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A decision model for sustainable informal entrepreneurship in cities

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Abstract

Purpose – Sustainable development goals and the climate change agenda are becoming widely promoted topics of research for the 21st century. The role of cities is increasingly recognised as central to investigating these topics. Yet, the field of informal sector entrepreneurship which so many urban entrepreneurs in developing countries depend upon is seldom considered. To redress this imbalance, this study aims to develop a decision model in accordance with institutional theory (IT) and resource dependency theory (RDT) for city managers to deploy. The model identifies and prioritises optimal strategies to address the three areas of sustainability requirements environment society and economy within the study context of Bangladesh.

Design/methodology/approach – This study used a mixed methods research design. In the qualitative part, the authors identified the three areas of sustainability requirements (i.e. environment, society and economy) and their corresponding strategies involving the informal sector that operates within the urban environment. In the quantitative part, the authors applied fuzzy quality function

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deployment (QFD) integrated with the 0-1 non-linear optimisation technique to identify optimal strategies.

Findings – The findings show that strategies such as legitimate frameworks, waste management, allocation of urban public space and training programs contribute in important ways to the three areas of sustainability requirements.

Practical implications – The proposed decision model will assist policy-makers and city managers to prioritise sustainability requirements and implement optimal strategies to address those requirements.

Originality/value – Through the integration of IT and RDT, the decision model developed in this study is unique in its application to urban-based informal entrepreneurship in the context of developing countries. The effective application of the fuzzy QFD approach and the optimisation model in the context of urban-based informal entrepreneurship also offers unique contributions to the field of study.

Keywords Informal entrepreneurship, Institutional theory, Resource dependency theory, Fuzzy QFD approach, Optimal strategy, Decision model

Paper type Research paper

1. Introduction

Stakeholder demands for sustainable development goals and climate change have introduced new challenges to informal sector entrepreneurship in cities (Terán-Yépez *et al.*, 2020). As such, issues of sustainability1 in urban areas must not be neglected (Popescu *et al.*, 2018). Entrepreneurs operating in the informal sector are pervasive, inventive and substantial in number, constituting a predominant share of employment in developing regions, for example, 80–90% in South Asia; 60% in Asia and the Pacific region [ILO (International Labour Organization), 2018] and 47% in Latin America [ILO (International Labour Organization), 2013]. To address the three areas of sustainable development – environment, society and economy – the current study considered informal sector entrepreneurship in Bangladesh, as 87% of the population is engaged in this sector [BBS (Bangladesh Bureau of Statistics), 2016]. The study defines urban-based informal entrepreneurship in reference to a self-employed person, household or a few people, who operate a private business under minimal governmental control (Godfrey, 2011; Khan, 2017; Khan and Quaddus, 2020a, 2020b).

Informal entrepreneurial activities are inherently connected to the formal sector and support overall economic growth (Khan and Quaddus, 2015a, 2015b; Popescu *et al.*, 2018). Yet, conflicts arise between urban authorities and informal entrepreneurs as the latter inadequately meet sustainability requirements (i.e. environmental, social and economic requirements) (Brown and McGranahan, 2016). People engaged in informal entrepreneurial activities are accused of unethical practices including, but not limited to, taking minimal or no responsibility for environmental pollution, operating without authorised use of urban public space, exploiting human rights and with minimal or no responsibility in areas of waste management and recycling (Brown and McGranahan, 2016). As a result, in most cases, urban authorities take action to remove informal activities as a process of civic management and cleanliness. However, this kind of action does not address the real problem; it only shuffles the activities to another location and even exacerbates the situation. In most cases, informal operators reappear in the same place a few days after being expelled by the urban authorities (Brown and McGranahan, 2016). Policy-makers, urban authorities, relevant agencies and urban studies scholars in many developing countries need comprehensive reporting on this problem, so a development strategy can be set for purposes of long-term sustainability. In line with this need, academic interest in sustainability requirements and strategies as a situated practice is growing, and a decision model that

considers the three sustainability requirements and strategies to improve the informal sector is needed, particularly in the context of developing countries (Webb *et al.*, 2014).

Informal entrepreneurship is a burgeoning field and a substantial amount of work has focused on reducing and controlling informal operations (Mukim, 2011), setting institutional boundaries (De Castro *et al.*, 2014; Webb *et al.*, 2020; Williams *et al.*, 2017), processes of migration leading to informal entrepreneurship (Zhu *et al.*, 2019), along with cultural (Canclini, 2019) and psychological dimensions (Khan, 2021), and social entrepreneurship perspectives (Williams and Nadin, 2012). Informal entrepreneurship has also been studied in terms of resources and capabilities (Khan, 2018; Khan and Quaddus, 2017), as well as the external environment, and competitiveness in relation to informal entrepreneurs (Williams and Bezeredi, 2018). Some studies have also addressed sustainability issues (Gast *et al.*, 2017; Xue *et al.*, 2019) and governance (Chien, 2018). However, a decision model, focusing on the three sustainability requirements and strategies to improve urban-based informal entrepreneurship, has received limited attention. Therefore, our study is committed to developing a decision model that identifies the emerging areas of sustainability requirements (i.e. environment, society and economy) for urban-based informal entrepreneurship in developing countries and determines the optimal strategies to address the sustainability requirements.

A mixed methods research design consisting of several phases was used (Creswell, 2012). In the first phase, the qualitative part of the quality function deployment (QFD) phase, a field study was conducted with data collected from ten participants. The field study data were analysed using the content analysis method. The second phase, the quantitative part of the QFD phase, was extended with a fuzzy QFD approach. To avoid complexity, only one case was chosen. Finally, we applied a non-linear optimisation model to determine the optimal strategies (Park and Kim, 1998).

Our study offers several contributions to the field. This decision model will help civic managers not only identify the three areas of sustainability requirements (environmental, social, and economic) within an informal entrepreneurship context but also prioritise those requirements. Civic managers can address the prioritised issues based on importance using limited resources as these are scarce in developing countries. In addition, the decision model will allow city managers to determine optimal strategies to address the sustainability requirements. Such optimal strategies will also assist in experimenting with alternative sets of optimal strategies under different scenarios resulting in cost savings. Further, our decision model is generic and applicable to any strategy optimisation with respect to context-specific requirements, thus contributing to the extant literature.

2. Literature review

2.1 Theoretical foundation

The foundation of our decision model relies on the concept of institutional theory (IT) (DiMaggio and Powell, 1983) and resource dependency theory (RDT) (Pfeffer and Salancik, 1978). In line with IT, we identify the sustainability requirements of the stakeholders while the concept of RDT assists our study in determining strategies to address the sustainability requirements. We argue that institutional settings alone cannot play an effective role unless or until priority is given to the resource-dependent settings. In other words, the institutional settings can effectively influence the behaviour of actors (urban informal entrepreneurs) while deploying the required resources to these actors. These idiosyncratic and context-specific situations yield ambiguities that urban authorities and policy-makers find difficult to handle and manage (Webb *et al.*, 2014). To improve this situation for now and in the

future, urban authorities and policy-makers need to advocate for more realistic and appropriate decision models to accommodate this phenomenon (Dentchev *et al.*, 2016). However, the task is even more difficult for urban authorities in developing countries where resources and capabilities remain the key limitations in implementing and adopting strategies (Grimm *et al.*, 2011). Therefore, theorising on the interaction of IT and RDT allows policy-makers and city managers to reconfigure appropriate decision models for informal entrepreneurship in urban areas.

