

DEVELOPING A HOLISTIC MODEL FOR IMPROVING THE FOOD QUALITY AND SAFETY ASPECTS OF THE STREET VENDED FOOD

VINOD KOTWAL



**CENTRE FOR RURAL DEVELOPMENT AND TECHNOLOGY
INDIAN INSTITUTE OF TECHNOLOGY DELHI**

AUGUST 2019

DEVELOPING A HOLISTIC MODEL FOR IMPROVING THE FOOD QUALITY AND SAFETY ASPECTS OF THE STREET VENDED FOOD

by

VINOD KOTWAL

Centre For Rural Development And Technology

Submitted

In fulfillment of the requirements of the degree of Doctor of Philosophy

to the



INDIAN INSTITUTE OF TECHNOLOGY DELHI

AUGUST 2019

Certificate

This is to certify that the thesis entitled **“Developing a Holistic Model for improving the food quality and safety aspects of the Street Vended Food”** being submitted by **Ms. Vinod Kotwal** to the Indian Institute of Technology Delhi for the award of **“Doctor of Philosophy”** is a record of bonafide research work carried out by her under our guidance and supervision in conformity with the rules and regulations of Indian Institute of Technology Delhi. The research report and results presented in this thesis have not been submitted, in part or in full, to any other university or institute for the award of any degree or diploma.

(Dr. S.N. Naik)

Professor

Centre for Rural Development and Technology
Indian Institute of Technology Delhi

(Dr. Santosh Satya)

Professor

Centre for Rural Development and Technology
Indian institute of Technology Delhi

Acknowledgements

Writing acknowledgements is the hardest part of any project. There are so many people to be thanked. I would like to begin by thanking whole heartedly my supervisors, **Prof. Santosh Satya** and **Prof. S. N. Naik**, Centre for Rural Development and Technology for paving the way towards successful completion of this research work. Their wisdom, knowledge, insightful comments and commitment to the highest standards of research inspired and motivated me. My thesis is an outcome of their guidance, constructive suggestions and careful editing. It has been a great learning experience and privilege to work under their able guidance.

I am also thankful to Prof. Satyawati Sharma (Former Head) and Prof. V.K. Vijay, Head, Centre for Rural Development and Technology for their support. I thank my SRC members – Prof. Rajendra Prasad and Prof. K.K. Pant for their valuable suggestions and comments during my progress presentations, which further refined my research findings. I am also grateful to Prof. Jyoti Kumar, Department of Design, IIT Delhi for enthusiastically taking up the street food cart design project with his students. He was ably assisted by Mr. Abhishek Dahiya, Research Scholar at the same Department.

I would like to extend my heartfelt thanks to all the respondents to my survey/case-study research- the street food vendors who wage a daily battle for livelihood. They were open to sharing their experiences, hopes and aspirations and their grit is indomitable. This work would have remained incomplete without the insights that I gathered from my interactions with stakeholders in the street food sector particularly, Dr. Koshia, Food Safety Commissioner, Government of Gujarat, Mr Salim Veljee, Ex-Food Safety Commissioner and Mr. Richard Noronha, Designated Officer, Government of Goa, Ms. Madhavi Dass, Chief Management Services Officer, FSSAI. I would also like to thank Dr. Sridhar Dharmapuri, Senior Food Safety and Nutrition Officer, FAO for sharing his experiences of leading the

FAO work on street food in Bangladesh, Also, to be thanked are food safety experts with whom informal discussions were held during the course of this work. It helped in clearing lot of cobwebs in my mind to bring clarity. Mr. Arvind Singh and Ms. Sangeeta Singh of NASVI were ever willing to share their experiences from the field and I am grateful to them.

I profusely thank my husband Mr. L. Madhu Nag and daughter Shravani for their unstinted support in all my endeavours, always! The roles of mother and daughter were reversed with Shravani nudging me to complete my work. Thanks to my mother, Ms. Kiran Kotwal for encouraging us to push boundaries and teaching that there are no shortcuts to success except through hard work. My father-in law, Mr. L.S. Sarma (late) was a source of strength and would have been happy with this academic achievement. Special thanks to my mother-in-law, Ms. Lanka Subhadra for her quiet, inspirational strength.

I would like to thank my colleague at CRDT Dr. Prachi Singh for her support in innumerable ways. She smoothed lot of things for me logistically and was ever ready to help with a warm smile. I also acknowledge and thank the cooperation extended by other research colleagues, Mr. Umesh Sharma, Mr. Ajay Kumar, and Ms. Arjoo. A special thanks to ever helpful CRDT office staff and lab attendant, Mr. Gopi. I would also like to acknowledge the technical help rendered by Mr. Anil Malik at a very crucial juncture of thesis submission and wholeheartedly thank him for that.

