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Article

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OPERATIONS, INFORMATION & TECHNOLOGY | RESEARCH ARTICLE

The impact of innovation on the performance of small-to-medium informal metal-trade enterprises in Zimbabwe

Clifton Makate^{1*}, Marshall Makate², Shephard Siziba² and Zvakanyorwa Sadomba³

Abstract: The informal sector in Zimbabwe plays a fundamental role in the supply of intermediate agricultural technologies. The seemingly never-ending economic crisis has arguably contributed to the collapse of the formal industrial sector resulting in a shortage of farming technologies especially amongst small-scale farmers whose numbers increased exponentially post the agrarian reform in 2000. However, innovation capabilities by informal entrepreneurs and overall firm performance are critical elements for eventual impact of the sector to the farming community. This study scrutinises the effect of informal entrepreneurial innovations on firm performance using data from 602 randomly selected informal metal industry entrepreneurs clustered across 15 districts from eight provinces in Zimbabwe. An instrumental variable regression method is employed to control for potential endogeneity bias associated with the voluntary nature of the decision to innovate. Results show that firm and firm owner characteristics and policy are important correlates of innovation while entrepreneurial innovations promote firm performance. Overall, these findings highlight the importance of entrepreneurial innovations on firm performance and the need for ensuring continuity of the informal metal businesses. Also, policies that promote acquisition of cheap



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Clifton Makate is Agriculture and Resource Economist specialized in socioeconomics of smallholder agriculture value chains upgrading. Over the years, he has done substantive work on the nexus between informal economy proliferation and supply of intermediate agricultural technologies to small-scale farmers in Zimbabwe, smallholder value chain studies in Southern Africa, socioeconomics of sustainable agricultural practices adoption and impact in Southern Africa, maternal and child health in Africa, agriculture policy analysis, natural resources management and food security. His research has relied on a wide range of both quantitative and qualitative research methodologies. Currently, his research focus more on economic, environmental and social aspects of climate smart agriculture innovations adoption and upscaling in East and Southern Africa.

PUBLIC INTEREST STATEMENT

This article outlines the importance of entrepreneurial innovations in the Zimbabwe's informal sector. Cycles of economic crisis in Zimbabwe have led to the growth and development of a fully functional informal economy. The informal economy now plays a fundamental role in supplying intermediate agricultural technologies to resource-poor smallholder farmers after the collapse of the formal economy. This study therefore highlights how important innovation abilities of informal players in metal-trade business is helping grow their businesses. Innovators are benefiting more from producing and selling differentiated products particularly to niche markets such as smallholder farmers than their non-innovative counterparts. Encouraging innovation through a supportive government policy that can enhance acquisition of cheap entrepreneurial skills and create a better working environment for the informal players have far-reaching implications for livelihood and food security in Zimbabwe.

entrepreneurial skills and a favourable business climate that supports innovation might help to steer Zimbabwe's economy out of trouble.

Subjects: Economics and Development; Entrepreneurship; Small Business Management; Social Entrepreneurship; Manufacturing industries

Keywords: entrepreneurial innovation; firm performance; agricultural technologies; informal economy; Zimbabwe

1. Introduction

Small and medium enterprises (SMEs) play an essential role in promoting innovation, and economic growth especially in less-industrialized countries like Zimbabwe (Makate, Siziba, Hanyani-Mlambo, Sadomba, & Mango, 2016; McIntyre, 2001). This observation is partly explained by the fact that, in most low-income countries, SMEs contribute significantly to employment creation, innovation, manufacture of goods and services, entrepreneurship and consequently to economic growth (Le Roux & Bengesi, 2014; McIntyre, 2001; McPherson, 1996). In the case of Zimbabwe, the many years of economic distress has arguably contributed to the collapse of the formal industrial sector. The collapse of the formal industry and the demand of intermediate technologies by small-scale farmers have provided opportunities for informal business enterprises to produce and supply intermediate agricultural technologies to the new crop of farmers that emerged following the agrarian reform of 2000 widely known as the Fast Track Land Reform Programme (FTLRP) (Makate et al., 2016; Mujeyi, Mutambara, Siziba, Sadomba, & Manyati, 2015).

The ability of the informal SME sector to develop and implement innovations is increasingly important for competitiveness (productivity and profitability), and sustainable growth (Farsi & Toghraee, 2014; McEvily, Eisenhardt, & Prescott, 2004; Senge, Carstedt, & Porter, 2001). More importantly, innovation in the sector is important in ensuring greater cost efficiency and production and distribution of new products that match consumer needs. According to the International Labour Office ILO (2002), the business acumen, creativity and innovation of informal business owners motivate the informal sector to serve as an incubator for business potential and transitional base for graduation to the formal economy. The literature examining the influence of innovation on firm performance or productivity amongst informal entrepreneurs in Zimbabwe is scarce but emerging. A fair share of emerging literature has largely focused on assessing the determinants of innovation knowledge sharing on technological innovations and existence of some innovation (Manyati, 2014a, 2014b; Mujeyi et al., 2015; Mushipe, 2007).

This article, therefore, seeks to answer the following question; does innovation amongst informal metal manufacturing firms influence their performance? Responding to this question is important as it might reveal whether the production of new and unique products bolsters an informal firm's competitive position relative to its non-innovative counterpart. As highlighted in Geroski, Machin, and Van Reenen (1993), innovating firms can possess a competitive edge over their rivals as they are more liable to produce unique products which might increase their profitability at least in the short-run before rivals begin to imitate and begin to chew-up the innovator's rents (Geroski et al., 1993). Alternatively, innovation helps a firm build-up its core competencies in a variety of ways that make it quicker, more flexible, adaptable, and capable of dealing with market pressures compared to its non-innovating rival. Moreover, as competition for customers and resources intensifies, the ability of a small business to innovate becomes an essential component for its long-run sustainability (Acs & Audretsch, 1990; Cairncross, 2001). Evaluating the influence of innovation on informal firm performance might benefit policies meant to promote sustainable growth in the Zimbabwean economy.