Our decision model is based on the conceptual framework shown in Figure 1. The proposed conceptual framework explains the sustainability requirements and corresponding strategies to improve urban-based informal entrepreneurship by capturing the components and consequences that impact the society, environment and economy that could lead to the decision model. Further, in this model, IT helps to explain the sustainability requirements, whereas RDT describes the strategies to address those sustainability requirements. We have integrated IT and RDT because these concepts alone cannot explain both institutional and resource-dependent settings required for a decision model. Therefore, the model extends the knowledge by conceptualising sustainability requirements and the corresponding strategies to improve urban-based informal entrepreneurship through the lens of IT and RDT and developed the decision model.

While sustainability is a critical parameter in any informal sector business, little research has adequately focused on the sustainability requirements and corresponding strategies to improve urban-based informal entrepreneurship by focusing on a decision model (Popescu *et al.*, 2018; Webb *et al.*, 2014). Thus, this study fills this void by conceptualising the sustainability requirements and corresponding strategies in a single model and framing the decision model. The proposed conceptual framework and decision model differ substantially from the existing studies (Popescu *et al.*, 2018).

The decision model links with sustainability requirements and corresponding strategies of urban-based informal entrepreneurship in a developing country context. More specifically, this relationship amplifies the dominant "sustainability" decision-making process for urban-based informal entrepreneurship with its effect on the society, the environment and the economy. The model conceptualises and develops the decision model as a focal point that requires capturing the sustainability requirements and corresponding strategies to improve urban-based informal entrepreneurship. In the following sub-sections, we describe the theoretical background with sustainability requirements and the

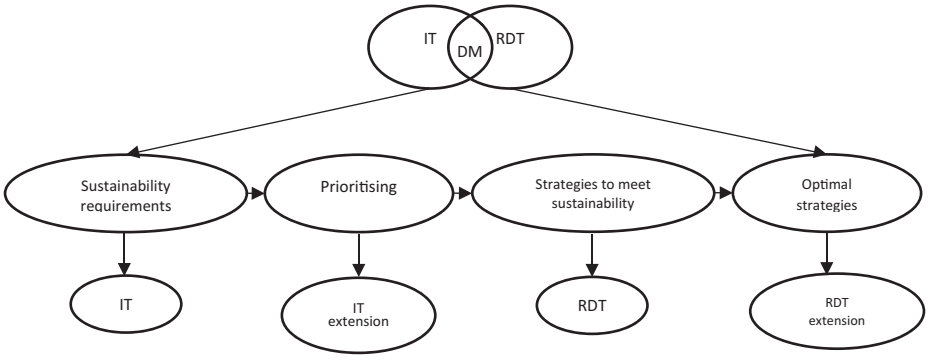


Figure 1. Conceptual framework

Notes: IT – institutional theory; RDT– resource dependency theory; DM – decision model

corresponding strategies for urban-based informal entrepreneurship before moving to the decision model.

2.2 Informal entrepreneurship and sustainability requirements

At present, concepts such as "green entrepreneurship" (Jiang *et al.*, 2018; Khan, *et al.*, 2019; Silajdžić *et al.*, 2015) or "sustainable entrepreneurship" (Hahn *et al.*, 2018; Khan and Quaddus, 2015a, 2015b; Terán-Yépez *et al.*, 2020) are becoming more extensively used, indicating society's increasing interest in the influence of entrepreneurial activities such as urban-based informal entrepreneurship on society, the environment and the economy. To discover this "green" or "sustainable" entrepreneurship phenomenon, scholars have used IT (Kojouharov and Dzhekova, 2017) as a means of defining the appropriate or acceptable behavioural structure (e.g. norms, values, law and rules) of firms while these firms operate within society. Therefore, IT suggests that institutional characteristics affect entrepreneurial activities. Variations in formal and informal institutional standards and degrees of authority, rules and procedures, control mechanisms and so on influence sustainability requirements within informal sector entrepreneurship (Mathias *et al.*, 2015). These variations in institutional standards occur because of inadequate coordination between institutions and their lack of knowledge and understanding regarding stakeholders' real needs. Further, ambiguity and complexity in sustainability standards that entrepreneurs need to meet are created by weak institutional settings, such as weak management, poor governance and internal management, inadequate controls and lack of transparency (Li and Zahra, 2012).

Studies have revealed that informal entrepreneurs do not meet many sustainability requirements in areas of the economy, the environment and society. In terms of economic issues, informal entrepreneurs are commonly accused by institutions of having minimal or no licensing and a propensity for tax avoidance (Visser, 2016; Webb *et al.*, 2014). However, most of the time, tax and licensing issues are not clearly defined and developed by institutions. Because of the informality of the entrepreneurs, institutions appear to have a lack of interest in resolving these issues.

Issues of poor environmental sustainability are also prevalent in the informal entrepreneurship sector. These issues range from environmental pollution (Chen *et al.*, 2018; Webb *et al.*, 2014) to waste management and recycling (Burcea, 2015). In such cases, institutions also fail to provide proper facilities to support informal entrepreneurs in managing waste and reducing pollution.

Social sustainability issues, such as the violation of civil rights or involvement with crime (Visser, 2016; Webb *et al.*, 2014), occur because of corruption and improper governance and law enforcement. The inadequate measurement of health and safety issues (Webb *et al.*, 2014) or the production and sale of low-quality and hazardous products (Williams and Horodnic, 2017) are also very common among entrepreneurs in the informal sector.

These all occur because of a series of factors: a lack of understanding, a reluctance to follow and sometimes not knowing the consequences. Table 1 presents a list of sustainability requirements relating to informal entrepreneurship in the urban context.