Last but definitely not the least; I thank the Almighty for giving me the tenacity and strength to complete the research work.

Vinod Kotwal

Abstract

World over street foods are popular as they are conveniently available, economically priced, and offer a wide variety. Street foods are also being positioned as a tourist attraction as they are reflection of the local cuisines and culture. Also, street food vending offers livelihood to millions of people particularly in developing countries because of low-entry barriers. Infrastructural facilities like potable water, waste disposal etc are not available at the vending locations as most of the street food vendors are plying their trade informally without requisite regulatory permissions. There are concerns with the safety and quality of street foods as microbiological, physical, chemical and toxicological hazards render them unsafe. However, given their importance as a means of food and livelihood, government authorities across the world as part of the national food control systems regulate street food vending.

In India too, the street food vending from a food safety perspective is governed by various authorities. However, situation at operational level seems to be grim. In this background, present study focuses on: i) To study the status of street food vendors in the urban as well as rural areas about their food safety regulatory compliance ii) To identify areas where technological interventions can improve the quality and safety of street vended foods iii) To develop a holistic model and recommend policy guidelines for promoting safe street foods.

During March-May 2015, a field survey was undertaken to understand the 'AS-IS' situation of the 200 urban street food vendors in the city of Delhi and 100 rural street food vendors in rural areas of UP and Haryana bordering NCT Delhi. The survey is one of its kinds as it has examined the urban and rural street food vendors from different perspectives. The situational analysis focused on various aspects with particular focus on regulatory compliance of the Street Food Vendors (SFVs) and their surveillance, existing facilities provided to the street food vendors at the selected area and information on the food vending unit, their cooking and serving profile, assessment of their training needs and other appropriate interventions to improve food safety and hygiene of street foods etc. Case-study research focusing on 20 street food vendors was carried out in Vasant Kunj areas of city of Delhi during July-September 2017. The survey and case-study research was supplemented with field visits to states of Gujarat and Goa; and discussions with various stakeholders of the street food sector. Parallely, literature review focusing on international case studies from Bangladesh, Singapore and Thailand was also carried out.

The field survey and case study research revealed that very few (8 % of the SFVs) are either registered or licensed under different government regulations. Compliance to food safety regulatory regime is low particularly so in rural areas. Poor regulatory compliance and surveillance of street food vendors is also accentuated by lack of infrastructural facilities like potable water, waste and water disposal facilities at the vending locations. Though the personal hygiene of the street food vendors in urban as well as rural areas was almost same, rural vendors showed poor waste disposal practices. The vending sites in rural areas were more prone to littering and had dirty surroundings. Also, most of the SFVs are located in places that are prone to air pollution. The study also brought to the fore that most of the vending carts are poorly designed and do not meet the sanitary and hygiene requirements.

Cooking practices also revealed that cooking oil is repeatedly heated and artificial colours are used in certain foods, which have impact on the quality of street vended food. The situational analysis, therefore, highlighted that street foods are at risk of various hazards which can render them unsafe as well as of poor quality.

Internationally, case studies also revealed that different countries follow different methods of regulating the street vended food. Singapore has followed a highly regulated model wherein all the street food vendors were translocated to fixed locations called as hawkers' centres that were provided with all the infrastructural facilities. On the other hand, countries like Thailand have discontinued certain locations that are permitted for street food vending and the vendors have to follow the sanitary requirements. A FAO assigned project in Bangladesh followed an '*in-situ*' approach wherein the street food vendors were provided the training, were regularly monitored and also provided a well-designed street food cart.

The present study revealed that ensuring safety and quality of street vended food is complex and multi-dimensional phenomenon and it can be assured only when there is collaboration between different stakeholders and thus a holistic model has been proposed. The holistic model has four components: Intrapersonal, Relational, Environmental, and Regulatory. These components have to work together as the Intrapersonal focuses on the elements that are to be addressed by the street food vendors himself/herself. Relational component focuses on building linkages with institutions and organizations that will undertake trainings, provide technological solutions for clean water, energy, well-designed food cart, bio control methods for house fly etc. This component also highlights the importance of use of mobile technology including involvement of customers and civil society. The regulatory component should focus on providing a single window clearance to the SFVs, a regulation based inspection and surveillance programme, standardization of street food carts and linkage with various Government of India schemes, which have linkages with the street food vending. All these activities will be ineffective if the vendors are not provided proper location for vending, infrastructural facilities like potable water, solid waste disposal etc., which form part of the environmental component. However, this highly interconnected collaborative approach of the holistic model can be operationalised by a hub consisting of Food Safety and Standards Authority of India (FSSAI) at the federal level and Food Safety Authorities and municipalities at the State and City level respectively. A set of policy guidelines have also been suggested to operationalise the model.

