Role of Informal Sector Competition on Innovation in Urban Formal Manufacturing Enterprises in India

K Chandra Shekar[*]

Abstract   The paper examines the role of the informal sector on innovation activities of urban formal manufacturing enterprises in India. It provides empirical evidence on firm-level linkages between formal and informal sectors by using the World Bank Enterprise Survey, 2013-14 and the Innovation Follow-up survey, 2014. Primarily, the paper aims to examine the effect of informal sector competition on innovation in urban formal manufacturing enterprises in India. Secondly, the paper analyses the mediation effect of informal sector competition on innovations in the urban manufacturing enterprises. It determines the direct and indirect influence of business regulations and constraints on innovation outcomes through the mediation effect of informal sector competition by using the SEM "Structural Equation Modeling" guidelines. The econometric results show that informal sector competition has a negative effect on the introduction of product innovations while industry-level informal sector competition has a positive effect on product innovation through the local knowledge spillovers from the informal to the formal sector. However, the informal sector competition was found to have no significant effect on the probability of introducing process innovations. Further, the results show the inhibitive role of informal sector competition on innovation in urban formal manufacturing enterprises is more severe for firms with heavy regulatory burdens and is relatively weakened in firms with resource constraints. This suggests that the informal sector plays an important role in the NIS (National Innovation System) in India.

Keywords   Informal Sector; Innovation, Innovation System, World Bank Enterprise Survey, Formal-informal Linkages, Informal Sector Competition; Structural Equation Modeling

I. Introduction

The informal as a new normal has challenged the perceptions of conventional development literature (ILO, 2019), and discussions around this domain have gained significant momentum at all political, administrative and policy levels in India. While the informal sector in several developing countries including India

* Ph.D. scholar at Centre for Development Studies, Trivandrum, India 695011, Chandrashekarhcu@gmail.com

serves as a primary means of livelihood for a majority of population, overtime it has also emerged as a source of competition in the commodity market (Mendi and Costamagna, 2015; Avenyo et al., 2020; Lamanna and Gonzalez, 2007), at least through local prices (Gonzalez and Lamanna, 2007; Najman & Ali, 2015), where in the product market competitive interaction exists (Lamanna and Gonzalez, 2007). The growing evidence of the "permanence" of the informal sector in developing countries in recent years has resulted in a rise in political and academic interest (Chen, 2006; Elahi & de Beer, 2013). Despite a noticeable upsurge in studies on informal enterprises, the economic impact of the rise in the informal firms - impact of informal sector competition on formal sector innovation activities - has been studied insufficiently (Mendi and Costamagna, 2017; Friesen and Wacker, 2013; Avenyo et al., 2020). In general, a somewhat negative perception dominates regarding the impact of informal sector enterprises and their activities on the economy. The firm-level data from several developing nations shows that the competitive behavior of informal enterprises in the market is one of the main barriers of formal sector enterprises in the product market (Mendi and Costamagna, 2017; Avenyo et al., 2020; Gonzalez and Lamanna 2007; Wacker and Friesen, 2013; Najman and Ali, 2015;).

Competition among the enterprises is observed as a pusher of growth, catalyst of performance as well as efficiency enabler (Najman & Ali, 2015). However, a few empirical pieces of literature (Gonzalez & Lamanna, 2007; Wacker & Friesen, 2013) in developing countries (utilizing "World Bank Enterprise Survey") frequently recognized competitive behaviors of informal sector enterprises an 'unhealthy' and as one of the major bottlenecks to the growth of formal enterprises. However, there is also a parallel perception that informal sector rivalry is perceived as an obstacle, as a result of local markets widely accepts the informal sector enterprises, especially because these enterprises meet the local needs (Mendi and Costamagna, 2017).

Formal enterprises also resort to vertical product differentiation to keep themselves competitive in the face of informal sector competition (Mendi and Costamagna, 2017; Avenyo et al., 2020). As per Eurostat & OECD (2005), Gault (2010), and Sandee & Van Dijk (2002), innovations - through introducing product, process or marketing innovations is a major performance driver and ensures industrial competitiveness at the firm level. However, adaptation and imitation along with growing complementarity between informal and formal sector enterprises open up the scope for dynamic development for informal firms. Therefore, the competitive advantage that the formal sector enterprises enjoy over product and process innovations may be hindered due to the informal sector competition.

This paper contributes to the literature in several respects. First, the paper offers empirical data to examine the impact of informal sector competition in India on product and process innovations of urban manufacturing enterprises.

Second, the paper begins with an overview of the literature on innovation by reviewing informal sector competition, followed by critically examining the business regulations and constraints to innovate for the urban formal manufacturing enterprises. What can be important for the urban manufacturing sector is how the formal sector enterprises introduce innovations in the presence of informal sector competition under formal regulations and with severe resource constraints. In the light of the above discussion, the objectives of the paper are as follows,

1. To empirically investigate the role of informal sector competition on innovations in urban formal manufacturing enterprises in India.
2. To assess the mediation impact of informal sector competition on innovations in urban formal manufacturing enterprises through the indirect effect of business regulations and constraints

Informality continues to be a traditional characteristic of many developing countries, including India, and there is a common notion that the informal sector enterprises have a negative effect on the output of formal manufacturing enterprises. In India, the relation between informal sector competition and innovation assumes salience because of persistent growth in the informal sector and the basic nature of the competition represented by the dualistic economic system.

However, it is evident from the existing literature that the linkages between formal and informal sector enterprises play a crucial role in production processes in the product market. Hence, the primary aim of this paper is to empirically examine the impact of informal market competition on innovations in urban manufacturing enterprises in India by using the "World Bank Enterprise Survey" and also provide a better picture of formal and informal interaction in competitive and coordinative behavior. Key findings suggest that competition in the informal sector has a negative influence on the introduction of product innovations in the formal sector. However, industries with a higher number of informal firms experience a significantly positive impact on innovations in the formal manufacturing firms. This may be due to the local knowledge spillover from the informal sector to the formal sector through subcontracting or outsourcing linkages exists in the same industry. This outcome also suggests that by strategic collaboration or partnering with the informal sector, firms increase the demand of the formal sector and encourages the introduction of innovative products.

By analyzing the impact of informal sector competition on innovation utilizing a binary dependent variable (whether the enterprise introduces process/product innovation or not), this paper broadly adds to the innovation literature in examining the relationship between the formal and informal sector enterprises in introducing innovations in the urban manufacturing sector in India.

This paper makes use of subjective responses, which could bias our assessments to the innovation literature. Ali & Najman (2015) and Avenyo et al. (2020) in their respective studies observed that the informal sector competition differs across several regions in the world using existing econometric methods by Zingales, Sapienza, & Guiso (2004). This paper thus employs a similar approach to construct an informal sector competitiveness indicator at the industry level through industries in each region. These econometric procedures help us to introduce as well as control nonlinear impacts into our model, which may further clarify the correlation between innovations and informal sector competition in private manufacturing enterprises (Scherer, 1967; Blundell, Bloom, Aghion, Howitt, & Griffith, 2005; Ali & Najman, 2015). The paper further sheds light on the innovation literature by analyzing the mediation impact of informal sector competition under a regulatory environment and business constraints on firm-level innovations.

The study additionally contributes to the innovation literature by combining (pooled) the World Enterprise Survey, 2013-14 with the newly available Innovation Follow-up Survey, 2014. While similar studies use the Enterprise Surveys (Najman & Ali, 2015; Gonzalez & Lamanna, 2007; Wacker & Friesen, 2013; Mendi and Costamagna, 2017), the paper varies by pooling innovation data from both "World Bank Enterprise Survey" as well as "Innovation Follow up Survey" to exploit a number of relevant novel variables as controls beyond those mentioned in the existing literature.

The paper attempts to analyze whether informal sector competition affects the innovation in formal manufacturing enterprises in urban India. Our results show that the presence of the "Schumpeterian effect" where in manufacturing enterprises, informal sector competition is found to be harmful to innovations. Conversely, growth in informal sector competition at the industry level suggests that informal sector competition has an "escape-competition effect" on innovation.