2.3 Strategies to improve informal entrepreneurship sustainability requirements

Sustainability requirements expected by the institutions and stakeholders can be achieved through understanding resource constraints and providing the necessary resources to informal entrepreneurs. With this in mind, the current study has adopted RDT to help reveal and explain the problem of resource constraints faced by entrepreneurs operating in the informal sector. RDT defines a firm's dependency on resources provided by the external

Sustainability requirements (SR)		References	Confirmed by participants
Society	Violation of civil rights (e.g. child labour use) (SR1)	Visser (2016), Webb *et al.* (2014)	a, b, c, d, e, f, g, h, i, j
	Involvement with crime (SR2)	Visser (2016), Webb *et al.* (2014)	a, b, c, d, e, f, g, i, j
	Inadequate measures to address health and safety issues (SR3)	Webb *et al.* (2014)	a, b, c, d, e, f, g, h, i, j
	Producing low-quality and hazardous products (SR4)	Webb *et al.* (2014), Williams and Horodnic (2017)	a, b, d, e, f, g, h, i, j
	Limited access to utilities: electricity, gas, water (SR5)	Roever (2016), Mbaye and Gueye (2018)	a, b, c, d, f, g, i, j
	Weak or poor networks (SR6)	Kebede (2018)	a, b, d, f, g, h, i, j
	Lack of private sector support (SR7)	Kabare (2018), Bhattacharya (2019)	b, c, d, e, f, g, j
	Poor knowledge of social issues (SR8)	Samson (2017), Chmutina and Rose (2018)	b, c, d, f, g, h, i, j
Economy	No or little licensing (SR9)	Visser (2016), Webb *et al.* (2014)	a, b, c, d, e, f, g, h, i, j
	Tax avoidance propensity (SR10)	Visser (2016), Webb *et al.* (2014)	a, b, c, d, e, f, g, h, j
	Lower level of innovation (SR11)	Webb *et al.* (2014), Meagher (2018)	a, b, c, d, e, f, g, h, i, j
	Lack of training (SR12)	Lamptey and Debrah (2018)	a, c, d, e, f, g, h, i, j
	Inadequate access to formal financial resources (SR13)	Khan and Quaddus (2020a, 2020b)	a, b, c, d, e, f, g, i, j
Environment	No or less responsibility on environmental pollution matters (SR14)	Webb *et al.* (2014), Chen *et al.* (2018)	a, b, c, d, e, f, g, h, i, j
	No or little activity on waste management and recycling (SR15)	Burcea (2015)	a, b, d, e, f, g, j
	Unauthorised use of urban public space (SR16)	Brown and McGranahan (2016), Racaud *et al.* (2018)	a, b, d, e, f, g, h, j
	Lack of knowledge on environmental pollution matters (SR17)	Webb *et al.* (2014), Chen *et al.* (2018)	a, b, c, d, e, f, g, h, i, j
	No or less facilities for waste management and recycling (SR18)	Webb *et al.* (2014), Chen *et al.* (2018)	a, b, c, d, e, f, g, h, j
	No or less allocation of urban public space (SR19)	Brown and McGranahan (2016), Racaud *et al.* (2018)	a, b, c, d, e, f, g, h, i, j

Table 1. Sustainability requirements

environment or by others to accelerate growth, as well as focusing on other organisations that may be dependent on that firm to obtain their goals (Pfeffer and Salancik, 1978). In line with RDT, we suggest that in the informal economy, entrepreneurs cannot be abundantly self-supporting with regard to strategic critical resources that they need for survival. They need to depend on resources from external parties and especially from institutions (e.g. government authorities and agencies) so that they may participate and sensibly manage dependencies with other firms while striving to meet sustainability requirements.

Addressing the sustainability requirements (economic, environmental and social) for urban-based informal entrepreneurship in developing countries demands strategies that

lead to a better quality of life for the disadvantaged now and into the future. A sizeable body of literature reveals that the most common and virtually unquestionable obstacles to achieving sustainability include the lack of regulatory frameworks, lack of awareness and education on sustainability, lack of government initiatives, resource constraints and the tendency to disobey laws. To alleviate these barriers, it is vital to fulfil sustainability requirements through strategic development.

Table 2 highlights several ways and means to meet requirements for the sustainability of informal entrepreneurship, as identified by previous studies.

3. Research methodology

Our research design used a mixed methods approach that involved a combination of qualitative and quantitative methods (Creswell, 2012). This process ensured the quality, accuracy, validity and reliability of the data (Creswell, 2012). Furthermore, both methods have their own capabilities in providing relevant data (Hohenthal, 2006). For example, the quantitative method offers solid groundwork for a theory, whereas the qualitative method ensures an actual understanding of the real issues.

3.1 Qualitative study

To explore the key issues and address the knowledge gap in sustainability requirements for urban-based informal entrepreneurship in developing countries, we began with a review of the current literature. This process identified the possible key variables for developing a set of sustainability requirements and corresponding strategies. In the next phase of the research process – the qualitative part of QFD – one-to-one semi-structured

Table 2. Strategies for meeting sustainability requirements

Strategies for meeting sustainability requirements (ST)	References	Confirmed by participants
Establishing participative supervision and dialogue on sustainability issues (ST1)	Farinmade *et al.* (2018), Williams and Krasniqi (2018)	b, d, f, g, j
Developing responses to health and safety issues by monitoring the existing conditions (ST2)	Thi Thuy Nga *et al.* (2018)	a, b, d, e, f, g, h, j
Continuous monitoring of civil rights and crime issues (ST3)	Visser (2016), Farinmade *et al.* (2018)	a, b, c, d, f, g, h, i, j
Appropriate and practical legitimate frameworks (e.g. taxation, licensing) (ST4)	Williams and Horodnic (2017)	a, b, c, d, e, f, g, h, j
Developing environmental certification by auditing the current conditions (ST5)	Chen *et al.* (2018), Williams and Kedir (2018)	a, b, c, d, e, f, g, h, i, j
Improving waste management planning including waste recycling (ST6)	Mbah and Nzeadibe (2017), Chen *et al.* (2018)	a, b, d, e, f, g, j
Creating awareness and knowledge programs on sustainability issues (ST7)	Chen *et al.* (2018), Belete (2018)	a, b, c, d, e, f, g, h, i, j
Planned allocation of urban public space (ST8)	Racaud *et al.* (2018), Roever (2016)	a, b, d, e, f, g, h, i, j
Reducing the practical constraints to access to public resources (ST9)	Mbaye and Gueye (2018)	a, b, c, d, f, g, i, j
Removing institutional barriers to access to finance (ST10)	Khan and Quaddus (2020a, 2020b)	a, b, c, d, e, f, g, h, i, j
Conducting training and development programs on all areas of sustainability (ST11)	Visser (2016), Farinmade *et al.* (2018)	a, c, d, e, f, g, h, i, j

interviews were conducted with ten key informants consisting of eight informal entrepreneurs from different informal sectors and two officials (see Table 3). The number of sample cases for qualitative studies can vary, depending on the author. Creswell (1998) suggests 5–25, whereas Morse (1994) recommends at least 6. For selecting key informants, we used the judgement sampling technique because it enables us to address our research questions (Frey, 2018). Consulting key informants who are knowledgeable about situational factors helps to yield better and more reliable data (Weiss, 1995). The interviews sought to identify any sustainability requirements and corresponding strategies that might not be acknowledged in the literature. The content analysis technique was used to transcribe the interviews and analyse their data. In the qualitative part of the QFD, the removal and addition of items and constructs were performed, taking into consideration their importance and redundancy. Phases 3 and 4 subsequently applied the QFD methodology (the quantitative parts) to prioritise and identify the optimal strategies for addressing the requirements for the sustainability of informal entrepreneurship.