In addition, the study also highlighted that a well-designed street food cart can play a critical role in ensuring safety of street foods. Thus, six designs have been developed for two, three and four-wheeler street food carts in collaboration with the faculty and students of Department of Design (DoD), IIT Delhi.

Overall, the results of the study present a holistic model including new designs of carts for improving the food quality and safety of street vended foods. In fact these research findings form a small step in the journey of paradigm shift related to street food safety.

सारांश

स्ट्रीट फूड दुनिया भर में लोकप्रिय हैं। इसकी लोकप्रियता इसलिए भी है क्योंकि ये किफायती दर पर आसानी से उपलब्ध तो होते ही हैं साथ ही इनमें बहुत विविधता भी है। ये भोजन पर्यटकों को भी खूब लुभाते हैं क्योंकि इसमें स्थानीय पाक कला और संस्कृति की महक होती है। विशेषतया विकासशील देशों में यह लाखों लोगों के जीवन-यापन का साधन है क्योंकि इसके लिए अधिक धन की जरूरत नहीं पड़ती है। लेकिन जहां ये दुकानें लगती हैं उन जगहों अर्थात् विक्रय स्थल पर पीने-योग्य पानी, कचरा प्रबंधन आदि जैसी अवसंरचनागत सुविधाएं उपलब्ध नहीं होती हैं क्योंकि ऐसे दुकानदार अपनी दुकान अपेक्षित विनियामक के आदेश के बिना ही अनौपचारिक रूप से चला रहे होते हैं। इस प्रकार के खाद्य पदार्थ माइक्रोबायोलॉजिकल, रसायनिक, जहरीलापन आदि खतरों के कारण खाने-पीने की दृष्टि से सुरक्षित नहीं होते हैं। परंतु भोजन और जीवन-यापन के साधन के रूप में स्ट्रीट फूड के महत्व को देखते हुए दुनिया भर के सरकारी प्राधिकरण स्ट्रीट फूड की बिक्री को राष्ट्रीय खाद्य नियंत्रण प्रणाली के हिस्से के तौर पर विनियमित करते हैं:-

भारत में भी खाद्य सुरक्षा की दृष्टि से स्ट्रीट फूड बेचना कई प्राधिकरणों द्वारा शासित होता है लेकिन व्यावहारिक स्तर पर इसकी स्थिति अच्छी नहीं कही जा सकती है। इस पृष्ठभूमि में वर्तमान अध्ययन को निम्नलिखित बिंदुओं पर केंद्रित किया गया है:-

- i) शहरी तथा ग्रामीण इलाकों में स्ट्रीट विक्रेताओं के खाद्य सुरक्षा से संबंधित विनियामक को लागू करने के बारे में उनकी स्थिति का अध्ययन करना
- ii) उन प्रकरण की पहचान करना जहां टेक्नोलॉजी द्वारा स्ट्रीट फूड की गुणवत्ता और सुरक्षा में सुधार किया जा सके
- iii) सुरक्षित स्ट्रीट फूड को बढ़ावा देने के लिए एक होलिस्टिक मॉडल तैयार करना तथा नीतिगत दिशानिर्देश की सिफारिश करना।

दिल्ली शहर में 200 स्ट्रीट फूड विक्रेताओं तथा राष्ट्रीय राजधानी क्षेत्र दिल्ली से लगे उत्तर प्रदेश और हरियाणा के ग्रामीण इलाकों के खाद्य विक्रय की वास्तविक स्थिति को समझने के लिए मार्च-मई 2015 में क्षेत्रीय सर्वेक्षण किया गया था। यह अपने तरीके का अनोखा सर्वेक्षण है क्योंकि इसमें शहरी तथा ग्रामीण खाद्य विक्रेताओं की विभिन्न कोणों से जांच की गई है। स्थितिपरक विश्लेषण, अध्ययन के विभिन्न प्रकरण जैसे स्ट्रीट फूड विक्रेताओं द्वारा विनियमों का पालन व उनकी निगरानी, चयनित स्थलों पर इन विक्रेताओं को दी गई सुविधाएं, भोजन विक्रय इकाई के बारे में जानकारी, भोजन पकाना व वितरण प्रोफाइल, उनके प्रशिक्षण की आवश्यकता की समीक्षा तथा स्ट्रीट फूड की खाद्य सुरक्षा व स्वच्छता आदि को सुधारने के लिए उपयुक्त उपायों पर केन्द्रित किया गया था।