The rest of the paper is organized as follows. In section two, the existing literature review presents the relationship between Informal sector competition as well as innovation, business regulations and constraints. Section three builds the theoretical model for analyzing the mediation impact of Innovations in informal sector competition. Section four and five give the research objectives and questions. Section six presents the methodological approach including empirical specifications and sources of data. Section seven analyses and interprets the results of the analytical assessment in conjunction with the research aim of the paper. Section eight concludes this paper.

II. Literature Review

The literature on the relationship between firm-level innovation and competition is well established. However, it remains at the center of both the political as well as academic world (Ferreira and Peroni, 2011; Blundell et al., 1999; Avenyo et al., 2020) because of the lack of conclusive empirical evidences. This section will help in positioning this paper in the vast series of existing literature.

The available literature mainly deals with Schumpeter's (1942) foundational contribution and with Agion and Howitt's (1992) theoretical formalization. Vertical innovations are seen in the "Schumpeterian perspective" largely as a process of "creative destruction" and the source of long-run growth in the commodity market. This approach is regarded as a restriction on innovations, targeted at eliminating the firm's inherent potential to implement innovations by lower-rent prospection (Schumpeter 1942; Aghion and Howitt 1992; Aghion et al. 2001).

In the 'escape-competition effect' as contrary to the Schumpeterian perspective, growing competition acts as an incentive for escaping market competition through undertaking innovation events as well as introducing innovations, especially in low technological gap industries (Aghion et al., 2001; Blundell et al., 1999). Blundell et al. (1999) found an' escape-competition effect' tended to undertake innovative activities wherein industry with higher competition in the product market. Similarly, Boldrin and Levine (2008) found that innovation significantly impacts competition by developing an innovation-competitive model where they analyzed the post-innovation rents under perfect competition.

A major part of innovation literature also suggests a nonlinear Inverted-U relationship between the competition of product markets and innovation activities at the firm level differently. Competition of product market at lower levels is generally found to encourage innovation activities. On the other hand, product market competition at higher levels discourages innovation activities. Moreover, this argument constitutes both the "escape-competition effect" as well as the 'Schumpeterian effect' (Mendi and Costamagna, 2017; Aghion et al., 2005; Scherer, 1967). Scherer (1967) found that the impact of industrial concentration on firm-level innovation strategies by analyzing the firm-level data in the USA. By taking the employment of technical engineers and scientists as a proxy for innovation strategies, the author also found that concentrations of the industry at a lower- level lead to higher innovative strategies and the higher industrial concentrations beyond a limited threshold discourage innovation strategies. For measuring the industry concentration, the author has taken the average industry concentration ratios.

Similarly, Aghion et al. (2005) also identified the Inverted-U shape association between innovation and product-market competition by analyzing the UK's firm-level panel data where innovation is calculated as average weighted patents as well as a proxy for competition equated with the Lerner index. The authors also discuss that the firms with lower technology gaps typically have organizations' side-by-side', and thus, the competition in these industries generally results in lower 'pre-innovation rents.' Hence, due to this, incumbents are trying to "escape-competition" through widening the technology gap along with 'post innovation rents' by innovations. In contrast, "leader-laggard" direct firms with larger technology gaps. In these firms, the intensification of product market competition, where 'leader-laggard' enterprises tend to decrease the leaders' "post-innovation rents", has the result of the 'Schumpeterian effect' (Aghion et al. 2005)

Innovations have a significant impact on informal sector competition, as creative practices contribute to raising firm performance, essentially responsible for competitiveness (Jones and Hall, 1999; Mendi and Costamagna, 2017; Avenyo et al., 2020). Indeed (Shleifer and La Porta, 2008), the presence of informal and formal enterprises in developing countries caused several formal sector enterprises to compete directly with informal sector enterprises. This arguably, lead to insufficient resource distribution in the economy and thus a lack of efficiency. This is a well-known misallocation issue and has been discussed through various contributions to economic literature (D'Erasmo et al., 2013; Rogerson and Restuccia, 2013; Bartelsman et al., 2013; Klenow and Hsieh, 2009). Moreover, informal sector enterprises provide less quality products as compared to formal enterprises (Amaral and Quintin, 2006). The result is a favorable scenario for vertically segregated products (Mendi and Costamagna, 2017). Informal sector enterprises can have different features than formal sector enterprises. For example, La Porta and Shleifer (2008) and La Porta and Shleifer (2014) have concluded that the profit per employee is higher in formal enterprises than informal enterprises of a comparable scale. Moreover, Funkhouser (1996) explores major gaps between informal and formal enterprises in terms of preparation for workers. Informality thus has significant consequences on the decision of an enterprise and the general distribution of resources. The term informality is used in this analysis as an underlying legal, economic operation (Oviedo et al., 2009).

Innovation in developing countries varies from developed countries. The nature of innovation itself is different. Besides informality, enterprises in developing countries are facing other barriers which are not present in developed nations. For example, resource constraints restrict firms' option for innovation (Keupp & Gassmann, 2013; Gibbert et al., 2007; Baker & Nelson, 2005; Pansera & Owen, 2015). Context factors, as a structural explanatory element, are also a major constraint on innovation. The structural theory assumes that enterprise

activity is essentially limited by an institutional framework (Peng et al., 2009; Dunning and Lundan, 2008). Meyer and Peng (2005, 2016) suggest that structural conditions are more likely to shift in developing nations and that, therefore, market decision-making is more likely to be context-specific than in more stabled economies of developed countries. The existence of institution will restrict the choices of formal enterprises by upholding diverse cultural traditions that may promote phenomena like corruption. These situational factors can influence the enterprise innovation decisions (Tigabu et al., 2015; Egbetokun, 2015) or even the innovation strategy at the country level (Amankwah-Amoah, 2016). In that the informal sector can, in part, be clarified by the institutional climate of the country and, conversely, the existence of an informal sector may affect institutional productivity, there is a strong relationship between the informal sector and institutions. Certainly, more extractive institutions are characterizing developing countries. It is critical to understand the nature of developing nations because several countries struggle to move from the extractive institutions to more egalitarian institutions that lead to structural instability (Acemoglu and Robinson, 2012; Acemoglu et al., 2001).

Indeed, Bennett (2010) analyses this problem logically to suggest that informality is a necessary first step that might prevent formalization. Particularly, this is the case where challenges to formality are high (Bruhn, 2013; Seynabou Sakho and McKenzie, 2010;). This will have an impact on employability and/or access to credit (Ayyagari et al., 2014; Bennett, 2011; Distinguin et al., 2016). The innovation decisions of enterprises can also be influenced in several respects by the presence of informality.

On the other way, informal sector enterprises competing with companies in the formal sector enterprises will incentivize formal sector enterprises to innovate. Specifically, if the products of informal enterprises are near substitutes for those of formal enterprises. In a recent analysis, Mendi and Costamagna (2017), for example, using the data from the World Bank's Enterprise Survey, 2006 showed that competitive demand from informal suppliers affected the innovation strategies of enterprises. Fu et al. (2015) found in the analysis of informal and formal enterprises that innovation may affect the firms' labor productivity as well as innovations based on learning and that innovation will bring informal businesses into the formal economy. The longevity of informal enterprises, on the other side, can be connected with their innovative potential. Schipper (2014) explores how innovation capacity impacts the decisions of enterprises to work informally and the ultimate effect of their choices. The author provides a sector choice model in which enterprises chose to work in a rich general mix setting in the informal and formal economy to examine the aggregate consequences of enterprises' decision-making as a reaction to government taxation. Contrariwise, the informal sector itself often has become the innovation source, and in some instances, it is a combination of informal and

formal enterprises that implement innovation (Radjou et al., 2012; Prahaltadh 2005; Bhattacharyya et al., 2010; von Hippel, 2005; George et al., 2012). In this paper, we concentrate on how informal sector competition affects the innovation activities and firm performance in private manufacturing firms in India. We rely on the possibility that new procedures, product, organizational and marketing innovations technologies will be launched as well as on the perceptions of enterprises on various barriers to innovation.

De Soto (1989) refers to the relationship between informality and regulations. In their study, Schneider and Enste (2000) list among the major triggers for growth, social security contributions, and regulations intensity (including labor markets) in the "shadow economy" and Williams (2004) distinguish the informal sector from the formal sector on the one hand and crime as an illegal sector on the other hand. He also explicitly points to the informality as "avoidance of labour legislation, such as employers' insurance contributions, minimum wage agreements or certain safety and other standards in the workplace." Castells and Portes (1989) represents the origin of the term 'informality' more than two decades before, decisively addresses the roots of informality as well as studies informal work as an inherent feature of advanced capitalism, which attempts for explaining it through reference to the chronic imbalance of the market that forces several micro-enterprises for selling their products or services at prices lower than the market price and they may only realize this with a severe reduction in cost, exempting from all sorts of regulatory measures.