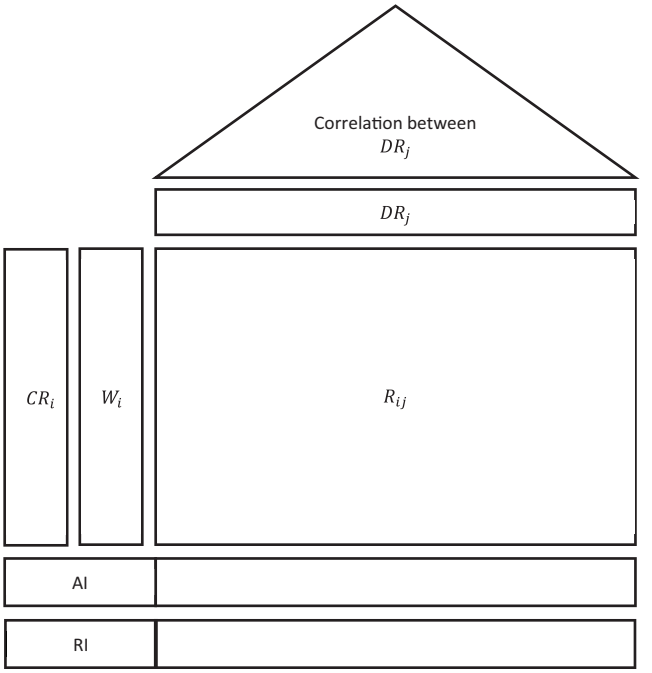
3.2 Quality function deployment

To identify and prioritise optimal strategies for meeting sustainability requirements for urban-based informal entrepreneurship, we used the QFD methodology. This approach is considered an operational methodology for setting organisational policies in the field of strategic management (Akao, 1990; Chan and Wu, 2003) and is a popular method for addressing the requirements of customers and stakeholders (Chowdhury *et al.*, 2019) and for solving organisational problems through appropriately designed strategies (Chowdhury and Quaddus, 2015; Chowdhury *et al.*, 2021). Because our study is committed to developing a decision model by identifying sustainability requirements for urban-based informal entrepreneurship and determining optimal strategies to address the sustainability requirements, the application of QFD is more operational in this context.

In this study, and in accordance with QFD, we defined the sustainability requirements of informal entrepreneurship as WHATs (i.e. CR_i) and the strategies to address the sustainability requirements as HOWs (i.e. DR_j). Figure 2 shows a generic QFD model. The W_i symbol means the degree of importance of CR_is or the WHATs. The absolute importance (AI) and relative importance (RI) are the weighted importance weights of the HOWs (weighted by the WHATs). More specifically, AI is the absolute importance of DR_js and RI is the relative importance of DR_js/strategies. The relationship matrix (i.e. the degree to which CR_i is met by DR_j) is denoted by R_{ij}. The relationship matrix shows the relationship between

Participant	Gender	Age (years)	Profile
a	Female	37	Tea-stall owner
b	Female	24	Street food vendor
c	Male	33	Own motor vehicle driver
d	Male	39	Building constructor
e	Male	34	Metal workshop owner
f	Male	48	Poultry farmer
g	Male	41	Motor vehicle repair shop owner
h	Female	36	Backer
i	Male	44	City manager
j	Female	32	City planner

Table 3. Field study participants' profiles



Notes: WHATs denoting the sustainability requirements = CRi. The HOWs represent the strategies = DRj and are the strategies t hat support the sustainability requirements. The Wi symbol means the degree of importance of CRis or the WHATs. The absolute importance (AI) and relative importance (RI) are the weighted importance weights of the HOWs (weighted by the WHATs). The relationship matrix (i.e. the degree to which CRi is met by DRj) is denoted by Rij

Figure 2.
Quality function deployment (QFD) model

the WHATs and the HOWs, that is, the extent to which the WHATs (the sustainability requirements/SRs) are realised by the HOWs (the strategies/STs). The roof of the QFD model (correlation matrix in Figure 2) shows the relationship between the HOWs (strategies) through the extent of overlaps in the strategies.

3.3 Fuzzy quality function deployment approach

In executing the fuzzy QFD approach, we adopted a systematic process. Detailed information about executing the QFD process, the corresponding steps and the results obtained are presented in Table 4.

During the execution of fuzzy logic, a fuzzy number set needs to be defined. This set is linked with a value that expresses the extent of membership. Usually, this value range is [0, 1], where 0 and 1 denote minimum and maximum degrees of membership, respectively. Values between 0 and 1 represent partial membership (Zadeh, 1965). We applied the triangular membership function (Bevilacqua *et al.*, 2006), which is called "triplets". The triplets can be expressed as $A = (x^{\propto}, x^{\beta}, x^{\gamma})$ where x^{β} is the most likely element, whereas

$x^{\propto}$ and x^{γ} are the lower and upper limits, respectively, of fuzzy membership group A. The function is as follows:

$$\mu_{x}(x) == \begin{bmatrix} \dfrac{x}{x^{\beta} - x^{\propto}} - \dfrac{x^{L}}{x^{\beta} - x^{\propto}}, & x\epsilon \left(x^{\propto},\ x^{\beta}\right) \\ \dfrac{x}{x^{\beta} - x^{\gamma}} - \dfrac{x^{\gamma}}{x^{\beta} - x^{\gamma}}, & x\epsilon \left(x^{\gamma},\ x^{\beta}\right) \end{bmatrix}$$
$$0, \text{ohterwise}$$

To quantify the linguistic data, we used the linguistic set U = (VL, L, M, H, VH) where VL = very low, L = low, M = medium, H = high and VH = very high (Bevilacqua *et al.*, 2006). Furthermore, each element of the linguistic set U is related to the value as follows: VL = (0, 1, 2); L = (2, 3, 4); M = (4, 5, 6); H = (6, 7, 8); and VH = (8, 9, 10) (Bevilacqua *et al.*, 2006). For example, the values of the linguistic variable H vary from 6 to 8, with 7 being the most likely value with the maximum degree of membership being 1.

4. Results and application of the method

4.1 Qualitative study of quality function deployment phase 1

The objective of the qualitative study (QFD phase 1) was to identify the sustainability requirements and corresponding strategies for meeting the sustainability standards from the field study. The aim of the field study was to fine-tune and contextualise the list of sustainability requirements and corresponding strategies found in the literature review. Most of the sustainability requirements are consistent with the factors and strategies identified in the literature review (Tables 1 and 2).