The rest of the paper is organised as follows: section (2) presents the background to the study, while section (3) presents a review of the literature pertaining to innovation and performance in small businesses. Section (4) highlights on the research methods followed in this study. Sections

(5) and (6) furnish the study results and discussions, respectively. Lastly, section (7) concludes, giving the study implications, and policy recommendations.

2. Background

Zimbabwe has a fully functional informal sector, which contributes significantly to socio-economic development. Recent estimates show that the informal sector in Zimbabwe contributes over 60% to gross domestic product (GDP) and slightly over 80% to employment (Government of Zimbabwe, 2011; Makochekanwa, 2010). With continued economic challenges facing the Zimbabwean economy, the informal sector continues to grow. Historically, the growth and development of the informal sector in Zimbabwe can be traced back to pre-independence but with a clear cut development highly noticeable post-independence in 1980. Strict laws and regulations such as the Town and Country Planning Act of 1946, the Vagrancy Act of 1960, the Urban and Council Act of 1973 and the Vendors and Hawkers by-laws of 1973 restricted growth of the informal sector before independence (Dhemba, 1999). A number of events contributing to economic crises post-independence that might have contributed to the growth of the informal economy are cited in the literature. For example, the economic structural adjustment programme (ESAP) introduced in 1991 is believed to have brought more suffering than solutions especially for the urban population (Dhemba, 1999). In particular, policy reversals that characterised the ESAP implementation process and droughts of 1991–2 contributed towards the overall failure of the program (Manatsa, Chingombe, Matsikwa, & Matarira, 2008; Mumvuma, Mujajati, & Mufute, 2006), which might have forced individuals to join the informal sector. Furthermore, the 2000–08 economic crisis which marked the country's worst economic performance since independence in 1980 (Coltart, 2008) provided further impetus to the growth of the informal economy in Zimbabwe. The economic crisis forced many people out of the formal job market which contributed to the expansion of the informal economy. The inevitable relationship between macro-economic downturn and growth and development of the informal economy is well documented (Chidoko & Makuyana, 2012; Sadomba, 2013). Continued economic challenges in the country have kept the informal economy flourishing.

SMEs in Zimbabwe's informal sector are uniquely important for their role in helping smallholder farmers source intermediate agricultural technologies. The new agrarian reform of 2000 culminating in the Fast-Track land reform programme (FTLRP) led to an increase in the number of smallholder farmers who are mainly resource poor (Moyo, 2011a; Moyo & Chambati, 2013). Official statistics reveal that the FTLRP benefited nearly two hundred thousand households through politically motivated acquisition and distribution of more than 10 million hectares of land formerly held by about 4,500 large-scale white commercial farmers (Moyo, 2011b; Moyo & Chambati, 2013; Sadomba, 2013). Due to political pressure from various grievance groups, particularly the war veterans of the 1970s liberation struggle, the agrarian reform of 2000 employed guerrilla strategies and tactics, therefore appearing chaotic and without proper planning (Sadomba, 2008, 2011). Thus, the agrarian reform did not yield the desired results as the government did not have any supporting policy to back the new crop of resource-constrained farmers. This lack of a supportive policy to the hurried land reform and general economic crisis had great push effects for informal entrepreneurship and innovation particularly for the manufacturing of intermediate agricultural technologies (implements, tools and equipment) (Makate, 2013; Mujeyi et al., 2015).

The collapse of the formal sector that traditionally supported large-scale farmers in the manufacture and distribution of agricultural mechanization technologies (Mafu, 2011) and consumption of intermediate agricultural technologies by the new crop of farmers created an enormous demand-driven opportunity for informal players to create self-employment through manufacture and distribution of intermediate agricultural technologies mostly suited to the smallholder farming sector (Makate, 2013; Manyati, 2014b; Mujeyi et al., 2015). This development has been a huge boon especially for improving productivity and food security in the country as smallholder farmers produce most of the food in the country. Moreover, the development of a home-grown solution to address a local problem has positive connotations for sustainable developmental plans or growth strategies.

Against this background, there is therefore a need to keep the informal manufacturing firms functional so that the gains to the smallholder farming sector and consequently to the overall economy continue to be realised. Innovation is one important aspect that can drive the sector forward. Innovations are important in ensuring competitiveness, sustainable growth, profitability and productivity in small firms (Farsi & Toghraee, 2014; McEvily et al., 2004; Senge et al., 2001). Precisely, innovation can result in cost efficiency and provision of new products to meet specific customer demands (Senge et al., 2001) which contributes to business viability. More so, innovation has been linked and credited with the smooth transitioning from developing to full industrialisation of nations (ATPSN, 2010; Stone, Rose, Lal, & Shipp, 2008). Emerging literature on informal metal manufacturing entrepreneurs in Zimbabwe has provided evidence on innovation ability among informal entrepreneurs (Manyati, 2014a, 2014b; Mujeyi et al., 2015; Mushipe, 2007). To the best of our knowledge, we are unaware of any study for Zimbabwe that attempts to ascertain the influence of innovation by informal metal manufacturing enterprises on firm performance.

3. Related literature; entrepreneurial innovation and performance in small firms

In this section, a review of the literature pertaining to the influence of innovation on firm performance is discussed. Innovation in small business as defined by Cairncross (2001) involves identification, application and exploitation of a new product, process or marketing opportunity by the small business which increases its capability to generate wealth and strengthen its competitive position (Cairncross, 2001). Since the focus of this study is on manufacturing by small businesses, the study adopts the definition of innovation proposed by Freeman (1982), who defined innovation as the technical, design, manufacturing, management and commercial activities involved in the marketing of a product or the first commercial use of an improved or new process or equipment (Bessant & Tidd, 2007; Freeman, 1982; Terziovski, 2010).

Innovation in small firms can transcend in all areas from production, finance, planning, marketing and human resources management, but it is mainly one dimensional as many of these functions are carried out by the owner (Tunney, 2011). For this reason, it is highly probable that innovations are a result of technological breakthroughs, designing or as an output of once-off events or difficulties to be overcome (Acs & Audretsch, 1990; Tunney, 2011).

