.21*	.05	.21*	.52**	-.09	-.12	-.02	.01	-.10	.10				
12	-.19+	.16	.01	.06	-.05	-.09	.05	-.10	.01	-.11	.07			
13	.06	.03	.14	-.12	.12	.03	-.21*	.02	-.26*	.05	-.13	-.02		
14	-.04	.01	.15	.06	.01	-.11	-.06	-.04	.11	-.01	-.38**	.10	.07	
15	-.44**	.15	.16	.49**	-.19+	-.26*	.15	.19	-.09	-.05	.29**	.05	.01	.00

n = 45 failed, and 51 successful firms

+ $p < .10$
* $p < .05$
** $p < .01$

SAMPLING METHODOLOGY

The sample was limited to the six New England states--Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. A total of 103 questionnaires were return, but seven were dropped from analysis due to missing data. Therefore, 96 usable questionnaires were analyzed: 45 from failed and 51 from successful firm owners. The combined response rate was 43%. This rate is high for a failure survey.

The population of failed businesses includes Chapter 7 and 11 companies. Due to difficulties in locating liquidated business owners, the failure sample frame was Chapter 11 companies. Lussier (1995a&b) and Lussier and Corman (1995) used a sample of Chapter 11 companies. The rationale for the company size of 0 to 10 employees is the fact that a very small percentage of businesses start with more than 6 employees (Cooper et al. 1990). The model was designed for young firms up to ten years old with up to ten employees.

The failure sample was generated from the bankruptcy court records. The questionnaire was first mailed to each owner/CEO filing Chapter 11 during the most recent year. The questionnaire was then mailed to each failed respondent's successful company match. Matching was selectively based on size (number of employees 0 - 10), age (all firms are 10 years old or less), location (same state and city, or city close by), and industry (same Dun + Bradstreet classification) to ensure relevant comparisons. Each Chapter 11 company owner was asked to identify the company's major competitors. Estimating a 50% response rate from successful company matches, two competitors were selected and sent a questionnaire as the failed company's match. All 45 failed firms have at least one match. Six additional successful companies data were also included as a second match.

RELIABILITY AND VALIDITY TEST OF THE SAMPLE

Reliability of the Questionnaire

The questionnaire was carefully developed through four pretests to increase reliability of the sample measurement instrument. One of the major concerns of the study was response rate. The questionnaire's length was limited to increase the response rate; therefore, a trade-off was made. Rather than having several repeat questions, the questionnaire used one open-ended question to check reliability. There was only one nonreliable response (.005%); therefore, reliability is inferred.

Chapter 11 firms are early representatives of closed businesses. Wood (1990) reported less than 5% of Chapter 11 companies survive whereas Flynn (1989) reported a 10 to 12% survival rate. In this study 19% of the respondents were in Chapter 7 proceedings. The responses of the Chapter 7 companies were compared to the Chapter 11 companies to determine differences. Of the questions testing the model, none were significantly different ($p<.05$). Therefore, t-testing implies that the dominantly Chapter 11 sample is a valid representation of failures.

Sample Representation

To ensure that the sample represents the population, a comparison was made of the sample failure frequency distributions to the failure population by state and industry. The population figures include Chapter 7 and Chapter 11 failures (Dun + Bradstreet 1993). Using the chi-square test, there is no significant difference ($p<.05$). In other words, businesses in all six states from all industries are represented by about the same percentage in the sample as in the population which they represent. Percentage representation of the sample was listed above.

Nonresponse Bias

Nonresponse bias was minimized in this study by including initial nonrespondents in the sample, and by comparing statistically the initial nonrespondents' data to that of the initial respondents to ensure that there is no significant difference. Approximately 10% of the sample includes initial nonrespondents. Of the questions testing the model, no responses are significantly different ($p<.05$). The t-test and chi-square test results imply that the sample is not problematic due to nonresponse bias. In addition, the combined response rate of 43% is relatively high for failure studies.

RESULTS AND DISCUSSION OF MODEL TESTING

Testing the Literature Model to Develop the Startup Business Success versus Failure Prediction Model

To test the 15 independent variable literature model, stepwise discriminant analysis was run in order to predict the success or failure of 96 businesses. Because some of the variables are not significant, they are dropped from the Literature Model to form the Business Success Versus Failure Prediction Model. Below is a list of the variables retained and those excluded from the model after step 10 of stepwise discriminant analysis. The variables are in rank order by ability to discriminate between success and failure.

