Debdatta Saha

Economics of the Food Processing Industry
Lessons from Bihar, India
## Contents

1 **Introduction** ........................................................................................................ 1  
References .................................................................................................................. 11

2 **Food Processing: Understanding Common Threads** ........................................ 13  
2.1 Introduction: Why Food Processing? ................................................................. 13  
2.2 General Food Processing Characteristics ....................................................... 19  
   2.2.1 Agro-Based Versus Food Processing Industries .................................. 19  
   2.2.2 What Is Processed Food? ................................................................. 20  
   2.2.3 Defining Food Processing as an Industry ......................................... 21  
2.3 Sub-sectors/Product Networks in Food Processing ........................................ 23  
2.4 Common Product Networks in Food Processing .............................................. 28  
   2.4.1 Meat Processing Product Networks ................................................. 28  
   2.4.2 Fish Processing Product Networks ................................................. 31  
   2.4.3 Fruit and Vegetable (F&V) Product Networks .................................. 32  
   2.4.4 Dairy-Based Product Networks ..................................................... 33  
   2.4.5 Grain-Based Product Networks ..................................................... 35  
   2.4.6 Miscellaneous Groupings .................................................................. 36  
2.5 Product Networks and Region Specificity in Food Processing ....................... 41  
   2.5.1 Financing Options in Food Processing ............................................. 43  
2.6 The Way Forward: Embedding Product Networks  
   Within the Regional Context .............................................................................. 45  
Appendix .................................................................................................................... 47  
References .................................................................................................................. 50

3 **Identifying Trajectories in Food Processing** .................................................... 53  
3.1 Food Processing: A Regional Perspective ....................................................... 53  
3.2 Trajectory 1: Benchmark Stylized Facts About Food  
   Processing ............................................................................................................ 54  
3.3 Trajectory 2: The Indian Experience with Food Processing ....................... 61
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3.1 Stylized Facts and Trajectory 2</td>
<td>62</td>
</tr>
<tr>
<td>3.3.2 Working Capital Constraint in Trajectory 2</td>
<td>63</td>
</tr>
<tr>
<td>3.3.3 Other Constraints in Trajectory 2</td>
<td>67</td>
</tr>
<tr>
<td>3.3.4 Performance of Private Companies in Food Processing in India</td>
<td>68</td>
</tr>
<tr>
<td>3.3.5 National Policies and Subnational Outcomes for Food Processing in India</td>
<td>73</td>
</tr>
<tr>
<td>3.4 Summary</td>
<td>75</td>
</tr>
<tr>
<td>Appendix</td>
<td>77</td>
</tr>
<tr>
<td>References</td>
<td>79</td>
</tr>
<tr>
<td>4 Food Processing: The Bihar Trajectory</td>
<td>81</td>
</tr>
<tr>
<td>4.1 Bihar: A Short History of Regional Attributes</td>
<td>81</td>
</tr>
<tr>
<td>4.1.1 Pre-2000 Bihar: Economy, Industries and Food Processing</td>
<td>82</td>
</tr>
<tr>
<td>4.1.2 Up to 2006: Leading to Bifurcation of Bihar</td>
<td>83</td>
</tr>
<tr>
<td>4.1.3 2006 Onward: The Bihar Turnaround with Focus on Food Processing</td>
<td>85</td>
</tr>
<tr>
<td>4.2 Relative Performance Post-2008: Trajectory 3 (Bihar) Versus Trajectory 2</td>
<td>88</td>
</tr>
<tr>
<td>4.2.1 Sub-sectoral Inefficiency</td>
<td>91</td>
</tr>
<tr>
<td>4.2.2 Missing Middle Size in Registered Manufacturing Post-2008</td>
<td>92</td>
</tr>
<tr>
<td>4.2.3 Perception of the Business Environment</td>
<td>100</td>
</tr>
<tr>
<td>4.2.4 Business Intentions</td>
<td>102</td>
</tr>
<tr>
<td>4.2.5 Summarizing Observations About Bihar’s Manufacturing Pre-2016</td>
<td>103</td>
</tr>
<tr>
<td>4.2.6 Industrial Policy in Bihar</td>
<td>103</td>
</tr>
<tr>
<td>4.3 Identifying Product Networks in Bihar’s Food Processing Industries</td>
<td>104</td>
</tr>
<tr>
<td>4.4 Summarizing Across Trajectories: Potential Lessons from Bihar</td>
<td>105</td>
</tr>
<tr>
<td>Appendix</td>
<td>108</td>
</tr>
<tr>
<td>References</td>
<td>113</td>
</tr>
<tr>
<td>5 Food Processing in Bihar: Industrial Ecosystem</td>
<td>115</td>
</tr>
<tr>
<td>5.1 Introduction: Government as a Stakeholder in Industrialization</td>
<td>115</td>
</tr>
<tr>
<td>5.1.1 Industrial Policy: What Is Its Role in Food Processing?</td>
<td>117</td>
</tr>
<tr>
<td>5.2 Government Policy in Food Processing in Bihar</td>
<td>121</td>
</tr>
<tr>
<td>5.2.1 Pattern of Entry into Food Processing in Bihar</td>
<td>122</td>
</tr>
<tr>
<td>5.3 Evaluating Policy Effects for Food Processing in Bihar</td>
<td>127</td>
</tr>
<tr>
<td>5.3.1 Project-Level Analysis: PMA as Unit of Account</td>
<td>128</td>
</tr>
<tr>
<td>5.3.2 Sub-sectoral Spillover Effects: Factory as the Unit of Account</td>
<td>134</td>
</tr>
</tbody>
</table>
5.4 Policy Networks: Going Beyond IP for Food Processing .......................... 136
5.4.1 Policy Networks for Bihar Industries ............................................. 137
5.4.2 Other Incentive Policies ................................................................. 138
5.4.3 Recent Indirect-Tax Policy Changes: Introduction of GST in India .......... 138
5.4.4 Land Policies and Institutions ......................................................... 141
5.4.5 Industrial Credit Institutions .......................................................... 142
5.5 Electricity Infrastructure .................................................................. 143
5.6 Targeting of Policies and Design of Institutions for Food Processing .......... 143
5.6.1 Green Industrial Policy ................................................................. 145
References ......................................................................................... 146