However, in small family-run firms, innovation may suit the specific needs of the owner-managers and staff. For example, innovation may take the form of the following; labour-saving techniques, improved and simplified processes, new processes to be owned by the employers and not necessarily the owner and increased visibility of problem areas which needs to be addressed (Beaver & Prince, 2002; Tunney, 2011). In addition, small businesses may innovate through producing new and improved products developed and offered to a niche of customers (e.g. producing intermediate technologies for smallholder farmers in the Zimbabwean case), the development of lean processes, development and implementation of new management techniques and being open to best practice ideas and external influences (Beaver & Prince, 2002; Tunney, 2011).

The role of innovation in driving performance is well documented in the literature (Jiménez-Jiménez & Sanz-Valle, 2011). In particular, there is a substantial amount of literature on the influence of innovation on firm performance in developed country contexts and mainly from formal small- and medium-sized firms. However, very little is yet known in the context of developing countries particularly amongst players operating in the informal economy. This study relies on available literature on the subject to shed light on the potential consequences of innovation in Zimbabwe's informal metal manufacturing firms on performance.

From the available literature, innovation influences a firm's performance as it helps to deal with the instability of the exterior settings that may impact the business (Baker & Sinkula, 2002; Darroch & McNaughton, 2002; Jiménez-Jiménez & Sanz-Valle, 2011). This point is also echoed in Brown and Eisenhardt (1995) who highlight the need for business to innovate if they are to survive in dynamic

and unstable market environments (Brown & Eisenhardt, 1995). Innovative firms in such environments are more liable to cope with the increasing complexity and change through exploitation of new products, processes and market opportunities compared to their non-innovative counterparts. Also, innovation can result in small firms gaining rents through the temporary establishment of a monopoly (Schumpeter & Backhaus, 2003) which can act as a key source of long-term firm success (Rosenbusch, Brinckmann, & Bausch, 2011). It is also important to note that, through innovation, small firms can withstand stiff industry competition (i.e. price competition) (Porter, 2008) as they are more likely to benefit from serving attractive niches with their innovative products and from brand loyalty of customers valuing distinctiveness of their innovations (Lieberman & Montgomery, 1988). These benefits are more likely in innovative small firms than their non-innovative counterparts. Furthermore, Branzei and Vertinsky (2006) suggest that innovative firms are likely to possess a competitive advantage over their non-innovating counterparts given their dynamic capabilities which manifest in the form of recombination, improvement and/or creation of wealth in value creating tactics (Branzei & Vertinsky, 2006). Further benefits of innovation include; economies of scale, ability to set standards, learning economies, advantages in further innovation proficiencies and pre-emption of scarce resources (Shepherd & Shanley, 1998).

Most of the empirical literature on innovation and firm performance point to a positive relation (for example, Bierly & Chakrabarti, 1996; Brown & Eisenhardt, 1995; Caves & Ghemawat, 1992; Damanpour, 1991; Damanpour & Gopalakrishnan, 1998; Darroch, 2005; Hansen, Nohria, & Tierney, 1999; Miles, Snow, Meyer, & Coleman, 1978; Roberts, 1999; Schulz & Jobe, 2001; Terziovski, 2010; Thornhill & Amit, 2003; Verhees & Meulenbergh, 2004; Weerawardena, O'Cass, & Julian, 2006) and hence this study hypothesises a positive relation between innovation and firm performance, and innovators/innovative firms to be in more competitive positions than their non-innovative counterparts.

4. Methods and data

4.1. Data

The empirical analysis uses data collected from 602 randomly selected informal metal industry businesspersons across 15 sampled districts in 8 of the 10 provinces of Zimbabwe. The survey leading to collection of this data was part of a regional project *Sharing growth through informal employment in Eastern and Southern Africa* sponsored by the International Development Research Centre (IDRC). Sampling considered dissimilar categories of main industries, such as agro-industry, forestry, manufacturing and mining, and aimed to collect data from areas dominated by these industries (Makate et al., 2016). All major towns in the eight selected provinces were selected and studied as clusters, including their rural peripheries. A Multi-stage sampling technique was applied. Provinces were identified first, then cities were randomly selected, towns, rural growth points, and mining plus agro-industry centres. Specific sample units that dominated informal metal manufactures were then identified from aforementioned clusters for data collection. Special external factors as market influence of South Africa and official border exists were considered. The survey covered all firms in the identified clusters. The firms were almost of the same sizes and were involved in the same line of business (metal fabrication). Data analysed in this article were collected through formal questionnaire interviews with firm owners (metal fabricators). Interviews with identified manufacturers captured in-depth information on the production cycle, supply chain and informed innovations. Data were gathered between July 2012 and April 2013.

4.2. Measures of innovation and firm performance

This study uses the ability of informal manufacturers to design or modify known designs to suit customer needs as a measure of innovation following earlier definitions presented on innovation. Given the nature of sources of innovation highlighted in Tunney (2011), most innovations in the informal metal manufacturing were found to be consumer-induced (mainly induced by small-scale farmers and miners). Small-scale miners and/or farmers could specify their specific needs on

certain technologies and equipment hence forcing the informal entrepreneurs to design and produce differentiated products.

In addition, the study relies on four variables relating to growth and business volume in the informal businesses and achievement of household livelihood goals as proxy measures of informal firm performance. Sales (*Sales_High*) measured as a summation of all the months (January to December) when sales were reported to have been average or higher, total business expenditures transformed to logarithm (*log_tot_expenditure*), Income level in the preceding month (*income* above US \$1000) and average proportion of household income obtained from the metal business (*prop_income*). The study takes cognisance of the fact that family-run firms in the informal sector aim to achieve a combination of financial and non-financial business goals (Daily & Dollinger, 1992) hence such a mix in choice of variables in this study. Sales and total expenditure are good proxy measures of growth and business volume (Chandler & Hanks, 1993; Lee, 2006; Murphy, Trailer, & Hill, 1996) and operational liquidity (Lippman & McCall, 1986) hence can be good proxy measures of performance in informal metal manufacturing firms under study. In addition, since family-run firms may have the main goal of pursuing personal livelihood objectives (Daily & Dollinger, 1992), for example income and survival, which is common in the informal economy, income measures as proxy for performance chosen in this study may be appropriate. More so, several income variables have been proven to be good proxy measures of growth and business volume (Marques, Gerry, Covelo, Braga, & Braga, 2011; Murphy et al., 1996) hence income is a good performance measure in the informal economy.