The Success versus Failure Prediction Model for Entrepreneurs with 0-10 Employees

S/F = *f* (professional advisors, planning, education,
minority business ownership, staffing,
parents owned a business, record keeping and
financial control, capital, industry experience,
economic timing)

The following variables were excluded from the model: management experience, product/service timing, age, partners, and marketing. Ten variables are kept in the model, and five are dropped from the model. For the standardized canonical discriminant function coefficients, classification results, and functional statistics of the model see Table 4.

The standardized coefficients (Beta) are similar to the coefficients in regression. The standardized coefficients are adjusted for unequal means and standard deviation. The absolute values of the standardized coefficients provide information concerning the relative importance of the predictor variables in the function. Therefore, they are presented in rank order. However, unlike regression, it is inappropriate to interpret the signs of the coefficients (Scherr 1989).

The most appropriate evaluation statistic of the model is not the coefficients because they are rank ordered, and the signs should not be interpreted. Therefore classification accuracy, canonical correlation, and the significance of the model are better test of the validity and reliability of the model.

Table 4
Discriminant FUNCTION Analysis Results

Model Standardized Canonical Discriminant Function Coefficients

Variable Name (Ranked by coefficient discriminant ability)	Standardized Coefficients
6. Professional advisors	-.75***
5. Planning	.65***
7. Education	.46***
14. Minority	-.37***
8. Staffing	.31***
13. Parents owned business	.29***
2. Record keeping and financial control	-.29***
1. Capital	-.28***
3. Industry experience	.27***
10. Economic timing	-.22***

*** $p < .001$

Classification Table

Actual Group	Predicted Group Failure	Success	Percentage Correct
Failure	67% (30)	33% (15)	67.7%
Success	18% (9)	82% (42)	82.4%
Overall Grouped Cases Classified			75.0%

Discriminant Function Statistics

Canonical correlation	.54
Eigenvalue	.42
Wilks' lambda	.70
Chi-square	30.89
Model significance level	.0006

Validity and Reliability of the Model

The research results imply content validity, empirical validity, construct validity, and reliability. To address content validity, this study based all questions on prior research. The model includes 15 variables stated in the literature as being factors contributing to success versus failure. There is no generally accepted list of variables/factors contributing to success or failure. Therefore, a criterion is established concurrently with the model. To help ensure the reliability of the model, stepwise discriminant analysis was run to eliminate collinear variables, and those with little discriminatory power. It can be inferred that multicollinearity is not problematic.

Empirical validity and reliability were tested three ways:

1. Predictive ability of the model. The model predicted 67.7% of the failed sample, and 82.4% of the successful firms correctly for an overall accuracy rate of 75%. See Classification Table section of Table 4. If random guessing produces a 50% correct classification, then the model is 25% more reliable at classifying a specific business as successful or failed.

2. Ability of the 15 independent variables to explain the variance in success or failure. The canonical correlation [simply the Pearson correlation between Y and X, similar to R in regression] was .54 indicating a correlation between predicted and observed group membership. This is reflective of the overall 75% correct classification.

3. Significance of the model. The chi-square of 30.89 was used to test the significance level of the model (p=.0006) [comparable to the F test in regression]. In other words, the model will reliably predict a group of businesses as failed or successful more accurately than random guessing over 99% of the time. Two other discriminant function statistics shown in Table 4 include: Eigenvalue .42 [the ratio of the between-groups to within-groups variability] and Wilks lambda .70 [the ratio of within-group variability to the total variability].

IMPLICATIONS

Use and Limitations of the Model

There are at least seven groups that can benefit from using the prediction model developed in this study: entrepreneurs, investors, lenders, suppliers, educators, consultants, and public policy makers. Entrepreneurs can assess the probability of success or failure before starting a business. Investors and lenders may be able to avoid conducting business with firms with a high probability of failure. Suppliers may decline credit or limit it to high risk businesses. Educators and consultants can make these other groups aware of the model and help them to use it. Public policy makers can use the model when selecting assistance either to prevent failure or to promote further growth.

When the seven groups use the model, it is important to realize that the model is not intended to replace existing default risk prediction techniques. It should be used in conjunction

with the present techniques used by investors, lenders, creditors, and other groups to avoid default. The model does not provide numerical guidelines for variables distinguishing success from failure. Judgment is needed when applying the model. For example, the variable "planning" states that people starting firms with a specific business plan have a greater chance of success than people without a specific plan. However, the model neither defines "specific" nor gives a sample business plan needed to be successful. The user must look at the list of variables in the model and subjectively assess the strengths of the business for each variable. Use judgment when a business is strong on some variables and weak on others. When judgment is needed, the other decision criteria previously used become increasingly important in avoiding default.