बीस स्ट्रीट फूड विक्रेताओं को केन्द्र में रखकर जुलाई-सितंबर 2017 में दिल्ली के वसंत कुंज इलाके में 'केस स्टडी रिसर्च' किया गया था। इस सर्वेक्षण और 'केस स्टडी रिसर्च' के साथ-साथ गुजरात और गोवा राज्यों का क्षेत्रीय दौरा तथा स्ट्रीट फूड सेक्टर के विभिन्न हितकारकों (स्टेकहोल्डरों) के साथ विचार-विमर्श भी किया गया। इसके साथ-साथ बंगलादेश, सिंगापुर तथा थाईलैंड के अन्तरराष्ट्रीय केस स्टडी पर केंद्रित साहित्य की समीक्षा भी की गई।

क्षेत्रीय सर्वेक्षण और केस स्टडी रिसर्च से यह बात सामने आई है कि बहुत कम स्ट्रीट फूड विक्रेता (~ 8%) विभिन्न सरकारी विनियमों के तहत पंजीकृत अथवा लाइसेंस प्राप्त किए हुए हैं। इन इलाकों में खाद्य सुरक्षा संबंधी विनियमों का पालन भी बहुत कम हो रहा है। विनियमों के अनुपालन की खराब स्थिति एवं स्ट्रीट फूड विक्रेताओं की निगरानी से यह स्पष्ट होता है कि बिक्री स्थलों पर पीने के पानी की और कूड़ा निपटान तथा जल निकासी जैसी सुविधाओं की कमी है। हालांकि शहरी और ग्रामीण दोनों ही इलाकों में स्ट्रीट फूड विक्रेताओं की व्यक्तिगत साफ-सफाई कमोबेश एक जैसी पाई गई लेकिन ग्रामीण विक्रेताओं में कचरा निपटान का स्तर ठीक नहीं था। ग्रामीण इलाकों के बिक्री स्थलों पर सफाई नहीं थी, चारों ओर गंदगी फैली थी और उसका परिवेश गंदगी भरा था। अधिकतर ये भोजन इकाई वायु प्रदूषण की दृष्टि से संवेदनशील स्थानों पर थे। इस अध्ययन से यह भी सामने आया है कि अधिकतर स्ट्रीटफूड गाड़ी का डिजाइन ठीक नहीं है और ये स्वच्छता और साफ-सफाई के पैमानों पर खरे नहीं उतर रहे हैं। खाना पकाने की प्रक्रिया से यह भी स्पष्ट हुआ है कि खाद्य तेल बार-बार गर्म किया जाता है और कुछ खाद्यों में कृत्रिम रंगों का इस्तेमाल भी किया जाता है जिसके चलते स्ट्रीट फूड की गुणवत्ता पर बुरा असर पड़ता है। स्थितिपरक अध्ययन से पता चला है कि स्ट्रीट फूड कई लिहाज से खतरे में है जो इन्हें असुरक्षित और गुणवत्ता के लिहाज से घटिया बना सकता है।

अंतरराष्ट्रीय स्तर पर किए गए अध्ययन से यह भी पता चला है कि अलग-अलग देशों में स्ट्रीट फूड को विनियमित करने के लिए अलग-अलग पद्धति प्रचलित है। इस संदर्भ में ये देश सख्त विनियामक मॉडल का पालन करते हैं जिसके तहत यहां-वहां दुकान लगाने वाले सभी स्ट्रीट फूड विक्रेताओं को वहां से हटाकर एक स्थायी स्थान पर स्थापित कर दिया गया है जिसे 'हॉकर्स सेंटर' कहा जाता है। इस सेंटर में उन्हें हर प्रकार की अवसंरचनागत सुविधाएं उपलब्ध कराई गई हैं। वहीं दूसरी ओर थाईलैंड जैसे देश में कुछेक स्ट्रीट फूड स्थलों को बंद कर दिया गया है तथा विक्रेताओं के लिए स्वच्छता संबंधी जरूरतों का पालन करना अनिवार्य है। बंगलादेश की एक FAO प्रायोजित परियोजना में 'स्व-स्थानिक' विधि (in-situ approach) का पालन किया गया था। इसके अर्न्तगत स्ट्रीट फूड विक्रेताओं को प्रशिक्षित किया गया और उनकी लगातार मॉनिटरिंग की गई। इसके अलावा उन्हें बढ़िया ढंग से डिजाइन किए गए स्ट्रीट फूड गाड़ी भी दिए गए थे।