6 Food Processing in Bihar: Efficiency in Physical Costs .......................... 149
6.1 Introduction ..................................................................................... 149
6.2 Theory: Role of the Missing Middle, Physical Costs and Firm Performance .................................................. 152
6.2.1 Limited Credit for Small Firms .................................................... 154
6.2.2 Limited Credit for Larger Firms .................................................. 156
6.3 Efficiency Analysis of Food Processing in Bihar .............................. 159
6.3.1 Sub-sectoral Focus in the Bihar Trajectory: Why Grain Milling and Dairy? ..................................... 162
6.4 Empirical Estimation of the Production Process for Grain Milling and Dairy in Bihar .................................................. 166
6.4.1 Size Distribution in the Population of Grain Milling and Dairy ............. 167
6.4.2 Nature of the Production Process: Grain Milling in Bihar .................. 168
6.4.3 Nature of Dairy Processing in Bihar ............................................. 171
6.5 Efficiency Analysis of Grain Milling and Dairy in Bihar ..................... 172
6.5.1 Traditional and Modern Approaches to Measure Efficiency ................. 173
6.5.2 Two-Stage Network DEA (NDEA): A Brief Description .................. 175
6.6 Government Policy and Firm Efficiency: Rice Mills in Bihar ................. 179
6.6.1 Subsidy and Rice Mills in Bihar .................................................... 181
6.6.2 Efficiency in Rice Milling: Two-Stage Network DEA (NDEA) ............ 182
6.6.3 Benchmarking Efficiency Scores .................................................... 186
6.6.4 Efficiency Differences Between SFC and Non-SFC Mills: Simar-Zelenyuk-Adapted Li Test ............. 187
6.6.5 Quantile Regression for Explaining Inefficiency in Rice Mills in Bihar ...... 189
6.7 Conclusion .......................................................... 191
Appendix: Table Describing Efficiency Scores and Other Features
of SFC and Non-SFC Mills .............................................. 193
References ................................................................ 195

7 Food Processing in Bihar: Entrepreneurial Perceptions ............ 199
7.1 Physical Versus Non-physical Costs in Food Processing ........ 199
7.2 Existing Literature on Entrepreneurial Identity and Behaviour ... 205
  7.2.1 Motivation for Non-physical Costs and rCFT ............... 207
7.3 Theoretical Model: Non-physical Costs of Business and rCFT . 210
  7.3.1 Post-entry Behaviour: Types of rCFT ....................... 214
  7.3.2 Policy Targeting of Entrepreneurial Mindsets .............. 218
7.4 Empirical Observations from Primary Survey in Bihar .......... 219
  7.4.1 Survey Method: Snowball Sampling ......................... 219
  7.4.2 Sample Description ............................................. 221
  7.4.3 Empirical Measurement of Risk Perception and rCFT .. 225
  7.4.4 Empirically Testable Hypotheses ............................. 226
  7.4.5 Results ......................................................... 228
  7.4.6 Limits to Theory or Limits to Empirical Testing
    of Theory? ................................................................ 229
7.5 Going Forward: What Should Industrial Policy Focus On? ...... 230
7.6 Benchmarking Results: World Bank Enterprise Survey ........ 232
References ................................................................ 233

8 Comparing Lessons Across Trajectories ................................. 237
8.1 Bihar and Food Processing: Central Features ...................... 237
8.2 Successful and Not-So-Successful Regional Trajectories
   in Food Processing .................................................. 239
  8.2.1 Enjera in Ethiopia ............................................... 240
  8.2.2 Warehouse Receipts Program in Tanzania ................ 241
  8.2.3 Dairy Initiatives ................................................. 241
8.3 Technology-Based Food Start-Ups .................................... 244
8.4 Going Forward: Viable Strategy in Processed Food for Bihar ... 246
Appendix .................................................................... 248
References .................................................................. 248

9 Conclusion: Lessons From Bihar’s Food Processing ................. 249
9.1 Lessons From Bihar .................................................. 249
9.2 Alternative Theories .................................................. 252
9.3 Data Issues ............................................................. 253
9.4 So What? ................................................................ 254
References .................................................................. 256

Glossary ...................................................................... 257
Index .......................................................................... 261