4.2 Quantitative part of quality function deployment phase 2

In Step 3, the three city managers (decision makers) were asked to provide responses using the linguistic set U = (VL, L, M, H, VH). Table 5 shows the importance rating of the

Qualitative study of QFD phase 1	Step 1	Identifying the sustainability requirements (WHATs) of informal entrepreneurship
	Step 2	Identifying strategies (HOWs) to support the sustainability requirements
Quantitative part of QFD phase 2	Step 3	Determining the relative importance ratings (weights) of WHATs by using the fuzzy set theory
	Step 4	Determining the relationships between WHATs and HOWs using QFD methodology
	Step 5	Determining the absolute importance and relative importance of HOWs weighted by the weights of the sustainability requirements (WHATs) found in Step 3
Quantitative part of QFD phase 3	Step 6	Finding the correlation between the strategies (HOWs) to determine the cost savings as a result of joint implementation of the correlated HOWs
	Step 7	Determining the cost–benefit ratio of the strategies (HOWs)
	Step 8	Using non-linear optimisation model to determine the optimal strategies (HOWs) within budget limitations

Table 4.
Stepwise research process adopted in this study

Table 5.
Importance ratings using fuzzy QFD approach: defuzzified and aggregated

Sustainability requirements (SRs)/WHATs		CM1	CM2	CM3	x^{α}	x^{β}	x^{Υ}
Society	SR1 – Violation of civil rights (e.g. child labour use)	*H*	*H*	VH	6.67	7.67	8.67
	SR2 – Involvement with crime	VH	*H*	*H*	6.67	7.67	8.67
	SR3 – Inadequate measures to address health and safety issues	VH	*H*	VH	7.33	8.33	9.33
	SR4 –Producing low-quality and hazardous products	*H*	VH	VH	7.33	8.33	9.33
	SR5 – Limited access to utilities: electricity, gas, water	VH	VH	VH	8.00	9.00	10.00
	SR6 – Weak or poor networks	*H*	*H*	VH	6.67	7.67	8.67
	SR7 – Lack of private sector support	*H*	VH	*H*	6.67	7.67	8.67
	SR8 – Poor knowledge of social issues	VH	*H*	*H*	6.67	7.67	8.67
Economy	SR9 – No or little licensing	VH	VH	VH	8.00	9.00	10.00
	SR10 – Tax avoidance propensity	VH	VH	VH	8.00	9.00	10.00
	SR11 – Lower level of innovation	*H*	VH	VH	7.33	8.33	9.33
	SR12 – Lack of training	VH	VH	VH	8.00	9.00	10.00
	SR13 – Inadequate access to formal financial resources	VH	VH	VH	8.00	9.00	10.00
Environment	SR14 – No or less responsibility on environmental pollution matters	VH	*H*	VH	7.33	8.33	9.33
	SR15 – No or little activity on waste management and recycling	VH	VH	VH	8.00	9.00	10.00
	SR16 – Unauthorised use of urban public space	VH	VH	VH	8.00	9.00	10.00
	SR17 – Lack of knowledge on environmental pollution matters	VH	*H*	VH	7.33	8.33	9.33
	SR18 – No or less facilities for waste management and recycling	VH	VH	VH	8.00	9.00	10.00
	SR19 – No or less allocation of urban public space	VH	VH	VH	8.00	9.00	10.00

Notes: VL = very low (0, 1, 2); *L* = low (2, 3, 4); *M* = medium (4, 5, 6); *H* = high (6, 7, 8); and VH = very high (8, 9, 10); x^{α} = lower limits; x^{β} = most likely; x^{γ} = upper limits

sustainability requirements (WHATs) using this linguistic set. The responses of the city managers are noted as not being evidently different. We then defuzzified the linguistic data. As numerous aggregation techniques are available to calculate fuzzy weights, we adopted the "average operator" because of its simplicity and useability (Bevilacqua *et al.*, 2006). Table 5 presents the importance ratings after defuzzification and aggregation with the aggregated importance ratings (W_i, i = 1–19) in fuzzy triplets in terms of $x^{\propto}$ (lower value), x^{β} (most likely value) and x^{γ} (upper value). For example, SR5, SR9, SR10, SR12, SR13, SR15, SR16, SR18 and SR19 are noted as having the highest importance rating of 9 in column x^{β} (most likely).

In Step 4, we attempted to analyse the relationship between sustainability requirements (WHATs) and strategies (HOWs). To do so, a wide range of interactions was needed with all data from the city managers' responses. The city managers were asked the question "In what way do the strategies/policies (HOWs) support the sustainability requirements (WHATs)?" Using the defuzzification and aggregation procedures, the main body in Figure 3 shows the correlation between WHATs and HOWs: R_{ij} is in fuzzy triplets in terms of $x^{\propto}$ (lower value), x^{β} (most likely value) and x^{γ} (upper value), where i = 1–19 are the WHATs and j = 1–11 are the HOWs.

In Step 5, we determined the AI and RI of the strategies/policies requirements (HOWs). For the AI calculation, we used the following equation:

$$AI_j = \sum_{i=1}^{n} W_i R_{ij} \qquad \forall j \quad , \quad j = 1, \ldots\ldots, \ m \tag{1}$$

where AI_j = absolute importance of the jth strategy (ST or HOWs) (j = 1–11 in our case); W_i = weight of the ith sustainability requirements (SR or WHATs) (i = 1–19 in our case, obtained from Table 5); and R_{ij} = correlation value between the ith WHATs and jth HOWs (obtained from Figure 3). We have calculated the "crisp" value by using the following equation, as suggested by Bevilacqua *et al.* (2006) and Facchinetti *et al.* (1998):

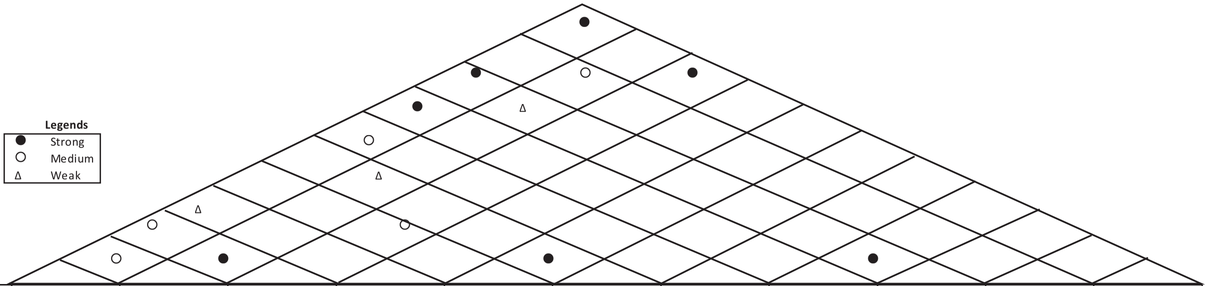
$$AI_{crisp} = \left(AI_{lower\ value} + 2AI_{most\ likely} + AI_{upper\ value}\right)/4 \tag{2}$$

The above equation offers a compromised crisp value in terms of optimistic, pessimistic and most likely values. These crisp values are beneficial for executing the corresponding strategies. From Figure 3, the AI crisp values vary from a low of 43.67 (for ST3: continuous monitoring of civil rights and crime issues) to a maximum of 140.33 (for ST7: creating awareness and knowledge programs on sustainability issues). Figure 3 shows the RI of the strategies, with RI calculated by the following equation:

$$RI_j = \frac{AI_j}{\sum_{k=1}^{n} AI_k} \tag{3}$$

4.3 Quantitative part of quality function deployment phase 3

The aim of the quantitative part of the QFD phase 3 was to determine the optimal strategies (HOWs) by using non-linear optimisation. At the starting point of this phase, we established the interrelationships between the strategies/policies (HOWs) by deliberating with the city managers in a group environment. This result is shown in the roof of Figure 3. For instance, a very tight relationship was found between ST1, ST7 and ST11. This indicates that a