वर्तमान अध्ययन से यह बात भी सामने आई है कि स्ट्रीट फूड की सुरक्षा और गुणवत्ता को सुनिश्चित करना जटिल और बहुआयामी कार्य है और इसका आश्वासन तभी दिया जा सकता है जब अलग-अलग हितधारकों (स्टेकहोल्डरों) के बीच आपसी सहयोग हो। इन निष्कर्षों को आधार बनाकर एक होलिस्टिक मॉडल विकसित किया गया है। इस होलिस्टिक मॉडल के चार घटक हैं: अंतर-व्यैक्तिक (इंटरपर्सनल) घटक, संबंध-परक घटक, पर्यावरणीय घटक तथा विनियामक घटक। इन सभी पहलुओं को ध्यान में रखते हुए उन सभी मुद्दों पर जिनका समाधान स्वयं स्ट्रीट फूड विक्रेताओं द्वारा किया जाना है, मिलजुल कर काम करना होगा। संबंध-परक घटक का फोकस संस्थानों एवं संगठनों के साथ सम्बन्ध बनाने पर होता है जो प्रशिक्षण प्रोग्राम आयोजित करेंगे तथा स्वच्छ जल व ऊर्जा वाले बेहतर डिजाइन की स्ट्रीट फूड गाड़ी के लिए प्रौद्योगिकीय समाधान, मक्खियों के लिए जैव नियंत्रण प्रणाली आदि प्रदान करते हैं। यह घटक ग्राहकों एवं समाज की भागीदारी सहित मोबाइल टेक्नोलॉजी के इस्तेमाल की महत्ता को भी रेखांकित करता है। विनियामक घटक के अन्तर्गत स्ट्रीट फूड विक्रेताओं को एकल कार्यालय अनुमति (सिंगल विंडो क्लियरेंस), विनियम आधारित निरीक्षण तथा निगरानी कार्यक्रम, स्ट्रीट फूड गाड़ी का मानकीकरण एवं स्ट्रीट फूड विक्रय से जुड़ी विभिन्न सरकारी स्कीमों के साथ सम्बन्धों पर ध्यान केंद्रित करना होगा। विक्रेताओं को विक्रय के लिए उचित स्थान, पर्यावरण को ध्यान में रखकर अवसंरचनागत सुविधाएं जैसे पीने योग्य जल, ठोस कचरा निपटान आदि का उचित प्रबंध उपलब्ध कराए बिना ये सारे कार्यकलाप निष्प्रभावी रहेंगे।

इस प्रकार उपरोक्त उच्चस्तर अन्तर्सम्बन्ध व सहभागिता विधि आधारित होलिस्टिक मॉडल को संघीय स्तर पर FSSAI, राज्य एवं शहर स्तर पर खाद्य सुरक्षा प्राधिकरण व नगर निगमों के संयुक्त 'हब' द्वारा प्रचालित किया जा सकता है। इसके अलावा इस अध्ययन में विशेष रूप से यह भी स्पष्ट किया गया है कि बेहतर ढंग से डिजाइन की गयी स्ट्रीट फूड गाड़ी भोजन की सुरक्षा को सुनिश्चित करने में महत्वपूर्ण भूमिका निभा सकती है। इस संदर्भ में आईआईटी, दिल्ली के डिजाइन विभाग की फैकल्टी एवं छात्रों के सहयोग से दुपहिया, तिपहिया और चार-पहिया स्ट्रीट फूड गाड़ी के डिजाइन तैयार किए गए हैं।

कुल मिलाकर अध्ययन के परिणाम स्ट्रीट फूड विक्रय की खाद्य गुणवत्ता तथा सुरक्षा को बेहतर बनाने के लिए गाड़ी के नए डिजाइनों सहित होलिस्टिक मॉडल प्रस्तुत करते हैं। वस्तुतः इन अनुसंधानों से प्राप्त निष्कर्ष स्ट्रीट फूड सुरक्षा से जुड़े बुनियादी बदलावों की दिशा में किया गया छोटा-सा प्रयास है।

Contents

		Page No.
	Certificate	i
	Acknowledgements	ii-iii
	Abstract	iv-v
	List of Figures	x-xi
	List of Tables	xii-xiii
	Abbreviations	xiv-xv
Chapter 1	Introduction	1-11
1.1	Background	1-4
1.2	Safety of Street Foods	4-6
1.3	Current Indian Scenario	6-9
1.4	Knowledge gaps and objectives	9-9
1.5	Scope of the present study and thesis structure	10-11
Chapter 2	Literature Review	12-29
2.1	Definition of Street Food and Street Food Vendors	12-14
2.2	Types of Street Food	14-15
2.3	Significance of street food vending	15-17
2.4	Problems/Issues associated with safety and quality of street foods	17-18
2.4.1	Food Safety issues in street foods	18-19
2.4.2	Nutritional Quality issues associated with street foods	19-20
2.4.3	Economic, Infrastructural, Political and Legal changes	21-22
2.5	Steps taken to address the food safety and quality issues of street foods-Regulatory aspects	22-27
2.5.1	National Interventions	22
2.5.1.1	Regulatory steps	22-24
2.5.2	International interventions	24-27
2.6	Steps taken to address the food safety and quality issues of street foods-Non Regulatory aspects	27-29
2.6.1	Training and Capacity building	27
2.6.2	Areas for technological interventions	27-28
2.6.3	Socio-economic initiatives	28-29
Chapter 3	Research Methodology	30-39
3.1	Introduction	30-31
3.2	Conceptual basis for the research methodology	32-35
3.3	Phases of the study	35-39
3.3.1	Phase 1 : Situational analysis of the street food vendors	35-38
3.3.2	Phase II: Semi-structured interviews with different stakeholders including field visits	38