It was perceived on the other side as informality, instead of forced withdrawal, as a voluntary choice to ''exit" formal economy (Snyder, 2004; Cross, 2000). Several writers, from neo-liberals (De Soto, 2001), institutional theories to a variety of critical (Webb et al., 2013) Postcapitalist, post-development, Post-colonial, post-structural, academics who aim to unpack the messy logics of monetized transactions (Zelizer, 2005; Snyder, 2004), argued the same way in this context. The factors behind this decision to support informal enterprise have been consistently proclaimed to be, first the, higher tax rates, second, public sector corruption, lastly, over-regulation and stifling bureaucracies (Kemal, 2007; Iqbal, 1998; De Soto, 1989) and, fourth, resentment and resistance to the government because of lack of redistributive as well as procedural fairness and justice (Kaufmann and Zoido, 2000; Bühn & Schneider, 2011; Friedman, Johnsón)

The main criticism of the above-mentioned literature is that most research concentrate on developed and industrialized nations, which are predominantly non-dualistic. In this section, the study of a particular category of competition involving informal competitions is based on this literature. The available

literature calculates competitiveness at the firm level alone. We also contend that competition in the informal sector is very local.

As mentioned above, the paper analyses the competition from a dualistic perspective, which takes into account informal sector competition. The number of informal competition studies in Africa and Latin America, as well as the influence of informal sector rivalry on the success of formal enterprises, is growing. These studies are primarily based on cross-sectional data published by the "World Bank Enterprise survey." The evidence shows that informal sector competition and their production activities negatively affect the innovation and performance of formal sector enterprises as well as the economy (Wacker and Friesen, 2013; Shleifer and La Porta, 2008; Lamanna and Gonzalez, 2007; Avenyo et al., 2020). Especially, the small- and medium-sized enterprises are adversely affected by informal sector competition (Gonzalez and Lamanna 2007, Najman and Ali 2015); financial limitations (Friesen & Wacker 2013); tax constraints, and high-cost, high-capital regulations in the industry (Lamanna & Gonzalez 2007; Friesen & Wacker 2013). By using the "World Bank Enterprise Survey" data on 33 Sub-Sharan African (SSA) counties, the authors have observed, however, that formal sector enterprises with higher levels of informal competition appear to improve productivity in large-scale industries by using these impacts. Ali and Ajman (2015) find that informal sector competition has influenced the efficiency of industries. Mendi and Costamagna (2017) establish that an Inverted-U shape correlation where informal sector competition has increasing as well as decreasing impact on introducing product and process innovations at lower along with higher intensities of informal sector competition respectively in the study of cross-country variation analysis of African as well as Latin American countries by taking average regional measure for a proxy of informal sector competition.

While the above studies illustrate the effect of informal sector competition in the success of the formal sector enterprises undertakings, there remains conflicting evidence at the industry-level informal competition. There are still insufficient data available in the literature concerning the effects of informal sector competition at the industry level on the possibility of product or process innovations. While Mendi and Costamagna (2017) analyzed the impact of informal sector competition on the probability of introducing innovations at the firm-level using "World Bank Enterprise Survey" in SSA countries, our analysis is based on India's firm-level data and goes further by considering the industry-level informal sector competition effect of innovations and mediation effects of informal sector competition on innovations at a firm-level under the regulatory framework and business constraints.

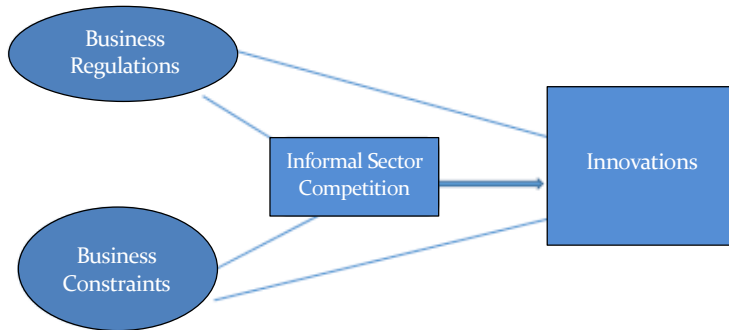### III. Theoretical Model for Mediation Effect of Informal Sector Competition

The available literature on factors influencing the innovations was restricted to advanced economies, thereby identifying the internal factors, as well as external factors that affect the firm-level innovations (Geldes et al., 2017, Felzensztein & Geldes, 2013; Becheikh et al., 2006;). Many developing countries including India are characterized by a sense of the dualistic environment that experiences an unexpected change in economic instability along with major increases in informal sector rivalry (informal enterprises). Here, we aim to understand better the conditions under which informal sector competition (informal enterprises) affect innovations through the indirect effect of business regulations and constraints. We apply a structured equation model of analysis to describe the mediation impact of informal sector competition in the introduction of firm-level innovations (see Figure 7.1).

In Developing countries, Peng et al. (2008) proposed the 'strategy tripod' referring to firm factors, institutional as well as industrial factors, which are relevant and complementary for explaining strategic behavior as well as firm performance. We also adopted the 'strategy tripod' approach in this paper to study the mediation effect of informal sector competition and the institutional factors such as business regulations and business constraints (Borrmann, Neuhaus & Busse, 2006) affecting the innovation outcomes in urban formal manufacturing enterprises. Following this, we categorize the factors into the two divisions of institutional factors that include business regulations as well as business constraints. In the following section, we discuss the impact of the business regulatory factors and constraints on firm-level innovations to build a theoretical model. The model interprets how business regulations and constraints affect firm-level innovations with the mediating role of informal sector competition.

1. Indirect effect of business regulations and constraints on firm-level innovations mediated by informal sector competition

Concerning the institutional features, urban manufacturing enterprises find their business performance to be negatively impacted by business regulation (Pitrobelli & Grazzi, 2016). Indeed, excessive business regulations are the primary cause for the more meaningful existence of informal sector enterprises that prefer operating in the informal sector to get rid of the labor regulations, trade costs, permits licenses, and corruptions and taxes imposed in the regulatory environment by the formal economy (De Soto, 2000). Similarly, (Tokman, 1978)

revealed that an increased share of formal enterprises is affected by informal sector competition when the government regulations were effectively enforced.

Source: own compilation

Figure 1 Theoretical Model for Informal sector Mediation effect

Kaufmann, Kraay & Mastruzzi (2009) proposed indicators of business regulations such as business permitting licenses, political instability, tax administration, tax rate, corruption and courts. (Tokman, 2001) considered the poor institutional efficiency of the sector in developing countries which raises insecurity and corruption and overregulation of informal sector competition. (Mendi & Costamagna, 2017) explained that the country's institutional setting may partially explain the interconnection between the informal sector and various forms of formal institutions. On the other hand, the presence of an informal sector can affect institutional proficiency. In view of the high barriers to entry and proliferation of opportunities for imitation generated by the lack of security of intellectual property and the reduced productivity advantages, this formal sector productivity has a detrimental impact on traditional firms in developed countries (Godfrey, 2011; Park & Allred, 2007;). Ineffective IPR "Intellectual Property Right" discourages manufacturing enterprises from seeking new patents of their inventions (Park and Allred, 2007). This is particularly significant in the developing countries because of the vulnerability of the IPR system (Pietrobelli & Grazzi, 2016), which includes managing license, obtaining credits as well as paying tax (Borrmann et al., 2006). Turkina & Thai (2014) further expanded the concept of labor regulations by adding supply factors like the resource accessibility category, which includes both human resources and labor regulations. The number of informal industry undertakings in developed countries is therefore affected by the inappropriate use of labor regulations and procedures for market growth (Webb et al., 2014). In developing

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countries, informal sector competition increases due to high labor regulations as well as a lack of well-qualified professionals (Ketchen, Ireland & Webb, 2014). Moreover, both informal sector and formal sector enterprises compete for similar suppliers and customers (McGahan, 2012). This may result into informal sector competition that decreases innovation at private manufacturing enterprises through adaptation and imitation.