Further Research

Some unanswered questions require further research. Why are there inconsistencies within the literature and discrepancies between the literature and this study? Almost all of the major variables identified in the literature as factors contributing to success or failure have been rejected by one or more other existing studies; see Table 2. Management experience constitutes one major area of discrepancy between the literature and this study. Fourteen of the twenty articles support this variable as a distinguishing factor between success or failure. However, management experience was not a significant variable in this perdition model.

In this study ten of the 15 variables were significant predictors of success or failure ($p<.001$). Of the 20 journal articles from which the variables were adapted, only Cooper et al. (1990 + 1991), and Reynolds and Miller (1987 + 1989) developed nonfinancial empirically tested predictive models. They each developed two models based on the same data set. The following bullet list compares each of the 15 variables, Tables 1 and 2, for these four models and this study's model [prediction model for 0-10 employees] to show discrepancies among studies.

1. *Capital* is the only tested significant variable in their four models and this 0-10 model.

2. *Record keeping and financial control* was a significant variable in the Reynolds models and this 0-10 model, and it was not a tested variable in the Cooper models.

3. *Industry experience* was a significant variable in the Cooper 1991 model and this 0-10 employee model, but it was not significant in the Cooper 1990 model, and it was not a tested variable in the Reynolds models.

4. *Management experience* was not a significant variable in the Cooper models or this 0-10 model, and it was not tested with the Reynolds models.

5. *Planning* was a significant variable in Cooper 1990, both Reynolds models, and this 0-10 model, and it was not a tested variable in the Cooper 1991 model.

6. *Professional advisors* was significant in the Cooper models and this 0-10 model, and it was not a tested variable in the Reynolds models.

7. *Education* was significant in the Cooper 1991 model and this 0-10 model, but it was not significant in the Cooper 1990 model or the Reynolds and Miller 1989 model, and it was not a tested variable in the Reynolds 1987 model.

8. *Staffing* was a significant variable in this 0-10 model, but it was not significant in the Reynolds models, and it was not a tested variable in the Cooper models.

9. *Product/service timing* was a significant variable in the Cooper 1990 model and the Reynolds models, but not in the Cooper 1991 model or this 0-10 model.

10. *Economic timing* was a significant variable in the Cooper 1990 model and this 0-10 model, but not in the Cooper 1991 model, and the Reynolds models did not test it as a variable.

11. *Age of owner* was a significant variable in the Cooper 1990 model; but it was not significant in Cooper 1991, Reynolds and Miller 1989, or this 0-10 model; and it was not tested in the Reynolds 1987 model.

12. *Having partners* was a significant variable in the Cooper 1990 and Reynolds and Miller 1989 model, but not the Cooper 1991 or this 0-10 model, and the Reynolds 1987 model did not test this variable.

13. *Parents owned a business* was a significant variable in the Cooper 1991 model and this 0-10 model, and it was not tested by the Reynolds models or Cooper 1990 model.

14. *Minority ownership* was a significant variable in both Cooper models and this 0-10 model, and it was not a tested variable in either Reynolds models.

15. *Marketing skills* was not a significant variable in any of the models, it was rejected as significant in the Reynolds 1987 model and this 0-10 model, and the Cooper models and Reynolds and Miller 1989 model did not test it.

To summarize, the only variable tested and accepted by all five models is capital. The variables tested by at least three models and not rejected by any as significant include: planning, record keeping and financial control, professional advisors, and minority ownership. Variables both supported and rejected as significant include: industry experience, education, staffing, product/service timing, economic timing, age of owner, and partners. The variables not supported as significant by any of the five models, and rejected by two or three include: marketing skills and management experience. With these discrepancies among studies, further predictive model testing is needed to provide reliability and validity.

Conclusion

The purpose of this study has been achieved. The generic young nonfinancial business success versus failure prediction model for businesses with 0-10 employees developed in this study will reliably outperform random classification of a group of businesses as successful or

failed over 99% of the time (model p=.0006). The model will accurately predict the success or failure of a specific business 75% of the time. The ten variables in the model explained 54% of the variance of factors contributing to success or failure.

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