4.3. Explanatory variables

The study controlled for several explanatory variables supposed to influence firm performance. To account for any provincial differences, the study included indicators for the province of residence (i.e. Bulawayo; Harare; Manicaland; Mashonaland central, east, and west; Midlands; and Masvingo). More so, the study also included some background controls for the owner's age, marital status and years of education. The years of education are likely to positively impact innovation since educated individuals are likely to engage in research and developmental activities for their businesses (Kleinknecht & Mohnen, 2001). Some of the respondents in this study who had missing years of education (nearly 14% overall) were assigned an average level of education in the overall sample. To account for the plausible bias of such imputation, the study included a binary indicator for missing education in all regressions. The study also included the number of employees, binary indicators for electricity and coal usage, indicators for affiliation to professional organizations, and level of competition in the industry (i.e. very stiff, stiff, moderate and fair). Affiliation to professional organizations might act as an important source of information for the business and thus can have a positive influence on firm innovation. Also, as one would expect, the level of competition in the industry might also impact firm performance as firms will fiercely compete for a share of the market. Lastly, the study included a variable to capture the views of the respondent regarding the influence of the multi-currency policy on business performance (i.e. whether it has increased, decreased, not affected business activity at all).

4.4. Empirical strategy

To understand the influence of firm innovation on firm performance, this study adopts the empirical methods specified in Baldwin, Hanel, and Sabourin (2002) with slight modifications to suit this particular analysis. We start by specifying a basic model linking firm innovation to firm performance as follows:

$$Performance_i = \gamma_0 + \gamma_1 \times innovation_i + \gamma_2 X_i + \varphi + \varepsilon_i \quad (1)$$

where *Performance_i* represents a performance measure for firm *i*, *innovation_i* is the binary measure for innovation by firm *i* which takes a value of one if the firm is engaged in some form of manufacturing design or alteration activity and zero otherwise, *X_i* is a vector accounting for other firm-level characteristics believed to influence firm performance, φ are the province fixed effects, and ε_i is an

idiosyncratic disturbance term. The province fixed effects allow us to control for obvious differences among Zimbabwe's surveyed provinces (eight). Some of the variables included in the vector X_i include the age of the owner, marital status, gender, educational attainment (measured in years of completed schooling), availability of electricity or coal, professional affiliation to organizations, indicators for industry level of competition, and a binary indicator to reflect the subjective views of the individuals on the influence of the multi-currency system implemented in the country. The primary coefficient of interest in this case is γ_1 which measures the influence of firm innovation on firm performance.

As is well known, estimating equation (1) using an ordinary least squares (OLS) approach might result in misleading inferences of the causal impact of innovation on firm performance, given the plausible endogeneity nature of firm innovation (Baldwin et al., 2002). The firm's propensity to innovate is liable to be correlated with some unobserved factors that also influence firm performance (i.e. correlated with the error term ϵ_i). Thus, the study seeks an empirical technique that identifies variabilities in innovation that is exogenous to firm performance. To this end, this study follows the previous literature in this area and uses the years of business of the firm (age of business) as an instrumental variable for firm innovation (Harris & Li, 2009). The idea here is that firms that have been in existence for some time are less liable to be cash constrained than their younger counterparts and thus able to engage in research and development or training activities to boost their innovative capacities (Hall, 2002). Equation (1) is estimated using an instrumental variable (IV) method in this study. The first stage of the model is specified as follows:

$$innovation_i = \alpha_0 + \alpha_1 X_i + \alpha_2 Z_i + \varphi + \epsilon_i \quad (2)$$

where $innovation_i$ is defined as before, Z_i is the instrumental variable of choice (i.e. the age of the firm), X_i is a vector of variables assumed to influence firm innovation such as competition, location, education among others, φ is as defined earlier, and ϵ_i is an error term. For ease of interpretation, the study estimates equation (2) using a linear probability model to generate the predicted level of innovation, $\widehat{innovation}_i$. The next step involves estimating firm performance, $Performance_i$ as a function of the predicted value of innovation including other factors impacting firm performance as explained earlier. The second stage equation can now be specified as follows:

$$Performance_i = \beta_0 + \beta_1 \times \widehat{innovation}_i + \beta_2 X_i + \varphi + \epsilon_i \quad (3)$$

The coefficient estimate β_1 found after considering the potential endogeneity of innovation can now be interpreted as representing the causal impact of firm innovation on firm performance. However, the study wishes to note that the estimate of β_1 we find can only be interpreted as measuring the local average treatment effect (LATE) and could still be minimally plagued with other unobserved factors. Interpreting the coefficient β_1 as causal requires at least two assumptions to be satisfied. First, conditioning on other explanatory variables as described earlier, it must be the case that the chosen instrumental variable (number of years the firm has been in business) impacts the dependent variable, firm performance only through the treatment variable (innovation) (Wooldridge, 2010). Second, the chosen instrumental variable must be highly correlated with firm innovation. The study has furnished the F-statistics including the probability value (p-value) to formally check the strength of the instrumental variable. The previous literature in econometrics has established that an instrumental variable is considered strong if the value of the first stage F-statistic exceeds 10 (Staiger & Stock, 1997).

4.5. Robustness checks

To assess the robustness of the empirical estimates, this research conducted several specification checks. First, it considered another instrumental variable defined as the age of the business interacted by the education of the owner. The intuition here being that older firms owned by highly educated individuals are more liable to engage in research and development activities and thus more liable to innovate than their counterparts (Kleinknecht & Oostendorp, 1994). Second, since the main outcome of interest in this study is firm sales, the study considered a quarterly measure of firm sales to assess whether our estimates are influenced by seasonality or not. Our findings appear to reveal that the obtained estimates are weakly robust to all these sensitivity checks.