3.3.3	Phase III : Case study research	39
3.3.4	Phase IV: International case studies: Bangladesh, Singapore and Thailand	39
3.3.5	Phase V: Discussion with faculty members/students of DoD IIT Delhi	39
Chapter 4	Field Survey, SFV Case Studies, Stakeholder Interviews-The Situational Analysis	40-81
4.1	Introduction	40-41
4.2	Field survey	41-45
4.2.1	Spread of Urban and Rural Street Vendors in the survey	43-45
4.3	Results of the Field Survey	45-75
4.3.1	Socio-demographic Profile of Street-Food Vendors in Urban & Rural areas	45-48
4.3.2	Health Profile of Street-Food Vendors in Urban & Rural areas	48-49
4.3.3	Personal Hygiene Profile of Street-Food Vendors	49-50
4.3.4	Vending Profile of the Street food vendors	51-55
4.3.5	Regulatory Compliance of the Street Food Vendors	55-57
4.3.6	Number and Profile of the customers visiting the SFVs	57-59
4.3.7	Economic perspective of street food vending	59-60
4.3.8	Status of available infrastructural facilities for street food vending	60-63
4.3.8.1	Availability of drinking water	60-61
4.3.8.2	Availability of dust bins at the vending location	61
4.3.8.3	Waste disposal practices	62-63
4.3.8.4	Electricity at the cart and source of fuel for cooking	63-64
4.3.9	Purchasing and Cooking Practices followed by the SFVs	64-68
4.3.10	Status of training and further requirements	69-70
4.3.11	Requirements of the SFVs for street food vending	70-71
4.3.12	Awareness about Food Safety and use of modern communication technology	71-73
4.3.13	Areas requiring technological intervention and other support	73-75
4.4	Case Study Research	75-77
4.5	Discussions with different stakeholders	78
4.6	Discussions and conclusions	78-81
Chapter 5	International and National scenario (Selected Case Studies)	82-120
	International Scenario	82-83
5.1	Street-food vending in Bangladesh	83-84
5.1.1	FAO Project to improve the hygiene and quality of street food in Bangladesh (Khulna)	84-90
5.1.2	Outcomes of the implementation of the Khulna Project	90-92
5.2.	Street-food vending in Singapore	92
5.2.1	Important features of the Hawker Centres	93
5.2.2	Hawkers Centres Upgrading Programme	93-94
5.2.3	Requirements for licensing	94-95

5.2.4	Focusing on quality aspects of food sold in the Hawker Centres	95
5.2.5	Food Tourism in Singapore	96
5.2.6	Roles being played by the Hawker Centres	96-97
5.3	Street-food vending in Bangkok (Thailand)	97-98
5.3.1	Bangkok's Street Food Project	98-100
5.3.2	Salient features of the Bangkok's Street Food Project	100-101
5.3.3	Changing Policies of BMA on the street vending	101-102
5.4	Learning from International Scenario	102-105
	National Scenario	105
5.4	Regulating food safety at the State level	106
5.4.1	Regulating food safety in the state of Goa	106-107
5.4.1.1	Street-food vending in Goa	107
5.4.1.1.1	Implementation of a Capacity Building Project on food safety and quality of Street Food Units (SFUs) in Goa	107-111
5.4.1.1.2	Observations based on field visit to Goa in June 2014	111-112
5.4.1.1.4	Training for the street food vendors conducted during November-December 2016 in Goa	112-115
5.4.1.1.5	Telephonic interview with Ex-FSC, Goa and Designated Officer, FDA Goa in January/March 2018	115
5.4.2	Regulating food safety in the state of Gujarat	115-117
5.5	Learnings from Goa and Gujarat	117-118
5.6	Initiatives at the National Level by FSSAI	118-119
5.7	Conclusion	119-120
Chapter 6	Development of a Holistic Street Food Vending Model	121-140
6.1	Introduction	121-122
6.2	Development of the Holistic Model	122-127
6.2.1	Methodology	122-127
6.2.2	Building Blocks of the Holistic Model	127-129
6.3	Holistic Model for improving the food quality and safety aspects of the street vended food	129-131
6.3.1	Constituents of the building blocks	132
6.3.1.1	Intrapersonal (Hygiene and Sanitation aspects)	132-133
6.3.1.2	Relational (Building linkages)	133-136
6.3.1.4	Regulatory (Facilitating regulatory compliances-multi-pronged Approach)	136-138
6.3.1.5	Environmental (Vending site location & facilities therein)	138-140
6.3.1.6	Operationalising the Holistic Model	140
Chapter 7	Designing of street food vending cart	141-156
7.1	Introduction	141
7.2	Designing a Street Food Cart	141
7.2.1	User-centered design approach	141-142
7.2.1.1	Problem Identification	143
7.2.1.2	Contextual Enquiry	143
	Ecosystem analysis	144