	ST1			ST2			ST3			ST4			ST5		
SR1	5.33	6.33	7.33	0.00	1.00	2.00	8.00	9.00	10.00	8.00	9.00	10.00	0.67	1.67	2.67
SR2	5.33	6.33	7.33	0.00	1.00	2.00	8.00	9.00	10.00	8.00	9.00	10.00	0.67	1.67	2.67
SR3	5.33	6.33	7.33	8.00	9.00	10.00	0.00	1.00	2.00	7.33	8.33	9.33	6.67	7.67	8.67
SR4	2.67	3.67	4.67	7.33	8.33	9.33	0.67	1.67	2.67	7.33	8.33	9.33	7.33	8.33	9.33
SR5	0.00	1.00	2.00	0.00	1.00	2.00	0.00	1.00	2.00	8.00	9.00	10.00	0.67	1.67	2.67
SR6	7.33	8.33	9.33	0.00	1.00	2.00	0.00	1.00	2.00	0.67	1.67	2.67	0.67	1.67	2.67
SR7	6.67	7.67	8.67	0.00	1.00	2.00	0.00	1.00	2.00	1.33	2.33	3.33	0.67	1.67	2.67
SR8	6.67	7.67	8.67	5.33	6.33	7.33	0.00	1.00	2.00	5.33	6.33	7.33	1.33	2.33	3.33
SR9	1.33	2.33	3.33	0.00	1.00	2.00	0.00	1.00	2.00	8.00	9.00	10.00	0.67	1.67	2.67
SR10	1.33	2.33	3.33	0.00	1.00	2.00	0.00	1.00	2.00	8.00	9.00	10.00	0.67	1.67	2.67
SR11	0.67	1.67	2.67	5.33	6.33	7.33	1.33	2.33	3.33	1.33	2.33	3.33	2.67	3.67	4.67
SR12	0.67	1.67	2.67	8.00	9.00	10.00	1.33	2.33	3.33	7.33	8.33	9.33	6.67	7.67	8.67
SR13	1.33	2.33	3.33	0.00	1.00	2.00	0.00	1.00	2.00	6.67	7.67	8.67	0.67	1.67	2.67
SR14	5.33	6.33	7.33	0.00	1.00	2.00	0.67	1.67	2.67	7.33	8.33	9.33	8.00	9.00	10.00
SR15	5.33	6.33	7.33	0.00	1.00	2.00	0.67	1.67	2.67	7.33	8.33	9.33	8.00	9.00	10.00
SR16	5.33	6.33	7.33	0.00	1.00	2.00	1.33	2.33	3.33	7.33	8.33	9.33	8.00	9.00	10.00
SR17	5.33	6.33	7.33	5.33	6.33	7.33	0.67	1.67	2.67	5.33	6.33	7.33	8.00	9.00	10.00
SR18	1.33	2.33	3.33	1.33	2.33	3.33	0.67	1.67	2.67	5.33	6.33	7.33	8.00	9.00	10.00
SR19	0.67	1.67	2.67	0.67	1.67	2.67	1.33	2.33	3.33	5.33	6.33	7.33	8.00	9.00	10.00
AI of HOWS	68.00	87.00	106.00	41.33	60.33	79.33	24.67	43.67	62.67	115.33	134.33	153.33	78.00	97.00	116.00
Crisp value for AI		87.00			60.33			43.67			134.33			97.00	
RI		0.08			0.06			0.04			0.13			0.09	
Cost	14.00	15.00	16.00	19.00	20.00	21.00	14.00	15.00	16.00	39.00	40.00	41.00	14.00	15.00	16.00
Expected cost		15.00			20.00			15.00			40.00			15.00	
CBR		5.80			3.02			2.91			3.36			6.47	

	ST6			ST7			ST8			ST9			ST10			ST11		
SR1	0.00	1.00	2.00	7.33	8.33	9.33	0.00	1.00	2.00	0.67	1.67	2.67	0.67	1.67	2.67	4.67	5.67	6.67
SR2	0.00	1.00	2.00	7.33	8.33	9.33	0.00	1.00	2.00	0.67	1.67	2.67	0.67	1.67	2.67	4.67	5.67	6.67
SR3	5.33	6.33	7.33	8.00	9.00	10.00	2.67	3.67	4.67	2.67	3.67	4.67	1.33	2.33	3.33	7.33	8.33	9.33
SR4	4.67	5.67	6.67	7.33	8.33	9.33	2.67	3.67	4.67	1.33	2.33	3.33	0.67	1.67	2.67	7.33	8.33	9.33
SR5	0.00	1.00	2.00	2.67	3.67	4.67	7.33	8.33	9.33	8.00	9.00	10.00	4.67	5.67	6.67	3.33	4.33	5.33
SR6	1.33	2.33	3.33	3.33	4.33	5.33	4.67	5.67	6.67	0.67	1.67	2.67	2.67	3.67	4.67	2.67	3.67	4.67
SR7	3.33	4.33	5.33	4.67	5.67	6.67	4.67	5.67	6.67	6.67	7.67	8.67	5.33	6.33	7.33	2.67	3.67	4.67
SR8	2.67	3.67	4.67	7.33	8.33	9.33	0.00	1.00	2.00	0.67	1.67	2.67	1.33	2.33	3.33	7.33	8.33	9.33
SR9	0.67	1.67	2.67	5.33	6.33	7.33	2.67	3.67	4.67	0.67	1.67	2.67	0.67	1.67	2.67	5.33	6.33	7.33
SR10	0.67	1.67	2.67	5.33	6.33	7.33	0.00	1.00	2.00	0.67	1.67	2.67	0.67	1.67	2.67	6.00	7.00	8.00
SR11	5.33	6.33	7.33	3.33	4.33	5.33	0.67	1.67	2.67	4.67	5.67	6.67	5.33	6.33	7.33	8.00	9.00	10.00
SR12	7.33	8.33	9.33	7.33	8.33	9.33	1.00	2.00	3.00	5.33	6.33	7.33	2.67	3.67	4.67	8.00	9.00	10.00
SR13	0.67	1.67	2.67	6.67	7.67	8.67	0.67	1.67	2.67	7.33	8.33	9.33	8.00	9.00	10.00	5.33	6.33	7.33
SR14	6.67	7.67	8.67	8.00	9.00	10.00	6.67	7.67	8.67	1.33	2.33	3.33	0.67	1.67	2.67	7.33	8.33	9.33
SR15	8.00	9.00	10.00	8.00	9.00	10.00	6.67	7.67	8.67	2.67	3.67	4.67	3.33	4.33	5.33	7.33	8.33	9.33
SR16	7.33	8.33	9.33	6.67	7.67	8.67	8.00	9.00	10.00	6.67	7.67	8.67	2.67	3.67	4.67	7.33	8.33	9.33
SR17	6.67	7.67	8.67	8.00	9.00	10.00	6.67	7.67	8.67	1.33	2.33	3.33	0.67	1.67	2.67	8.00	9.00	10.00
SR18	8.00	9.00	10.00	8.00	9.00	10.00	6.67	7.67	8.67	2.67	3.67	4.67	3.33	4.33	5.33	7.33	8.33	9.33
SR19	7.33	8.33	9.33	6.67	7.67	8.67	8.00	9.00	10.00	6.67	7.67	8.67	2.67	3.67	4.67	7.33	8.33	9.33
AI of HOWS	76.00	95.00	114.00	121.33	140.33	159.33	69.67	88.67	107.67	61.33	80.33	99.33	48.00	67.00	86.00	117.33	136.33	155.33
Crisp value for AI		95.00			140.33			88.67			80.33			67.00			136.33	
RI		0.09			0.14			0.09			0.08			0.07			0.13	
Cost	59.00	60.00	61.00	19.00	20.00	21.00	74.00	75.00	76.00	29.00	30.00	31.00	19.00	20.00	21.00	49.00	50.00	51.00
Expected cost		60.00			20.00			75.00			30.00			20.00			50.00	
CBR		1.58			7.02			1.18			2.68			3.35			2.73	