5. Results

5.1. Descriptive statics

The descriptive statistics for innovator and non-innovator groups including t-test results are displayed in Table 1. Most of the variable statistics are comparable between the innovator and non-innovator groups except, female representation, years in business, use of energy from electricity and coal, professional affiliation, and perception on the influence of the multi-currency system on business performance. The sample average for years of formal education by the firms in our sample was about 11.03 years at the time of the survey. The average age of entrepreneurs analysed is 34.95 years. Approximately, 4.20% of the entrepreneurs were female and 83.10% of the analysed entrepreneurs were married at the time of the survey. Of the 4.2% female entrepreneurs, 11.80% of them were non-innovators compared to only 2.60% innovators. In addition, average years in metal manufacturing business for entrepreneurs was found to be at 10.05 years, with innovators having more experience 10.64 years compared to 7.13 for non-innovators. Approximately, 88.70% and 30.70% of the informal business persons relied on electricity and coal as main energy sources, respectively. Innovators relied much on electricity (92.6% as compared to 69.5% non-innovators) and less on coal (27.4% as compared to 47.10% non-innovators). In terms of professional affiliation, only 6.10% of informal manufacturers were affiliated to at least one professional organization. More non-innovators (10.00% compared to 7.2% innovators) were found to be affiliated to at least one professional organization. More so, 79.60% manufacturers had a positive perception that the multi-currency system improved their businesses. More innovators (82.40% compared to 65.7% non-innovators) had that positive perception. More so, entrepreneurs in the informal economy believed industry competition was high as indicated by the average score of 2.12 on a four-level scale (1 = very stiff, 4 = fair).

5.2. Effect of years in business on innovation

Table 2 furnishes the first stage results from models on the influence of years in business on innovation. In the top panel of the Table, we show the results on the influence of years in business on innovation and in the bottom panel the influence of an interaction term for years in business and entrepreneur's education (alternative instrumental variable) on innovation. In the first column (1) model results for the overall sample are presented. Reported in the Table are coefficients and standard errors in parenthesis. Columns 2, 3, 4, and 5 show model results for female, Male, Bulawayo and Harare sub-samples, respectively. Main results in the top panel of Table 2 indicate that the number of years in informal business positively influence innovation by the informal entrepreneurs. Precisely, a single year of increase in the informal business improves the odds of innovation by the entrepreneurs by 0.90 percentage points result significant at 99% level. Also, the results indicate that years spent in informal business have a positive influence on innovation in both male and female samples. Specifically, a one-year increase in years in business improves odds of innovation by nearly 0.60 and 0.80 percentage points in female and male subsamples respectively results all significant at 99% level. Moreover, years in business have a positive influence on innovation in two major towns dominated by informal metal manufacturing activities in Zimbabwe. Specifically, a one-year increase in the informal business improves the odds of innovation by about 1.50 and 0.70 percentage points for the Bulawayo and Harare entrepreneurs, respectively. The results for Bulawayo and Harare are significant at 99% and 90% level, respectively.

Overall, the results indicate that the number of years in informal business positively influence firm innovation. The first stage F-test statistics and their corresponding p-values displayed in Table 3 show that the chosen instrumental variable (years in business) performed reasonably well. The F-statistic ranged from 46.02 to 65.90 and is statistically significant at the 95% level. The results in the bottom section of Table 2 confirm a positive and significant influence of years in business on firm innovation. The coefficients are slightly lower compared to the results in the top panel of Table 2 but results for all the models except for the female sub-sample are statistically significant. They

Table 1. Descriptive statistics for selected variables used in the analysis

Variable	Innovators	Non-innovators	t-Test (p-value)	Overall sample
	(1)	(2)	(1) -(2)	(3)
Years of schooling	10.993	11.211	0.386	11.030
Missing education	0.132	0.176	0.238	0.140
Age	35.155	33.928	0.244	34.947
Female	0.026	0.118	0.000***	0.042
Married	0.840	0.784	0.172	0.831
Years in business	10.643	7.131	0.000***	10.048
Has electricity	0.926	0.696	0.000***	0.887
Uses coal	0.274	0.471	0.000***	0.307
Professional affiliation	0.072	0.010	0.017**	0.061
Multicurrency	0.824	0.657	0.000***	0.796
Industry competition*	2.128	2.088	0.735	2.121
Geographic variables				
Bulawayo	0.092	0.078	0.663	0.090
Harare	0.462	0.696	0.000***	0.502
Manicaland	0.124	0.059	0.058	0.113
Mashonaland Central	0.042	0.029	0.554	0.040
Mashonaland West	0.130	0.098	0.374	0.125
Midlands	0.062	0.010	0.032	0.053
Mashonaland East	0.018	0.000	0.173	0.015
Masvingo	0.070	0.029	0.125	0.063

Notes: ***Significant at 99% level; **significant at 95% level; *significant at 90% level. *The variable industry competition is a categorical variable ranging from 1 = very stiff to 4 = fair competition.

all confirm the strength of firm age (years in business) or possibly interaction term of education and firm age as a good instrument for innovation in the informal sector. Precisely, the interaction term (Education \times age of firm) positively influences innovation by about 0.1 percentage points in both the overall and male sub-samples. The results are all significant at 99% level (i.e. $p \leq 0.01$). Further, the interaction term positively influences innovation by about 0.1 percentage points in both Bulawayo and Harare sub-samples. The results for Bulawayo and Harare are significant at 95% and 99% respectively (Table 2).