IV. Data, Variables, and Method

1. Data

The study draws upon the data from the "World Bank Enterprise Survey" which is a cross-sectional data conducted from June 2013 to December 2014 which is merged with the Innovation Followup survey, 2014. A stratified random sampling technique is used to perform the "World Bank Enterprise surveys." In other words, population units are grouped into homogeneous groups and simple random samples are chosen from each group. This survey covers mainly 3 strata: location of enterprises, business operation sector and enterprise size. In particular, it includes large, medium, small and micro-level enterprises from construction, retail trade, wholesale, manufacturing, and service sectors specially located in every major state of India.

For our study, we consider only the manufacturing enterprises. A criticism of the "World bank Enterprise Survey" has also been that they are not adequately reflective of the size distribution at the national level, especially because of the distribution of enterprises that is quite biased against micro and small enterprises.

The dataset consists of 6642 manufacturing enterprises. A representative sample of the private manufacturing sector in urban India is seen in the Enterprise Survey. It covers several topics of enterprises environment in the whole country. The key areas that are mainly covered are access to financing, infrastructure level, perception of corruption, competitiveness and crimes and various acts for the performance of enterprises including engagement, utilization of foreign techniques, certification, export activities, capacity, sales in the innovation activities. The survey is carried out by private companies employed by the World Bank, owing to the sensibility of certain problems, for example, bribery and other informal practices.

In the Enterprise Survey, the variables are given to estimate the effect of informal sector competition on innovation in India at unit level. A detailed overview of these variables is given in the next sub-section.

2. Variables and Method

For assessing the above-mentioned objectives, we constructed three major dichotomized variables. The dependent variables h3 and h1 indicate the introduction of new processes and new products, respectively. These two innovation outcome variables are binary in nature. As per independent variables, e30 measures the intensity of informal sector competition as an obstacle to the formal enterprises. The degree to which an informal sector competition is an obstacle for an enterprise is arbitrary and is given in four points Likert scale (refer to world bank enterprise survey, 2014). This variable is normalized between 0 and 1. The major drawback of utilizing the measure is the subjectivity involved. It may be endogenous in particular if the firm's expectations of competitive strength and the effect of innovation are concurrently decided by unconsidered market-specific characteristics. In expanding the research to industry-level informal sector competition, we constructed an informal competition indicator at the industry level. This indicator is standardized to 0 to 1, where 0 value is assigned to those firms that have the least informal competition intensity and value 1 is assigned to those firms that have the highest informal competition intensity. We have a whole variety of locations (state) and industry dummies as control variables in all of our requirements to take account of specific industrial factors (see Table. A5 for detailed variables chosen).

Table 1 Industry-wise intensity of informal sector competition

Industry	Share of informal sector competition (percentage)	Normalised values
Food	34.86	0.298184
Tobacco	39.62	0.538345
Textile	44.31	0.774975
Garments	48.77	1
Leather	39.77	0.545913
Wood	36.76	0.394046
Paper	43.05	0.711403
Chemicals	39.59	0.536831
Plastic And Rubber	36.76	0.394046
Nonmetallic Mineral	36.05	0.358224
Basic Metals	31.1	0.108476
Fabricated Metal Food	41.1	0.613017
Machinery Equipment	42.3	0.673562
Electronics	33.07	0.207871
Precision	28.95	0
Transport	41.01	0.608476
Furniture	41.54	0.635217

The control variables such as Top manager's experience, overdraft facility, technology license, export status, the employee provided timings, formal R&D, educated employees and formal training that may also affect innovation outcomes of the firms witness informal sector competition as a major obstacle. These studies are focused on previous World Bank Enterprises Surveys (Hudson et al. 2012; Williams et al. 2017) as well as other informal sector entrepreneurship literature (Khan and Quaddus 2015; Vu 2014). Other control variables at the firm level include,

- Firm age: The number of years the enterprise was founded is a continuous variable
- Export: it is a continuous variable that measures the share of exports in total sales in percentage.
- Firm size: value 1 is set for small organizations where the number of employees are less than 20 in a categorical variable, whereas value 2 is set for the medium size organization where the number of employees varies from 20 to 99, in the last value 3 is set for large organizations where the number of employees are more than 100.
- Experience of a top manager, a constant variable of the performance of the top manager in this sector

After explaining the used data and variables, here we discuss the empirical modeling utilized to assess the effect on informal sector competition on innovation in urban manufacturing firms in India. The probit model utilized for estimating the firm-level impact of informal sector competition is given below:

Innovation equation for informal sector competition as an obstacle (h1 or h3**):**

$$p\ (h1\ or\ h3=1) = \beta_0 + \beta_1\ e30 + \beta_2\ b7 + \beta_3 k7 + \beta_4 h7 + \beta_5 h8 + \beta_6\ l10 + \beta_7\ l9b + \beta_8 e6 + \beta_9\ d3c + \beta_{10} lg\_fage + \beta_{11}\ a3a + \beta_{12}\ a6a + \beta_{13} a4a + \mu \qquad (1)$$

Innovation equation for industry-level informal sector competition (h1 or h3**):**

$$p\ (h1\ or\ h3=1) = \beta_0 + \beta_1\ ind\_ic + \beta_2\ b7 + \beta_3 k7 + \beta_4 h7 + \beta_5 h8 + \beta_6\ l10 + \beta_7\ l9b + \beta_8 e6 + \beta_9\ d3c + \beta_{10} lg\_fage + \beta_{11}\ a3a + \beta_{12}\ a6a + \beta_{13} a4a + \mu \qquad (2)$$

Where h1 or h3 is product or process innovations, which are binary variables equal to 1 when an enterprise starts a new process or product in the last 3 years, otherwise 0. Here, e30 is defined as the independent variable representing informal sector competition at the firm level, and ind_ic is industry-level informal competition which are key variables of interest. The other control variables such as manager's experience (b7), overdraft facility (k7), technology license (e6), export status (d3c), hours of work by the employees (h8), formal R&D (h7), educated emplyees (l9b), formal training (l10), firm age (lg_fage), firm location (a3a), firm size (a6a) and industry dummy (a4a) are included for the innovation outputs at the firm level. Further, to detect the multicollinearity among the variables, we examine the correlations among the independent variables. No severe correlations exist, and thus, no multicollinearity problem was detected (see Appendix Table A1).

To analyze the mediation effect of informal sector competition on innovations in the urban manufacturing enterprises, firstly, we assessed the influence of business regulations and business constraints on innovation outcomes in urban manufacturing enterprises using probit model regressions. Following are the explanatory variables, which account for business rules and constraints, are taken for analyzing the impact on product and process innovations using the probit models.

Innovation equation for business regulations as an obstacle (h1 or h3):

p (h1 or h3=1) = $\beta 0$ + $\beta 1$ j30a + $\beta 2$ j30b + $\beta 3$ j30c+ $\beta 4$ j30e+ $\beta 5$ j30f+ $\beta 6$ h30 + $\beta 7$ l30a+ $\beta 8$ d30b+ $\beta 9$ SARB21d + $\beta 10$ lg_faget+ $\beta 11$b7+ $\beta 12$k7+ $\beta 13$ a3a+ $\beta 14$ a6a + $\beta 15$a4a + μ (3)

Innovation equation for business constraints as an obstacle (h1 or h3):

p (h1 or h3=1) = $\beta 0$ + $\beta 1$ d30a + $\beta 2$ SARb31e + $\beta 3$ SARb31f+ $\beta 4$ i30+ $\beta 5$ l30b+ $\beta 6$ c30a + $\beta 7$ lg_fage + $\beta 8$ b7 + $\beta 9$ k7 + $\beta 10$a3a + $\beta 11$a6a + $\beta 12$ a4a + μ (4)

Where h1 or h3 innovation outcomes (product/process) are binary which is equal to 1 if an enterprise has introduced new processes or products in the last 3 years, otherwise 0. Independent variables include a set of business regulations as well as business constraints in the respective models. These variables include tax rate (j30a), tax administration (j30b), business permitting licenses (j30c), customs and trade regulations (d30b), import and non-tariff barriers(SARd21d), political instability (j30e), corruption (j30f), courts (h30), and labor regulations (l30a). Similarly, for business constraints, we have considered variables such as transport obstacle (d30a), raw material accessibility (SARd31e), crime (i30), inadequately educated workforce (l30b), and electricity availability (c30a).