Notes: SR – sustainability requirements; ST – strategies; RI – relative importance; AI – absolute importance; CBR – cost–benefit ratio

Figure 3.
Informal entrepreneurship sustainability decision model

significant cost reduction can be attained by merging the three sustainability requirements during strategy planning and implementation. For example, as shown in Figure 3, the total cost of planning and implementing strategies ST1, ST7 and ST11 is ৳85m (US$1 = ৳85 [approximately]) with a total of ৳20m able to be saved by merging these three requirements. Using this technique, we obtained several cost savings (S_{ij}) estimations from the city managers by considering the implementation of strategies i and j together. Next, we estimated the expected cost of implementing the strategies (HOWs). To reach this objective, we interacted with the city managers in a group environment to obtain the fuzzy triplets in terms of pessimistic, optimistic and most likely values of the cost of implementing each strategy. Figure 3 presents these values in terms of millions of ৳. The formula for the expected cost saving is:

$$\text{Expected Cost} = (\text{Optimistic Cost} + 4\text{Most likely Cost} + \text{Pessimistic Cost})/6$$

We also calculated the cost–benefit ratio (CBR) of each strategy by using the values of AI (benefit) and the corresponding expected cost. For instance, the highest CBR was for ST5 (developing environmental certification by auditing the current condition) and ST7 (creating awareness and knowledge programs on sustainability issues). Finally, to maximise the total budget under budgetary constraints and to meet the sustainability requirements (WHATs), we developed the optimisation model to find the optimal strategies (HOWs). We used the 0-1 non-linear optimisation model suggested by Park and Kim (1998). We also used the CBR in our model. The model is as follows:

$$\begin{aligned} &\text{Max} f(x) = \sum_{j=1}^{n} CBR_j x_j \\ &s.t. \sum_{j=1}^{n} c_j x_j \; - \sum_{i=1}^{n} \sum_{j>i}^{n} s_{ij} x_i x_j \leq B \\ &x \; \in X \text{ and } 0,\ 1. \end{aligned} \tag{4}$$

where CBR_j is the cost–benefit ratio of strategy j; c_j is the cost of strategy j and s_{ij} is the amount of savings (in million ৳) in implementing strategies i and j together. The CBR_j and c_j are presented in Figure 3. Earlier in this section, the value for s_{ij} was found. The B is the available budget, which is ৳200m as suggested by the city managers. Maximising the CBR is equivalent to maximising the AI and minimising the expected cost. Hence, our optimisation model is an extension of the model presented by Park and Kim (1998). In our application, the specific version of the model is as follows:

$$\text{Max} f(x) = \sum_{j=1}^{n} CBR_j x_j$$

$$\text{subject to}: c_1x_1 + c_2x_2 + c_3x_3 + c_4x_4 + c_5x_5 + c_6x_6 + c_7x_7 + c_8x_8 + c_9x_9 + c_{10}x_{10} + c_{11}x_{11} - S_{1,7,11}x_1x_7x_{11} - S_{2,3}x_2x_3 - S_{4,10}x_4x_{10} - S_{5,6}x_5x_6 - S_{8,9}x_8x_9 \leq 200$$

$$x_j = 0,\ 1$$

The optimisation model results are shown in Table 6 along with the sensitivity analyses [2]. With the available budget of ৳200m, our study selected strategies ST1, ST2, ST4, ST5, ST7,

ST9, ST10 and ST11 with a total CBR of 37.32. Within this budget, two very important strategies (ST6 and ST8) could not be implemented. As shown in the sensitivity analyses, when the budget was increased to ৳300m, all strategies could be implemented.

The city management of the case urban authority wanted to implement strategies ST4, ST6, ST7, ST8 and ST11 as a matter of strategy and policy. We, therefore, added extra constraints to the above model and ran the optimisation model again. Table 7 shows the results. For the ৳200 budget, strategies ST1, ST2, ST3, ST5, ST9 and S10 remained unselected, whereas, to implement ST4, ST6, ST7, ST8 and ST11, the authority needed an additional ৳45m. Again, the sensitivity analyses showed that all strategies were selected when the budget was increased to ৳300m. The implications of these results are discussed in the next section.

5. Discussion and implications

5.1 Summary of the results

In our study, we identified 19 sustainability requirements (WHATs) that comply with past studies and field study dates (see Table 1). In total, 11 strategies (HOWs) addressing the sustainability requirements were explored from the past studies and field study date (see Table 2). Taking into consideration the budget limitations, we prioritised and optimised the strategies by applying the fuzzy QFD approach.

Results from the qualitative study in the QFD phase 1 showed that informal entrepreneurship in cities in Bangladesh is mostly struggling in the three aspects of sustainability requirements: the society, economy and environment. We classified these sustainability requirements through the lenses of IT and RDT, in line with the current literature (see Table 1). We found that two strategies (ST5 and ST6) dealt directly with environmental issues, whereas strategies ST2 and ST3 addressed social and safety issues. The remaining strategies (ST1, ST4, ST7, ST8, ST9, ST10 and ST11) covered all three sustainability issues.