5.3. Impact of innovation on firm performance

Results of the impact of innovation on informal businesses' performance are presented in Table 3. In the top part of, 3 baseline OLS estimates are presented while in the bottom part of the same table main IV estimates are presented. The baseline results in the top panel of Table 3 only show a negative significant correlation between innovation and total firm expenditure. The bottom part of Table 3 shows IV estimates indicating that innovation has a positive and significant influence on firm sales and total expenditures. The results indicate that firms that innovate are more liable to report above average or high sales in about 1.96 months in a year (significant at the 95% level). Also, firms that innovate are more likely to have increased expenditures by about 31.50 percentage points (significant at 90 % level of significance). Comparing baseline OLS and IV estimates indicate that the influence of innovation on sales and total firm expenditure is underestimated. This result emphasizes the importance and need for controlling for possible endogeneity bias arising from innovation in firm performance regressions. However, the observed underestimation could be explained by the fact that the IV estimator measures the local average treatment effect (LATE) while the OLS estimator calculates the population average treatment effect (ATE) (Angrist, Imbens,

Table 2. First stage results: the impact of years in business on innovation

	Overall	Female sample	Male sample	Bulawayo	Harare
	(1)	(2)	(3)	(4)	(5)
Years in business	0.009*** (0.001)	0.006*** (0.001)	0.008*** (0.001)	0.015*** (0.005)	0.007 *(0.003)
Observations	602	25	577	54	302
Mean of the dependent variable	0.831	0.520	0.844	0.852	0.765
Education × age of firm	0.001*** (0.000)	-0.000 (0.000)	0.001*** (0.000)	0.001* (0.001)	0.001** (0.000)
Observations	602	25	577	54	302
Mean of the dependent variable	0.831	0.520	0.844	0.852	0.765

Notes: ***Significant at 99% level; **significant at 95% level; *significant at 90% level. All the regressions include controls for the respondent's age; binary indicators for marital status, gender, missing years of education, electricity usage, coal usage, professional affiliation, industry competition, multi-currency system effects; years of education; and province fixed effects. Heteroskedasticity-robust standard errors are shown in parentheses and clustered at the province level.

& Rubin, 1996). Overall, results point to the importance of innovation in driving firm performance and the need to control for endogeneity bias arising from innovation in firm performance regressions.

5.4. Robustness check results

The analysis also conducted a number of healthiness tests to determine the sensitivity of performance outcomes. The results appear to reveal that obtained estimates are weakly robust to all these sensitivity checks. These results are shown in Tables 4 and 5 below.

Table 3. The impact of innovation on small-firm performance

	sales_high	log_tot_expenditure	income_above1000	prop_income
	(1)	(2)	(3)	(4)
OLS estimates				
Years in business	0.187 (0.127)	-0.225** (0.073)	-0.029 (0.067)	0.019 (0.010)
Observations	602	602	602	602
IV estimates				
Years in business	1.960** (0.628)	0.315* (0.134)	0.226 (0.475)	-0.182 (0.262)
Observations	602	602	602	602
First stage F-statistic	38.448	32.701	32.701	32.701
p-Value	0.024	0.025	0.025	0.025
Mean of the dependent variable	7.698	7.768	0.598	0.719

Notes: ***Significant at 99% level; **significant at 95% level; *significant at 90% level. All the regressions include controls for the respondent's age; binary indicators for marital status, gender, missing years of education, electricity usage, coal usage, professional affiliation, industry competition, multi-currency system effects; years of education; and province fixed effects. Heteroskedasticity-robust standard errors are shown in parentheses and clustered at the province level. Innovation is instrumented by years in business.

Table 4. Two-stage least squares estimates of the impact of innovation on small-firm performance—robustness

	Sales high (quarter 1)	Sales high (quarter 2)	Sales high (quarter 3)
IV estimates	(1)	(2)	(3)
Years in business	0.235 (0.482)	1.181*** (0.281)	0.571* (0.244)
Observations	602	602	602
First stage F-statistic	29.806	29.806	29.806
p-Value	0.025	0.025	0.025
Mean of the dependent variable	1.738	3.233	2.728
Education × age of firm	0.036 (0.392)	1.187*** (0.254)	1.046* (0.407)
Observations	602	602	602
First stage F-statistic	115.687	115.687	115.687
p-Value	0.026	0.026	0.026
Mean of the dependent variable	1.738	3.233	2.728

Notes: ***Significant at 99% level; **significant at 95% level; *significant at 90% level. Robust standard errors are shown in parentheses. In all the regressions, we controlled for the same explanatory variables as stated in Table 3.

Table 5. Two-stage least squares estimates of the impact of innovation on small-firm performance—robustness

	sales_high	log_tot_expenditure	income_above1000	prop_income
IV estimates	(1)	(2)	(3)	(4)
Education × age of firm	2.451*** (0.436)	0.235 (0.210)	0.175 (0.347)	−0.187 (0.207)
Observations	602	602	602	602
First stage F-statistic	459.239	237.766	237.766	237.766
p-Value	0.027	0.027	0.027	0.027
Mean of the dependent variable	7.698	7.768	0.598	0.719

Notes: ***Significant at 99% level; **significant at 95% level; *significant at 90% level. In all the regressions, we include controls as mentioned in Table 3. Heteroskedasticity-robust standard errors are shown in parentheses and clustered at the province level. Firm innovation is instrumented using education interacted with years in business.

Precisely, the analysis also considered a number of robustness tests to determine the sensitivity of the study performance results. Study results reveal that the obtained estimates are weakly robust to all these sensitivity checks. First, instead of instrumenting innovation by years in business, the study used another instrument defined as the age of the business interacted by the education of the owner. Second, since firm sales is the main outcome variable (a measure of growth and sales volume in the industry) used, the analysis considered a quarterly measure of firm sales. Using years in business as the instrument for innovation and a quarterly measure of sales, results (Table 4) show that innovation impacts positively on sales in the second and third quarters by about 1.18 and 0.57 months and the results are significant at 99% and 90% level of significance, respectively. In the same Table (Table 4) using interaction term (age of firm × education) results show similar positive and significant outcomes but with slightly larger estimates for impact. Specifically, results show that innovation impacts positively on sales in the second and third quarters by about 1.19 and 1.05 months, respectively. Results for the second and third quarter are significant at 99% and 90% levels of significance, respectively.

In Table 5 the analysis shows robustness estimates on the impact of innovation on all the performance variables. Results confirm the positive significant impact of innovation on high sales months. Precisely, this particular result (Table 5) shows that using an interaction term (age of firm \times education) as an instrument for innovation increases high sales months in a single year by approximately 2.45 months. The result is significant at 99% level of significance. Overall, the robustness checks (Tables 4 and 5) show that results are weakly robust to all these sensitivity checks, hence confirming the positive influence of innovation on firm performance.