	Day in the life of (DILO) analysis	145
	Task analysis	145-147
7.2.2	Preliminary Design Concepts	148-149
7.2.3	Final design solutions	150-154
7.2.3.1	Design for two-wheeler food vending cart	150-151
7.2.3.2	Designs for three wheelers food vending cart	152
7.2.3.3	Design for four or more than four wheeler food vending cart	152-154
7.3	Discussions on the street food cart design	155-156
Chapter 8	Summary, conclusions and policy guidelines	157-167
8.1	Summary	157-158
8.1.1	Compliance of street food vendors to food safety regulatory regime	158-160
8.1.2	International and national experience of regulating street food vending	160-161
8.1.3	Identification of areas requiring technological intervention and suggesting designs for street food carts	161
8.1.4	Development of a holistic model for improving the food quality and safety aspects of the street vended food with suggested policy guidelines	161-162
8.2	Policy Guidelines	162-165
8.3	Recommendations	165-166
8.4	Conclusion	166-167
References		168-178
Annexure I		179-180
Annexure II		181-182
Annexure III		183
Biodata		

List of Figures

	Page No.
Figure 1.1	7
Figure 2.1.	17
Figure 3.1	31
Figure 3.2	35
Figure 3.3	37
Figure 4.1	41
Figure 4.2	42
Figure 4.3	44
Figure 4.4	44
Figure 4.5	46
Figure 4.6	48
Figure 4.7	52
Figure 4.8	52
Figure 4.9	57
Figure 4.10	59
Figure 4.11	61
Figure 4.12	68
Figure 4.13	73
Figure 4.14	74
Figure 4.15	76
Figure 4.16	77
Figure 5.1	85
Figure 5.2	87
Figure 5.3	88
Figure 5.4	89
Figure 5.5	92
Figure 5.6	97
Figure 5.7	114
Figure 5.8	114
Figure 5.9	115
Figure 5.10	128
Figure 5.11	129
Figure 6.1	130
Figure 6.2.	131
Figure 6.3	131
Figure 6.4	131

	quality and safety of street vended food	
Figure 6.5	Operationalising the Holistic Model	140
Figure 7.1	Ecosystem analysis of the street food vendors	144
Figure 7.2	Day in the life of (DILO) analysis	145
Figure 7.3 and 7.4	Street food vending carts	146
Figure 7.5	Street food cart design concept 1	148
Figure 7.6	Street food cart design concept 2	149
Figure 7.7	Street food cart design concept 3	149
Figure 7.8 and 7.9	Designs for two-wheeler food vending cart	150
Figure 7.10 and 7.11	More Designs for two-wheeler food vending cart	151
Figure 7.12 and 7.13	Designs for three-wheeler food vending cart	152
Figure 7.14 and 7.15	Designs for four wheeler street food cart	153
Figure 7.16 and 7.17	Designs for more than four wheeled street food cart	154