The measurements of the above indices of business regulations and constraints as an obstacle to the innovation outputs of the firm are arbitrary and are measured at a 4-point Likert scale. Thus, these variables have been converted to 0 for no regulation or constraint as an obstacle and 1 for a severe obstacle.

The other variables such as firm age, export status, foreign ownership, size, access for financing and industry, state dummies controlling for the industrial sector where the organization works. To examine the multicollinearity among the variables, we checked the correlations among the variables for business regulations and business constraints separately. No multicollinearity was detected as there were no severe correlations among the selected exploratory variables (see Appendix Table A2 and A3).

The second step was to determine the direct and indirect influence of business regulations and constraints on innovation outcomes through the mediation analysis. A mediation model is used in statistical research for the purpose of defining and describing the system or process underlying observable interactions between independent and dependent variables by using a third hypothesizing variable, called the mediator variable (MacKinnon, 2008). An interpretation of the intervention indicates that the independent variable determines the mediating variable rather than the direct causal correlation between the independent and dependent variable, which in turn impacts the respondent variable. Mediation analysis describes an established interaction by analyzing the underlying system or process by which an intermediate variable relies on independent factors (MacKinnon, 2008; Cohen et al., 2013).

For examining the mediation effect of informal sector competition, the approach follows the SEM "Structural Equation Modeling" guidelines. The latent variables 'Business Regulations' (factor1), 'Business constraints' (envfactor1) are built using a method of factor analysis (see appendix Table A4). The mediation effect of informal sector competition is tested using a structured equation model with latent variables: (i) business regulations, (ii) business constraints and innovation outcomes include product or process innovations which are binary in nature. The remaining variable, the mediator Informal sector Competition as the biggest obstacle, is considered observable (binary dummy).

To assess the mediation effect, as indicated by Baron and Kenny (2010), regression analysis is performed, and the significance of coefficients is checked at every stage using Structural Equation Modeling. Multiple regression analyses are used as the first step to assess the mediation effect, where all predictor variables and their interaction term are based before model estimations to facilitate the understanding of regression coefficients.

The mediation effect has also been evaluated using the regression equations stepwise. The mediation effect is a cumulative effect between the independent and dependent variables. It was evaluated using the following econometric equations (5), (6) and (7).

$$p\ (e11{=}1) = \beta0 + \beta1\ factor1 + \beta2env\ factor2 + \varepsilon \qquad (5)$$
$$p\ (h1\ {=}1) = \beta0 + \beta1\ factor1 + \beta2\ env\ factor2 + \beta3e11 + \varepsilon \qquad (6)$$
$$p\ (h3\ {=}1) = \beta0 + \beta1\ factor1 + \beta2\ env\ factor2 + \beta3e11 + \varepsilon \qquad (7)$$

Where (β = Co-efficient, e11 = informal sector competition, h1= product innovation, h3= process innovation, factor1 = business regulations (latent variable), env factor2 = business constraints, $\beta0$ = intercept/constant, ε = error term).

Finally, the Structural Equation Model checks if the estimation of a dependent variable as innovation outcome, of an independent variable are business regulation and business constraints, varies with the influence of mediatory variable as informal sector competition. Mediation variables affect the intensity and/or trajectory of the predictor-outcome relationship: improving, reducing, or modifying predictor effect (Baron &Kenny, 2010). Usually, mediation effects are discussed as a relationship between factors or variables, where one variable's effects rely on the amounts of the other variable in the study.

V. Results and Findings

1. Descriptive Statistics

Table 2 Descriptive Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
h1 (product innovation)	6642	.486	.526	0	1
h3 (process innovation)	6642	.465	.563	0	1
e11 (informal sector competition)	6424	.302	1.025	0	1
e30 (degree of informal competition)	6424	.12	.325	0	1
ind_ic (industry-level inomal competition)	6642	.486	.223	0	1
j30a (tax rate obstacle)	6424	.314	.464	0	1
j30b (tax admin obstacle)	6424	.181	.385	0	1
j30c (business license obstacle)	6424	.125	.33	0	1
j30e (political instability)	6424	.17	.376	0	1
j30f (corruption)	6424	.451	.498	0	1
h30 (courts)	6424	.062	.241	0	1
l30a (labour regulations obstacle)	6424	.135	.342	0	1
d30b (customs and trade regulations)	6424	.111	.314	0	1
SARd21d (import regulation)	6424	.825	.38	0	1
d30a (transport obstacle)	6424	.11	.313	0	1
SARd31e (fuel and rawmareial accessibility)	6424	.419	.493	0	1
SARd31f (no storage facilities)	6424	.052	.222	0	1
i30 (crime, theft obstacle)	6424	.043	.202	0	1
l30b (inadequate edu. Workforce)	6424	.11	.313	0	1

c30a (electricity obstacle)	6424	.274	.446	0	1
b7 (top manager experience)	6424	14.246	9.511	0	64
k7 (overdraft facility)	6424	.532	1.051	0	1
h7 (formal R&D)	6424	.325	.707	0	1
h8 (employee provided time)	6424	.417	.84	0	1
l10 (formal training)	6424	.362	.858	0	1
l9b (edu. Workforce)	6424	45.855	30.714	0	100
e6 (tech. licensing)	6424	.028	.869	0	1
d3c (export share)	6424	7.223	21.68	0	100

In the observed three years, about 48% of sample enterprises have implemented new products, whereas 46% of them have introduced new processes (Table:2). About 30 % of the sample firms were reported to face informal competition and about 12 % of the firms consider informal sector competition as a severe obstacle to the growth of organization. Regarding business regulations, while 31% of the firms perceive tax as an obstacle, 18% are with tax administration, 12% of firms face obstacle with business permit licenses, 17% of firm struggle with political instability as the biggest obstacle, and nearly45% have a major obstacle with corruption in the business ecosystem. On average, 6% of the firm has a problem with courts. Moreover, 13% of the firms have considered labor regulations as the biggest obstacle, 11% of a firm face customs and trade regulations, and almost82% have considered import regulations as a severe obstacle to the business operations. On the other hand, business constraints such as transport (11%), raw material accessibility (41%), inadequately educated workforce (11%), non-availability of storage facilities (5%), electricity (27%), and crime, theft and disorder (4%) are considered to be severe obstacles to the firms.

2. Regression Results

Table 3 depicts econometric estimates regarding the association between informal sector competition on the probability of introducing innovations of process and product. Columns (1) and (2) of Table 3 shows estimates from the Probit Model equation where we regressed the informal sector competition indicator and informal competition at industry level on the introduce innovations of product. Similarly, columns (3) and (4) show the effects on process innovations. The estimates presented in column (1) confirm that informal sector competition as a severe constraint to urban manufacturing enterprises hase an expressively negative impact on the probability to introduce innovations on product, and column (3) indicates a negative but insignificant impact of informal sector competition on process innovations. This particular finding is consistent with observations in Hashmi (2013). Further, Mendi & Costamagna (2017) and

Avenyo et al. (2020) using data from the World Bank enterprise of African contries (SSA) and Latin American Nations confirm our results and find that informal enterprise competition has a negative influence on innovation forms (processes and products). Additionally, similar evidence has also been found in the Chinese market, where informal competition influences firm R&D investment (Su, Xie and Peng, 2010).

In expanding the research to industry-level informal sector competition, we constructed an industry-level indicator. This indicator is standardized to 0 to 1, where 0 value is assigned to those firms that have the least informal competition intensity and value 1 is assigned to those firms that have the highest informal competition intensity. This helps us to identify the variations in the informal competition at the industry level across various manufacturing industries. Column (2) and (4) of Table 3 represents the estimation outcomes presenting the impact of industry-level informal sector competition indicators on the product and process innovations respectively.   The results from column (2) show that the industry extent informal sector competition has a significantly positive impact on product innovations. This suggests that sectors with larger proportions of informal sector firms appear to introduce higher product innovations in product markets. The results are similar with a study found in the context of Sub-Saharan Africa (Avenyo et al., 2020). The difference between technical know-how and technology gap in the urban formal and informal manufacturing enterprises can also explain this result. As a result, it is more possible that informal businesses can transfer the local knowledge to the formal sector through subcontracting linkages and outsourcing activities. Thus, the local knowledge spillovers from informal sector enterprises to the formal sector may help formal sector enterprises in the same industry to introduce new product innovations.