6. Discussion

This study examines the effect of entrepreneurial innovations on firm performance using data collected from a nationally representative sample of informal family-run businesses in the metal manufacturing subsector of Zimbabwe. The study starts by comparing innovators and non-innovators according to their socio-economic and institutional characteristics. The empirical results reveal that innovators; are mostly male, have more years in the metal business, are more likely to be affiliated to professional organizations, have electricity as their main energy source and rely less on coal for energy than their non-innovator counterparts. Also, more innovators believed the multi-currency system adopted in Zimbabwe in 2009 improved their businesses as compared to their counterparts. These findings hint on the aforementioned factors as important conditions for innovation. For instance, the hardy nature of metal fabricating business could explain the dominance of male innovators in that industry. Metal manufacturing, from precolonial times, have been male dominated. Colonial and post-colonial conditions have not managed to change this culture which is enhanced by the gender bias of formal education. Courses like metal fabrication, boiler making, sheet metal engineering just to name a few, are dominated by men. This affects the overall number of women who get into informal sector metal manufacturing. Years in business (firm age) is an important factor of innovation (Manyati, 2014a; Mujeyi et al., 2015; Rosenbusch et al., 2011), which can also explain the discrepancy in years of experience in business between innovator and non-innovator groups. More so, professional affiliation to organizations such as academic institutions of higher learning, non-governmental organizations and vocational training centres can give an advantage to informal firms in accessing information, resources and skills that can enhance chances of innovation in the firm. Previous studies for instance (De Jong & Vermeulen, 2006; Romijn & Albaladejo, 2002) have also linked institutional support to small firms and their ability to innovate. The positive discernment by innovators on the impact of the multi-currency system to have improved informal businesses, highlight the possible importance of policy in creating a favourable environment that can allow cost-effective and sustainable innovations in the informal economy. The microeconomic environment influences the degree of innovation in the informal metal manufacturing of Zimbabwe. Innovation in this sector has been driven by extremely harsh microeconomic conditions. Farmers demand for more efficient cost-serving equipment to beat inflation. This is also at a time when formal industry dwindled owing to capital migration. The swift reaction of this sector has resulted in growth of a substitute competitive industry to sustain the national supply agricultural equipment and tools. The high performance of these firms, owing to intense communication with farmers under changing industrial structures has been the bastion of innovation. There is little wonder therefore how this sector has managed, albeit with difficulty, to substitute settler and international capital that positioned Zimbabwe as the second industrialised on the continent. From this angle, it is understandable why Sadomba (2011) has seen this structural change in Zimbabwe's industry as a reconfiguration rather than simply dwindling of industry. Innovation has played an important part in raising informal industry to levels of substituting formal industry. In this regard, Zimbabwe's informal sector, being able to sustain smallholder agricultural production through innovation, demands more and deeper studies. In literature, studies have also linked innovation with macroeconomic conditions (Hadjimanolis, 2000; Hoffman, Parejo, Bessant, & Perren, 1998; Hyvärinen, 1990), which signify that macroeconomic conditions can promote or constrain innovation in the informal sector. Higher (lower) incidence of innovators relying more (less) on electricity (coal) as their main source of energy as compared to their counterparts could signify the importance of electrical energy in aiding innovation in informal metal fabrication businesses. Related, Romijn and Albaladejo (2002)

linked innovation to service providers (e.g. energy utility institutions) which can explain this association. Furthermore, age, education and industry competition were found not to be significantly different between innovators and non-innovators. The results show that age, level of education and industry competition are similar between innovators and non-innovators.

Secondly, the study established a strong correlation of number of duration in business with innovation. Adding on to the positive correlations found between innovation and years in business from t-test results, correlation results point to the positive influence of length of period in business on innovation. Results obtained are consistent even when the overall sample is disaggregated by gender, Harare, and Bulawayo sub-samples. Moreover, results are also consistent even after using an alternative instrumental variable for innovation. This finding appears to suggest the appropriateness of duration in business by the informal entrepreneurs as a good instrument for innovation. This can be further explained by the fact that, with experience, firms may establish a specialized resource base that enables them to be efficient, flexible in operating in given conditions (Thornhill & Amit, 2003) better than their less experienced counterparts. Moreover, with development firms may grow established procedures which younger firms lack (Freeman, Carroll, & Hannan, 1983). Moreover, a study by Mujeyi et al. (2015) on drivers of innovativeness in informal entrepreneurs in Zimbabwe found that a year increase in years in the informal business approximately improves odds of innovativeness by 19.80%. Previous studies have also used years in business as instrumental variable for innovation for instance (Harris & Li, 2009). More importantly, duration in business fused with level of education was found to determine the propensity to innovate in Zimbabwe's informal sector. It is illustrating to note that Zimbabwe has both the highest levels of formal education and a young informal sector, comparably, on the continent. These are critical ingredients for growth of this resulting from high performance and competitiveness. The initial substitution role played during the flight of formal capital could be a prognostic trend. Only if the Government of Zimbabwe was sensitive to this could it be easier to groom an indigenous industry founded on firm innovations rather than wholesale technology importation. This is critical for what we call industrial democratization where more and indigenous players have a stake than in the previous situation where settlers and international capital were exclusive players. The longer this informal sector operates under high educational levels the higher the expected performance due to high propensity to innovate. This paints a bright and not a bleak future for Zimbabwe's industrial growth. With appropriate policies and investment, the country could attain its targets of Africa's agenda 2063.