List of Tables

	Page No.
Table 1.1 Important regulatory requirements of sanitary and hygiene practices	8
Table 2.1 Comparative analysis of the Codex codes of practices and guidelines for street-vended foods	26-27
Table 4.1 Spread of the urban and rural street food vendors covered in the survey	43
Table 4.2 Place of Origin of the Street Food Vendors	46
Table 4.3 Socio-demographic Profile of Street-Food Vendors in Urban & Rural areas	47
Table 4.4 Maximum, Minimum and Mean age of Urban and Rural SFVs	47
Table 4.5 Health Profile of the street food vendors (visit to the doctor in the last six months)	48-49
Table 4.6 Status of going to work, if sick	49
Table 4.7 Personal hygiene behaviour profile of the SFVs	50
Table 4.8 Profile of Types of Food sold	53
Table 4.9 Vending Profile of the SFVs	54
Table 4.10 Vending location of the vending cart	54
Table 4.11 Vending location of the SFVs	55
Table 4.12 Regulatory Compliance of the Street Food Vendors	56
Table 4.13 Number and profile of customers visiting in a day	57
Table 4.14 Profile of customers visiting the Street Food Vendors and their feedback	58
Table 4.15 Mean, Maximum and Minimum sale in a day (in Rs)	59
Table 4.16 Major cost Centres	60
Table 4.17 Gross Sales versus money spent on ingredients, fuel, transportation, cleaning material and wages in a day	60
Table 4.18 Availability of water, waste disposal practices, and other environmental factors	62-63
Table 4.19 Source of power at the vending cart and for lighting and cooking	64
Table 4.20 Purchase Profile of the Street Food Vendors	65-66
Table 4.21 Cooking Profile of the SFVs	66
Table 4.22 Cooking practices with regard to use of artificial colours and cooking oil	67
Table 4.23 Regarding learning and traditional knowledge system	68
Table 4.24 Status of training and further requirements	69
Table 4.25 Requirements of the SFVs	70-71
Table 4.26 Awareness about Food Safety	71-72
Table 4.27 Need for Technological intervention	73
Table 4.28 Other Suggestions by the SFVs	75

Table 5.1	Grading system for the vendors at the Hawker Centres, Singapore	94
Table 5.2	Learnings from Khulna (Bangladesh), Singapore and Bangkok (Thailand) models	102-105
Table 5.3	General Observations on food practices being followed by SFUs in Goa	109
Table 5.4	Number of SFVs trained during November-December 2016 in Goa	113
Table 5.5	Number of SFVs trained during January-February 2016 in Gujarat	116-117
Table 6.1	Key areas requiring attention from food safety regulatory compliance perspective	123
Table 6.2	Rationale for identifying the areas essential for food safety regulatory compliance	123-126
Table 6.3	Air Quality Index at certain locations of SFV interviews in Delhi over a month	139

Abbreviations

1. AcSIR- Academy of Scientific and Innovative Research
2. BIS- Bureau of Indian Standards
3. BMA- Bangkok Metropolitan Administration
4. CAC – Codex Alimentarius Commission
5. CAG- Comptroller and Auditor General
6. CFTRI- Centre Food Technological Research Institute
7. CMSO- Chief Management Services Officer
8. DFF- Deep Fat Frying
9. DNCC- Dhaka North City Corporation
10. DoD-Department of Design
11. DOH- Department of Health
12. DSCC- Dhaka South City Corporation
13. FAO- Food and Agriculture Organization
14. FBD-Food Borne Diseases
15. FBOs – Food Business Operators
16. FDA- Food and Drug Administration
17. FERG-FBD Burden Epidemiological Reference Group
18. FSC- Food Safety Commissioner
19. FSMs- Food Safety Monitors
20. FSO- Food Safety Officer
21. FSSA,2006-Food Safety and Standards Act, 2006
22. FSSAI- Food Safety and Standards Authority of India
23. GHP- Good Hygiene Practices
24. HPB- Health Promotion Board
25. HUP- Hawkers Centre Upgrading Programme
26. IDSP- Integrated Disease Surveillance Programme
27. IEC- Information, Education and Communication
28. ISO- International Standard Organization
29. KAPs- Knowledge, attitude and practices
30. KCC- Khulna City Corporation
31. MCD- Municipal Corporation of Delhi

- 32. NASVI- National Association of Street Vendors of India
- 33. NCDC- National Centre for Disease Control
- 34. NCR- National Capital Region
- 35. NDMC- New Delhi Municipal Corporation
- 36. NEA- National Environment Agency of Singapore
- 37. NFCS- National Food Control System
- 38. NOC- No Objection Certificate
- 39. PAHs- Polycyclic Aromatic Hydrocarbons
- 40. PIMC- Project Implementation and Monitoring Committee
- 41. PMJDY- Pradhan Mantri Jan Dhan Yojna
- 42. PMKVY- Pradhan Mantri Kaushal Vikas Yojna
- 43. RWAs-Resident Welfare Associations
- 44. SDMC- South Dhaka Municipal Corporation
- 45. SFUs- Street Food Units
- 46. SFVs- Street Food Vendors
- 47. STB- Singapore Tourism Board
- 48. TFA- Trans Fatty Acids
- 49. THSC- Tourism and Hospitality Skill Council
- 50. TOT- Training of Trainers
- 51. TVC- Town Vending Committee
- 52. UCD- User Centered Design
- 53. WHO- World Health Organization