Table 3 Effect of Informal Sector Competition on Product and Process Innovations

	Estimation Method: Probit Model			
	(1)	(2)	(3)	(4)
VARIABLES	h1	h1	h3	h3
e30 (informal competition)	-0.142***		-0.0575	
	(0.0539)		(0.0548)	
ind_ic (industry_infomal competition)		0.876*		-0.33
		(0.531)		(0.533)
Top manager experience	0.00204	0.002	0.00400**	0.00398**
	(0.002)	(0.002)	(0.002)	(0.002)
Overdraft facility	-0.0101	-0.0099	0.0114	0.0115
	(0.0161)	(0.0161)	(0.0164)	(0.0164)
Formal R&D	0.163***	0.163***	0.153***	0.153***
	(0.0281)	(0.0281)	(0.0285)	(0.0285)
Time provided to employees	0.127***	0.129***	0.247***	0.247***
	(0.0248)	(0.0248)	(0.0254)	(0.0254_
Formal training	0.023	0.0225	0.0934***	0.0938***
	(0.0208)	(0.0208)	(0.0249)	(0.025)
Edu. employees	0.00229***	0.00234***	0.00282***	0.00283***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Tech. licensing	0.0156	0.0149	-0.01	-0.0103
	(0.0194)	(0.0194)	(0.0204)	(0.0204)
Export share	0.00148*	0.00145*	0.00271***	0.00271***
	(0.0009)	(0.0009)	(0.0009)	(0.0009)
lg_fage	0.0221	0.0208	-0.0028	-0.0033
	(0.0224)	(0.0224)	(0.0226)	(0.0226)
State	yes	Yes	Yes	Yes
Firm size	yes	Yes	Yes	Yes
Industry	yes	Yes	Yes	Yes
Constant	-0.640***	-0.912***	-0.769***	-0.674***
	(0.109)	(0.206)	(0.11)	(0.207)
Observations	6,404	6,404	6,404	6,404
LR chi2	1,163	1,156	1,318	1,316
Prob > chi2	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.1310	0.1303	0.1489	0.1488

Robust standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

We, however, failed to find a significant effect of industry-level informal competition on process innovations (column 4). However, the negative impacts of industry-level competition are found in other empirical papers including Boldrin and Levine (2008), Aghion et al. (2001), and Griffith, Blundell, and Van Reenen (1999).

The theory which is focused on the "Schumpeterian effect," may be related to the enhanced capacity of informal sector firms to copy formal companies' latest technical products. This finding can also be explained by the increased non-competitive contact between informal sector enterprises and formal enterprises, primarily by outsourcing and collaboration of economic activities. Such non-competitive activities will allow a few registered companies to extend their size of markets by means of informal sector firms by taking advantage of the dynamic behavior of informal firms strategically. This makes for the intense direct competition from informal companies, who become more successful and recognizable rivals on consumer goods with comparable 'imitated' products in the formal firms without these non-competitive encounters. This business behavior, without uncompetitive relations with the vertical sector division, may weaken the strategic edge of formal enterprises, and have a detrimental effect on product innovations. However, the density of informal sector enterprises in the same industry has a significantly positive impact on the introduction of product innovations in urban formal sector enterprises. This finding may also clarify how the informal sector in India has continued lately in its development and its economic importance through local knowledge spill over to the formal economy.

Furthermore, the empirical analysis is extended to the mediatory effect of informal sector competition make use of the business regulation variable and constraints that we described in the methodology section. The dependent variables in all situations are binary, requiring the use of such econometric techniques that are suitable for this purpose. Also, the same controlled variables are also likely to evaluate process and product innovations. There is significant empirical evidence that these control variables are important as determinants of innovation. Thus, we tried to investigate the effects of selected business regulations and constraints on innovation outcomes at urban manufacturing enterprises in India.

The particular focus on business regulations is timely, as the nation has experienced institutional reforms since independence. Similarly, tax reforms have drawn renewed attention to the difficulties in India's economic growth in recent years. One of the most important reasons in the regulatory climate is that enterprise cannot meet their maximum competitive potential.

The major results of the study include empirical insights into the impact of regulations on the outcomes of innovation in urban manufacturing firms. Also,

an attempt was made in the paper to introduce and link regulatory environments with innovation at the enterprise level. This contributes to the literature on the role of institutions and innovation in emerging economies, and particularly in India.

The first two columns of Table 4 measure the probit model coefficients, in which the independent interest variables are business regulations in columns (1) and (2) with dependent variables as product and process innovations, respectively. Here, the tax rate, tax administration, business permit licenses and labor regulations as a severe obstacle reported by the firms show a significantly negative effect on the innovation outcomes. Tax administration has a significantly negative effect on product innovations while the tax rate is negatively affecting on process innovation. However, the tax rate is reported not affect the product innovations significantly. Form of governance given by political instability and courts is positively affecting the innovations but not significantly. Labor regulations and permit licenses negatively affect the firms' ability to innovate, whereas, customs and trade regulations have a positively significant effect on process innovations.

Corruption is seen as having a major influence on innovation performance and capacity. In India, corruption is perceived to be one of the key daunting institutional impairments for the government in delivering its constituent elementary facilities, even to the private sector (Aidis et al. 2008; Puffer et al. 2009). The findings show that corruption affects both innovation outcomes such as processes and product innovations in India.

The analysis captures the effect of business constraints on product and process innovations, on account of transport facilities, increase in raw material prices, no storage facilities, crime, theft, and disorder, inadequately educated workforce, and electricity as severe obstacles to the firms which is evident in columns (3) and (4) in Table 4. Specifically, in column (3), we include product innovations and devoted column (4) for process innovations. In the product innovations case, the coefficients of business constraint variables turn out to be negative and statistically significant. However, in the process innovations case, the business constraint variables lose their significance in this given equation, which defines the overview of process innovations. Thus, the results given in Table 4 indicate that the product innovations and process innovations are affected by the given business constraints and business regulations.

Our analysis builds on previous research (e.g., Porter 1990) which showed that in order to achieve a competitive advantage, which emphasizes the formal regulatory framework that enterprises need to build their innovation. The findings demonstrate empirically that the business regulations of enterprise do not support innovation at urban formal manufacturing enterprises. Poor legal standards, licenses and job regulations at the firm level have proven to have a negative effect on innovation. This particular result further amplifies the view

enshrined in the institutional theory of the existence and scales of transaction costs in the regulatory setting, which increase innovation costs and eventually hinder creative and competitive capacities for firms (Peng, 2010; Zhu et al., 2011).

Table 4 Effect of Business Regulations and Constraints on Product and Process Innovations

		Estimation Method: Probit Model		
	(1)	(2)	(3)	(4)
VARIABLES	h1	h3	h1	h3
Tax rate	-0.0271	-0.0917**		
	(0.0437)	(0.0442)		
Tax admin	-0.125**	0.0046		
	(0.0544)	(0.0541)		
Permit license	-0.205***	0.214***		
	(0.0602)	(0.0596)		
Political instability	0.0964*	0.0311		
	(0.0503)	(0.0505)		
Import regulatin	0.00824	0.113***		
	(0.0422)	(0.0423)		
Courts	0.0321	-0.0392		
	(0.0718)	(0.073)		
Labour regulations	-0.109**	0.0822		
	(0.0535)	(0.0532)		
Custom&trade reg.	0.103	0.244***		
	(0.0649)	(0.0646)		
Corruption	-0.202***	-0.292***		
	(0.0481)	(0.0481)		
Transport facilities			-0.0252	0.0882
			(0.0594)	(0.0582)
Raw material accessibility			-0.134***	0.00308
			(0.0408)	(0.0404)
No storage facilities			-0.157*	-0.0659
			(0.0851)	(0.0819)
Crime,theft&disorder			-0.294***	0.0169
			(0.0901)	(0.0872)
Inadequate edu. Workf			-0.200***	0.0759
			(0.0606)	(0.0588)
Eleciricity			-0.0807*	-0.144***
			(0.0423)	(0.042)
Top manager exp.	0.00153	0.00337*	0.00262	0.00391**
	(0.00199)	(0.00199)	(0.00198)	(0.00198)
Overdraft facility	-0.00065	0.0247	-0.00079	0.0257
	(0.0161)	(0.016)	(0.0161)	(0.016)
lg_fage	0.0274	0.00077	0.0262	-3.74E-05
	(0.0223)	(0.0224)	(0.0222)	(0.0222)
State	yes	Yes	yes	Yes
Firm size	yes	Yes	yes	yes
Industry	yes	Yes	yes	yes
Constant	-0.363***	-0.375***	-0.493***	-0.545***

	(0.112)	(0.113)	(0.106)	(0.107)
Observations	6,404	6,404	6,404	6,404
LR chi2	1,054	1,102	1,065	1,022
Prob > chi2	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.1188	0.1246	0.1200	0.1155

Robust standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The regulatory environment also points out the hostility as well as turbulence that Indian companies face in the external firm environment. These turbulences discourage enterprises from engaging in more constructive activities, like innovation instead of "firefights" for the battle against systemic rigidity and voids (Kolvereid and Shane, 1995).