Thirdly, main study findings point to the positive impact of innovation on growth and business volume. Precisely results show that innovation impacts positively on number of months with above-average sales and total business expenditures by approximately 1.96 months and 31.50 percentage points, respectively. Results are weakly robust to a number of sensitivity checks. This finding points to the importance of innovation by metal fabricating entrepreneurs in the informal economy in Zimbabwe on their performance. Important to note from the sensitivity checks is the fact that considering impact of innovation on quarterly sales revealed a highly significant positive causal correlation of innovation and sales in the second quarter. The second quarter (May to August) corresponds to main crop harvest and selling periods for farmers in Zimbabwe. Innovators could be benefiting more during this period due to their ability to produce distinguished products meeting farmer and other customers' needs and hence implicating positively on their performance. Furthermore, small-scale metal manufacturers reap the benefits of innovation during this effectively high demand of small-scale farmers who revamp their technology in preparation for the next cropping season. For example, farmers visit the Magaba Industries in Mbare Harare to buy won out plough parts. Interview with one innovator showed that when farmers' have money during this period, they (farmers) are eager to replenish the plough parts that are suitably modified. It was revealed that innovators take hardened and durable steel of heavy vehicle springs to create the base of the plough (muromo wegejo) that breaks the ground. This observation could also be as a result of a culture adopted by innovators of wanting to do things differently. For example, implements by large-scale formal producers are often coloured yellow. However,

exploiting farmer feedback, innovators in the informal economy had to change this usual appearance to brown or green because the colour yellow attracts bees and often results in attacks (Manyati, 2014a; Mujeyi et al., 2015). Through responding to the needs of customers they are bound to produce more equipment and technologies suited to farmer needs which boost their sales during a time when farmers are more liquid (i.e. have cash from selling their crop harvest). This finding corroborates the idea by Verhees and Meulenbergh (2004) that, small firms that produce distinguished products can innovate individually by acclimatizing products to the requirements of their clients (Verhees & Meulenbergh, 2004) which can improve sales in their businesses. Study findings also corroborate the bulk of literature on influence of innovation on performance in small firms (Baker & Sinkula, 2002; Branzei & Vertinsky, 2006; Brown & Eisenhardt, 1995; Darroch & McNaughton, 2002; Grant, 1996; Jiménez-Jiménez & Sanz-Valle, 2011; Lieberman & Montgomery, 1988; Porter, 2008; Schumpeter & Backhaus, 2003; Shepherd & Shanley, 1998; Vrakking, 1990; Wolfe, 1994). The aforementioned studies found innovation to have a positive influence on business performance. Ability by innovative firms to cope with complexity and change, ability to survive in unstable environments, ability to gain rents through temporary establishments of a monopoly, nimbleness by innovative small firms and ability to stand out from competition are some of the mentioned reasons in aforementioned literature sources that explain the positive influence of innovation on firm performance.

For instance, Porter (2008) found innovative firms to be more effective in serving attractive niches with their innovative products and to benefit from brand loyalty of customers valuing their distinctive innovations (Porter, 2008) as key to their performance. Study findings in this article also corroborate findings highlighted in Geroski et al. (1993) who found innovative firms to have a competitive advantage over their rivals at least in the short run. More recently a number of studies (e.g. Peters (2008) and Koellinger (2008)) also confirm that, innovative firms are able to improve their market and financial performance (Koellinger, 2008; Marques et al., 2011; Peters, 2008) which can explain findings obtained in this study.

7. Conclusion, implications and policy recommendations

In conclusion, study findings point to the importance of socio-economic status (i.e. gender and experience), energy, and macroeconomic environment (i.e. multi-currency system) as potential factors promoting innovation in the informal metal fabricating industry in Zimbabwe. Also from the findings, the study concludes that number of years in business positively impacts on innovation in informal metal entrepreneurs' businesses in Zimbabwe. Hence, years in business as a variable appears to be a good instrument for innovation. More importantly, the study also concludes that innovation influences informal firms' performance as indicated by positive causal correlations between innovation and high sales months and total business expenditures. Innovators benefit more in sales during periods when farmers sell their crop harvest and have money, i.e. during the second quarter (May to August). Overall, the study concludes that, innovative firms in the informal metal fabricating sector in Zimbabwe perform better than their counterparts who classify themselves as non-innovators. In other words, it can be concluded from the study that the ability to innovate by metal fabricators is a key determinant for their success.

The results have far important implications for small-scale farmers in Zimbabwe that rely on the informal economy for the supply of intermediate agriculture technologies necessary for improving their agricultural productivity. When small informal firms through their innovativeness continue to produce, and sell differentiated products suitable for such an important niche market (smallholder farmers) it has positive implications for sustainability of the smallholder farming sector and overall food security in Zimbabwe. More so, the nexus can benefit the informal businesses more. Through serving such niche markets, they can use market intelligence more effectively and improve their firms' competitive positions. Continuous improvement in their innovation capabilities will be key in improving their competitive positions in future.

From a policy standpoint, the upshots call for the need for public policy to install mechanism that improves informal businesses' performance and hence ensure continuity in the informal businesses. For instance, policies that enrich; institutional support, dependable sources of energy, acquisition of cheap entrepreneurial skills and creation of a favourable business climate that supports innovation might help to steer Zimbabwe's economy out of trouble.

This study is not without limitations. The study relies on cross-sectional data, which in itself is associated with limitations including failure to account for adequate dynamics associated with innovation and firm performance in the informal economy. Use of cross-sectional data also limits interpretation of performance estimates as representing causality as data reflects only on a snapshot of happenings in the informal metal industry in Zimbabwe. Moreover, it is plausible that number of years in informal business might not correctly reflect on experience of entrepreneurs that may impact on innovation. It is possible that new entrepreneurs in the informal economy could have gathered more experiences prior to joining the informal economy, i.e. from formal metal businesses they operated or were employed in before joining the informal sector. Despite the noted concerns, results from this study enrich understanding of the happenings of innovation and firm performance in Zimbabwe's informal economy particularly in the metal sector which is richly scarce. For instance, understanding of the role of innovation in a world-class hyperinflationary environment. For the situation under review, Zimbabwe was suffering the highest inflation ever recorded in peace times, globally. This study, therefore, enhances our understanding on (1) What are the likely reactions of an abandoned informal sector to capital flight? (2) How does innovation enhance firm performance under such conditions? (3) And finally what other ingredients besides education and experience are required to create firm models for high performance and competitiveness anchored on innovation? This study could provide important clues for industrialisation of the nation and the continent.

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