Using fuzzy logic, the quantitative part of the QFD phase 2 revealed the outcomes shown in Figure 3. According to the crisp values of AI, strategies related to legitimate frameworks and training were ranked highly (ST4, ST7 and ST11). On the other hand, ST2 (health and

Table 6.
Optimisation results with sensitivity analysis on budget

ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10	ST11	CBR	Budget
1	1	1	1	1	0	1	0	1	1	1	37.32	200
1	1	1	1	1	1	1	0	1	1	1	38.91	250
1	1	1	1	1	1	1	1	1	1	1	40.09	300

Notes: ST – strategies; CBR – cost–benefit ratio; 1 – yes; 0 – no

Table 7.
Optimisation results with sensitivity analysis on budget when ST4, ST6, ST7, ST8 and ST11 are fixed

ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10	ST11	CBR	Budget
0	0	0	1	0	1	1	1	0	0	1	15.87	200
1	0	0	1	1	1	1	1	0	0	1	28.13	250
1	1	1	1	1	1	1	1	1	1	1	40.09	300

Notes: ST – strategies; CBR – cost–benefit ratio; 1 – yes; 0 – no

safety) and ST3 (civil rights and crime) were ranked very low. These results indicated that the city managers are placing a higher priority on developing training programs and legitimate frameworks for urban-based informal entrepreneurs to resolve the many areas of sustainability requirements. However, when considering the CBR, the top-most strategies were ST1 (participative supervision and dialogue), ST7 (environmental certification) and ST7 (awareness and knowledge programs). The city corporation's two lowest-ranked strategies (ST6 and ST8) were related to waste management and the use of public space. When compared to the lower CBR values, we also noticed that these two strategies, namely, ST6 (waste management) and ST8 (allocation of urban public space) involved higher costs. The strategies that involved higher costs all had a high contribution to sustainability requirements, with these including ST4 (legitimate frameworks), ST6 (waste management), ST8 (allocation of urban public space) and ST11 (training programs). Therefore, these policies should be implemented by the city managers gradually and carefully.

To maximise the total CBR under budget limitations, the quantitative part of the QFD phase 3 provided the resultant composition of the strategies, followed by the optimal strategies. The roof of Figure 3 shows the positive relationships between the strategies. Nevertheless, according to theory, it is not impossible to have negatively overlapping strategies, that is, the implementation of a strategy can diminish the effect of another strategy (Pagell and Gobeli, 2009). This requires further quantitative research and evidence.

The results of the optimisation model (see Tables 6 and 7) show that all strategies, except for ST6 and ST8, could be selected with a budget of ৳200m, with a total CBR of 37.32. Two important strategies, namely, ST6 (waste management) and ST8 (allocation of urban public space) could not be implemented. Even after increasing the budget from ৳200m to ৳250m, one very important strategy, that is, ST8 (allocation of urban public space) could not be executed. Its implementation only becomes possible by increasing the budget to ৳300m. In doing so, the city corporation could save ৳60m. In addition, when the city managers decided to implement ST4, ST6, ST7, ST8 and ST11 as a matter of strategy and policy, this was also only possible when the budget was increased to ৳300m.

5.2 Theoretical implications

Our study offers several theoretical contributions. Firstly, we respond to the call for "important areas for research [that] include examining the considerations [of] [. . .] those drawing the line (i.e., legislators, regulators, and judges)" (McGahan, 2012, p. 19). Specifically, we leverage IT to advance our understanding of entrepreneurship in the informal sector. Few studies have investigated how institutions shape the behaviour of informal activities compared to formal activities. In addition, we answer the demand that "theorizing is required to evaluate the conditions under which an organization can productively employ its cohort of resources only through formal arrangements" (McGahan, 2012, p. 15). To the best of our knowledge, no previous study has used RDT in informal entrepreneurship research. This move assists scholars and policy-makers to understand the sustainability requirements and corresponding strategies for meeting the sustainability standards.

Secondly, we extend the knowledge by conceptualising sustainability requirements and corresponding strategies to improve urban-based informal entrepreneurship through the lens of IT and RDT and for developing the decision model (see Figure 1). In doing so, we argue that IT alone cannot effectively explain the behaviour of the informal sector entrepreneurship phenomenon without deploying the required resources (RDT) to this sector. More elaborately, IT helps to identify the sustainability requirements, whereas RDT facilitates the setting of strategies to meet sustainability requirements. Further, both IT and

RDT assist to prioritise the sustainability requirements and optimal strategies. Therefore, theorising the interaction of IT and RDT could lead to reconfiguring an appropriate decision model for informal entrepreneurship in urban areas.

Thirdly, our study shows the effective application of fuzzy set theory and QFD to explore and analyse the sustainability requirements and corresponding strategies for urban-based informal entrepreneurship in the context of developing countries. So far, no study to date has used or applied the combination of fuzzy logic and the QFD approach. In doing so, we offer a new and effective tool to examine informal entrepreneurship. Furthermore, we have used an optimisation model in our study. The optimisation of strategies shows that organisations need to select the best sustainability strategies for implementation within resource constraints as the shortage of resources is one of the major barriers to implementing these strategies in most developing countries.

5.3 Managerial implications

Our results have clear implications for policy-makers, urban designers and city mayors. As Schneider *et al.* (2011) state, city managers and mayors are emerging as "public entrepreneurs," helping to advance dynamic strategic change in the face of growing sustainability agendas. The decision model developed in our study shows the wide range of sustainability requirements and corresponding strategies for ensuring the sustainability of informal entrepreneurship in urban areas of developing countries. City managers can use this model not only to identify the sustainability requirements of informal entrepreneurship but also to prioritise those requirements in situations of scarce resources, which are limited in the developing country context.

Further, the decision model will allow city managers to determine optimal strategies to tackle the sustainability requirements. Such optimal strategies will also help to test alternative sets of optimal strategies under different scenarios, which can minimise costs. Furthermore, we explore sustainability requirements and corresponding strategies from the extant literature and field study, much of which can be generalised to similar cities elsewhere in the world.

6. Conclusions

Our study adds value both in theory and practice. Through the integration of IT and RDT, the decision model developed in this study is unique in its application in the context of urban-based informal entrepreneurship in developing countries. The effective application of the fuzzy QFD approach and the optimisation model in the context of urban-based informal entrepreneurship are also unique contributions.

This study has some limitations that reveal opportunities for further research. Our preliminary thoughts are offered on how the integration of IT and RDT can explain the sustainability requirements and corresponding strategies that could lead to decision models to improve urban-based informal entrepreneurship. However, for a more in-depth understanding of the informal entrepreneurship phenomenon within the urban context, several other theories, such as absorptive capability theory, dynamic capability theory and stakeholder theory, could be applied in future research. In the methodology section, we conducted a quantitative case study with one city. However, the selected city was large, thus detailed data for the QFD methodology were extremely demanding to collect. Another future research area that would be ideal would be a replication of the current study in a contrasting city in another developing country. Further research could also seek to identify conflicting strategies that would support sustainability requirements, thus resulting in negative complementariness in strategy implementation. Our immediate future research will address these issues.

Notes

1. Sustainability is a comprehensive concept that describes the use of resources that enables society to satisfy current needs without hampering the ability for following generations to meet their needs. The current study defines sustainability as including the long-term maintenance and reproduction of three areas (i.e. planet, people and profit) on which individuals, groups and organisations should focus when developing strategies.
2. In a numerical (or otherwise) model, the sensitivity analysis (SA) is a method that measures how the impact of uncertainties of one or more input variables can lead to uncertainties in the output variables. This analysis is useful because it improves the prediction of the model, or reduces it by studying qualitatively and/or quantitatively the model response to change in input variables, or by understanding the phenomenon studied by the analysis of interactions between variables. However, the target of interest must not be the model output *per se*, but the question that the model has been called to answer.

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