The representation of the 'regulatory dimension' (Scott 1995), which determines permissible actions and penalizes, is inappropriate. The two institutions are able to minimize the promotion of profit-making activity, promote transactional trust and discipline unethical and opportunistic behavior. The results indicated that there are statistically substantial effects on innovation and performance on the fully operating legal and judicial system, successful labor regulation, and customs and trade regulations. A productive regulatory framework reduces company registration, license, and permit compliance processing costs. Less procedural rigidity means lower regulatory enforcement processing costs. Firms should then concentrate on the core innovation operations.

Marred by the instability as well as unpredictability that inevitably undermined its authority, the legislative component of the country's facilitating position for innovation and development in the industry is inadequate. The Indian Regulatory climate tends to obstruct innovation and the firm's performance rather than functioning as a supporting framework to benefit the private sector, a view echoing the findings of leading academics on the subject (e.g., McCarthy & Puffer, 2011; Bruton & Ahlstrom, 2010; Lim et al., 2010). In addition to confronting the competition and industry-related forces in an intensely dynamic and global business climate, businesses have to struggle with needless regulatory burdens.
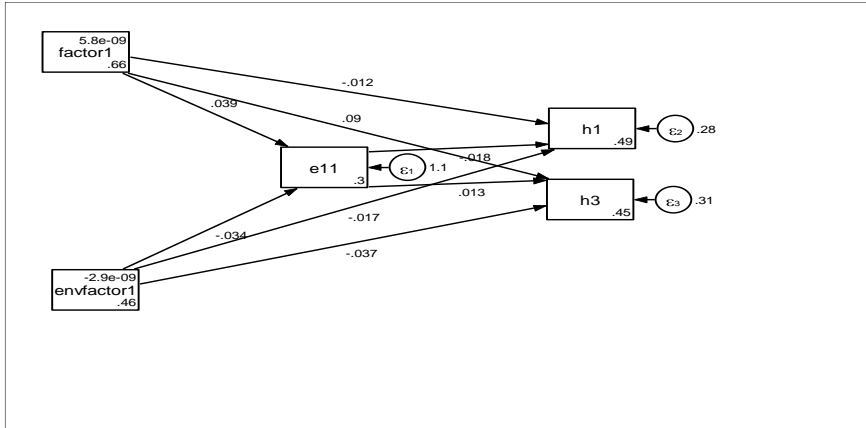
Mediation Effect of Informal Sector Competition:

Figure 2 Mediation Effect of informal competition with Business regulations and constraints on Innovation outcomes (Empirical)

Table 5 Structured Equation Modelling of informal competition

	Estimation Method: Structured Equation Modelling	
VARIABLES	informal sector competition	product innovation
informal sector competition		-0.0179***
		-0.0064
business regulations	0.0388**	-0.0118
	-0.0194	-0.01
business constraints	-0.0338	-0.0172
	-0.0231	-0.0119
Constant	0.302***	0.486***
	-0.0128	-0.0068
Observations	6,424	6,424
	Standard errors in parentheses	
	*** p<0.01, ** p<0.05, * p<0.1	

Figure 2 and Table 5 show the relation between latent variables 'Business Regulations' (factor1), 'Business constraints'(envfactor1), informal sector competition (e11), and both the innovation outcomes, i.e., product (h1) and process innovations (h3) using SEM modelling. In relation to the informal sector competition, this is stated that the business regulations are significantly positive

related to informal sector competition in India's urban manufacturing enterprises with 0.39 coefficient. Secondly, in the case of business constraints, it is negatively related to the informal competition but not significant (-.034). The informal sector competition is a significantly negative association with product innovations (-0.18). However, for process innovations impact of informal sector competition has shown insignificant relation.

Table 6 Mediation analysis: Total effect and Indirect effect on Product Innovation

Variables	Indirect effect	Direct effect	Total effect	% effect mediated
Business Regulations	-0.006958	-0.117511	-0.0124469	55%
Business Constraints	0.006057	-0.172232	-0.0166175	35%

Additionally, the mediation analysis shows, in relation to business regulations and constraints indirectly influence the firm's abilities for innovating when there is informal sector competition in urban manufacturing enterprises. The findings suggest that business regulations highly affect the innovation outcomes of urban manufacturing firms through informal sector competition than the business constraints. Table 6 shows the indirect effect in case of business regulations and business constraints, and they represent 55% and 35% of the effect mediated by informal sector competition, respectively. These findings represent the impact of the informal sector on the formal manufacturing sector, and the innovation processes give us a detailed understanding of the role of the informal sector in the national innovation system. Moreover, findings from industry extent informal sector competition impact on product market explain that it is essential for the urban manufacturing sector indicating a requirement for a non-competitive collaboration between formal and informal sector enterprises.

VI. Conclusion

Firm-level evidence from the present analysis clearly indicates that the competition from informal sector firms has an impact on the innovations by the formal urban manufacturing enterprises in India. However, the competitive linkages between informal and formal enterprises continue to increase, particularly in India, as the informal economy is recognized more and more as its "permanent feature." This paper fills the void with minimal empirical pieces of evidence analyzing the economic consequences of informal sector competition on the performance of formal enterprises. It adds to the limited

literature by analyzing the impact of informal competition on formal enterprises by making use of the pooled data set of the "World Bank Enterprise Survey" with the "Innovation Follow up survey" conducted in India.

The paper suggests the adverse effects of informal competition on "product innovations." Nevertheless, the findings suggest that industry-level informal competition in all requirements has a significantly positive impact on product innovation. This suggests that businesses with larger proportions of informal sector enterprises appear, with the advent of new technologies, to do well on product innovation. The outsourcing and coordination of business activity between informal and formal sectors increase the scale of demand and product developments by encouraging formal sector enterprises to expand the size of market as well as the introduction of new products through local knowledge spillover from the informal to formal sectors. As a result of the competition between 'informal' enterprises and formal firms without or with fewer non-competitive encounters, they are adversely affecting product innovation. Thus, it can be understood that urban manufacturing firms with strategic "footholds" prosper with competition in the informal market.

Further, the paper argues that the inhibitive role of informal sector competition on innovation in urban manufacturing enterprises is more intense in firms with heavy regulatory burdens and is somewhat weakened in firms facing resource constraints. The findings of this paper also support the view that the informal sector does play a significant role in the "National Innovation System" in India. Thus, the paper suggests the policy review on the role of informal sector enterprises in the innovation system.

Appendix: A

Table A1 Matrix of correlations for informal sector competition

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) e30	1.000									
(2) ind_ic	0.063	1.000								
(3) b7	0.025	0.024	1.000							
(4) k7	-0.002	0.019	0.034	1.000						
(5) h7	-0.046	0.011	0.021	0.048	1.000					
(6) h8	-0.056	-0.006	0.051	0.013	0.355	1.000				
(7) l10	-0.026	-0.022	0.075	0.067	0.089	0.121	1.000			
(8) l9b	-0.067	0.025	-0.004	0.115	0.148	0.153	0.167	1.000		
(9) e6	0.003	-0.001	0.011	0.042	0.015	-0.009	0.008	0.045	1.000	
(10) d3c	0.028	0.207	0.044	0.053	0.127	0.059	0.086	0.147	0.026	1.000

Table A2 Matrix of correlations for business regulations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) j30a	1.000								
(2) j30b	0.254	1.000							
(3) j30c	0.308	0.223	1.000						
(4) j30e	0.242	0.255	0.253	1.000					
(5) j30f	0.340	0.314	0.252	0.331	1.000				
(6) h30	0.139	0.184	0.174	0.271	0.143	1.000			
(7) l30a	0.236	0.286	0.312	0.179	0.187	0.080	1.000		
(8) d30b	0.263	0.398	0.379	0.288	0.230	0.188	0.274	1.000	
(9) SARd21d	0.012	0.016	0.042	0.033	0.033	0.008	0.068	0.041	1.000

Table A3 Matrix of correlations for business constraints

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) d30a	1.000					
(2) SARd31e	0.169	1.000				
(3) SARd31f	0.209	0.173	1.000			
(4) i30	0.287	0.140	0.218	1.000		
(5) l30b	0.277	0.198	0.279	0.233	1.000	
(6) c30a	0.150	0.239	0.084	0.130	0.100	1.000

Table A4 Factor loadings:

Business regulations:

```
. factor j30a j30b j30c j30e j30f h30 l30a d30b SARd21d
(obs=6,424)

Factor analysis/correlation                    Number of obs    =     6,424
    Method: principal factors                  Retained factors =         4
    Rotation: (unrotated)                      Number of params =        30
```

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	2.15582	1.96641	1.1775	1.1775
Factor2	0.18941	0.07572	0.1035	1.2810
Factor3	0.11369	0.07974	0.0621	1.3431
Factor4	0.03395	0.09227	0.0185	1.3616
Factor5	-0.05832	0.04084	-0.0319	1.3298
Factor6	-0.09916	0.02508	-0.0542	1.2756
Factor7	-0.12423	0.05906	-0.0679	1.2078
Factor8	-0.18330	0.01376	-0.1001	1.1076
Factor9	-0.19706	.	-0.1076	1.0000

```
    LR test: independent vs. saturated:  chi2(36) = 8586.41 Prob>chi2 = 0.0000
```

Factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Factor3	Factor4	Uniqueness
j30a	0.5589	-0.0504	-0.1920	0.0033	0.6482
j30b	0.6564	-0.1200	-0.0713	-0.0501	0.5471
j30c	0.5842	-0.1133	0.0943	-0.0196	0.6366
j30e	0.4817	0.2595	0.0400	0.0240	0.6985
j30f	0.4919	0.1314	-0.1372	0.0679	0.7173
h30	0.3113	0.2268	0.0894	-0.0555	0.8406
l30a	0.4310	-0.1462	0.0844	0.0594	0.7823
d30b	0.5577	-0.0407	0.1393	-0.0338	0.6667
SARd21d	0.0600	-0.0246	0.0887	0.1345	0.9699

Business constraints:

```
. factor d30a SARd31e SARd31f i30 l30b c30a
(obs=6,424)

Factor analysis/correlation                     Number of obs    =      6,424
    Method: principal factors                   Retained factors =          2
    Rotation: (unrotated)                       Number of params =         11
```

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	1.11039	0.98879	1.4925	1.4925
Factor2	0.12160	0.14223	0.1634	1.6560
Factor3	-0.02062	0.09780	-0.0277	1.6283
Factor4	-0.11842	0.04984	-0.1592	1.4691
Factor5	-0.16826	0.01246	-0.2262	1.2429
Factor6	-0.18072	.	-0.2429	1.0000

```
    LR test: independent vs. saturated:  chi2(15) = 2966.05 Prob>chi2 = 0.0000

Factor loadings (pattern matrix) and unique variances
```

Variable	Factor1	Factor2	Uniqueness
d30a	0.4874	-0.0542	0.7595
SARd31e	0.3875	0.1947	0.8119
SARd31f	0.4346	-0.0945	0.8022
i30	0.4511	-0.0760	0.7907
l30b	0.4905	-0.0927	0.7508
c30a	0.2994	0.2397	0.8529

Table A5 Variable Description:

S/N	Variable name	Definition/Measure
Respondent variables:		
1	h1 (product innovation)	Binary classification which takes the dummy value 1 if the enterprise has introduced new product, 0 otherwise.
2	h3 (process innovation)	Binary classification which takes the dummy value 1 if the enterprise enterprise has introduced new method of production, 0 otherwise.
Controlled variables		
	Firm_age (age)	It is the age of the enterprise measured in years.
	a3a(location of the enterprise; state)	It is a state dummy variable
	a6a (firmsize)	Firm size (dummy categorical variable)
	a4a (industry)	Industry type (dummy)
	k7 (over draft facility)	Binary classification which takes the dummy value 1 if the enterprise has Over draft facility, otherwise 0.
	b7 (experience of top manager)	Top managers experience
	e6 (technology license from foreign company)	Binary classification which takes the dummy value 1 if the enterprise has taken technology licensed from foreign owned company, otherwise 0.
	d3c (share of direct export)	Export: it is continuous variables measures the share od exports in total sales in percentage.
	h8 (employee provided time)	Establishment give employees some time to develop or try out a new approach or new idea about products or services, business process, firm management, or marketing? If yes, 1 otherwise 0.
	h7 (formal R&D)	Binary classification which takes the dummy value 1 if the enterprise involves in formal R&D, 0 otherwise.
	l9b (edu. Employees)	No. of employees completed higher education
	l10 (formal training)	Binary classification which takes the dummy value 1 if the enterprise gives formal training to its workforce, 0 otherwise.
Explanatory variables		
	e11 (informal sector competition)	Whether firm face informal sector competition or not
	e30 (degree of informal sector competition)	Binary classification that takes the value 1 if the firm considersthecompetitive practices of the informal sector as a major and a very severeobstacle and the value 0 otherwise.
	Ind_ic	Industry-level informal sector competition
Business Regulations		
	j30a (tax rate)	Binary classification which takes the dummy value 1 if the enterprise considers the tax rate as a major and a very severe obstacle and the value 0 otherwise.
	J30b (tax administration)	Binary classification which takes the dummy value 1 if the enterprise considers the tax administration as a major and a very severe obstacle and the value 0 otherwise.

j30c (business permit license)	Binary classification which takes the dummy value 1 if the enterprise considers the business and permit licenses as a major and a very severe obstacle and the value 0 otherwise.
j30e (political instability)	Binary classification which takes the dummy value 1 if the enterprise considers political instability as a major and a very severe obstacle and the value 0 otherwise.
j30f (corruption)	Binary classification which takes the dummy value 1 if the enterprise considers the corruption as a major and a very severe obstacle and the value 0 otherwise.
h30 (courts)	Binary classification which takes the dummy value 1 if the enterprise considers the courts as a major and a very severe obstacle and the value 0 otherwise.
l30a (labour regulations)	Binary classification which takes the dummy value 1 if the enterprise considers the labour regulations as a major and a very severe obstacle and the value 0 otherwise.
d30b (customs and trade regulations)	Binary classification which takes the dummy value 1 if the enterprise firm considers the customs and trade regulations as a major and a very severe obstacle and the value 0 otherwise.
SARd21d (import regulations)	Binary classification which takes the dummy value 1 if the enterprise considers the import regulations and non tariff barriers as a major and a very severe obstacle and the value 0 otherwise.
Business constraints	
d30a (transport obstacle)	Binary classification which takes the dummy value 1 if the enterprise considers the transport facilities as a major and a very severe obstacle and the value 0 otherwise.
SARd31e (fuel and rawmaterial accessibility)	Binary classification which takes the dummy value 1 if the enterprise considers the fuel and raw material accessibility as a major and a very severe obstacle and the value 0 otherwise.
SARd31f (storage facilities)	Binary classification which takes the dummy value 1 if the enterprise lack of storage facilities as a major and a very severe obstacle and the value 0 otherwise.
i30 (crime, theft and disorder)	Binary classification which takes the dummy value 1 if the enterprise considers the crime, theft and disorder as a major and a very severe obstacle and the value 0 otherwise.
l30b (inadequate educated workforce)	Binary classification which takes the dummy value 1 if the enterprise considers the iadequate educated workforce as a major and a very severe obstacle and the value 0 otherwise.
c30a (electricity)	Binary classification which takes the dummy value 1 if the enterprise considers the electricity as a major and a very severe obstacle and the value 0 otherwise.

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